

M.A. Space and Telecommunications Law NALSAR University of Law, Hyderabad, India.

Telecommunication Laws in India

Introduction to Telecom Industry in India

Dr. Mohanavelu

Meeting Links:

<https://nalsar.webex.com/nalsar/j.php?MTID=m7a61714ca29657eb43a489a3fcfb667c>

Meeting number: 2515 000 7999

ONLINE LECTURE PROGRAM
Date: 26/09/2022 at 11:15-13:15 Hrs

**M.A. Space and Telecommunications Law
NALSAR University of Law,
Hyderabad, India.**

**Introduction to Telecom Industry in India
(Telecommunication Laws in India)**

Speaker: K S Mohanavelu

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I also want to clarify that short falls in this paper, if any are entirely due to me.

K S MOHANAVELU

Introduction to Telecom Industry in India

(Telecommunication Laws in India)

Topics

- I Introduction**
- II Enabling Factors for Orderly and Efficient Operations of Telecommunication Services**
 - **Government of India Acts and Rules**
 - **Draft Indian Telecommunication Bill, 2022**
 - **Government of India Policies for Telecommunication Sector**
 - **Space Infrastructure / Satellite Based Telecommunications**
 - **National Digital Communications Policy (NDCP) 2018**
 - **National Telecommunications Regulations**
 - **Regulatory Institutional Structure for Telecom Sector**
 - **Telecom Regulatory Authority of India (TRAI)**
 - **Telecom Service Authorisation/Licensing regime**
 - **Telecom Service License Conditions**
 - **International Telecommunication Union**
 - **National Level Spectrum Management**
 - **Satcom Spectrum and Satellite Service Licence**

Introduction to Telecom Industry in India

(Telecommunication Laws in India)

III Profile of Telecom Services and Service Providers

- **Status of Telecom Services**
- **Access Services - Mobile**
- **National Long Distance (NLD) by Optical Fibre Circuits**
- **International Long Distance (ILD) and Autonomous System (AS)**
- **Internet and Broadband Services**
- **VSAT Service**
- **Global Mobile Personal Communication by Satellite (GMPCS) Service in India**
- **Public Mobile Radio Trunking Services (PMRTS) and Captive Mobile Radio Trunking Service (CMRTS)**
- **Public Protection and Disaster Relief (PPDR) Networks**
- **Universal Service Obligation Fund (USOF)**
- **5G and Applications of 5G Technology**

IV Mobile Phones, Telecom Equipment Vendors and Support of IT Organisations

INTRODUCTION

- Telecom in India is seen more as a Service Industry.
- Telecommunication is an essential service for the Nation;
Key factor for overall National growth of the economy;
Fetches **Revenue through License fee and Spectrum Auctions**
Telecom growth in India is phenomenon.
Presently Total Telecom Subscribers: About 1.2 billion;
Total Internet Subscribers: About 825 million.
About 450 million OTT users
About 2.3 million Mobile Base Stations spread all over the country
About 2.8 million Km of Fibre
About 70 million DTH Subscribers; 45 million Cable TV subscribers
About 43 million Free Dish Users'; About 3 lakh VSATs
In the recent 5G Auctions Government received Rs 1.5 lakh Crores

INTRODUCTION

- .
- **Telecom Sector Stakeholders :**
Central Government/ Ministries/Departments,
State /UT Governments, local authorities,
industry and
user communities.

The Central Government has a pivotal role in the Telecom Sector and will co-ordinate with all stake holders. Central Government will design and implement policies

- The Telecom infrastructure is largely provided by the Service Providers and Infrastructure Providers

Enabling Factors for Orderly and Efficient Operations of Telecommunication Services

GOVERNMENT OF INDIA ACTS AND RULES

Government of India Acts and Rules form the Legal Basis for Developing and Applying Telecommunication Regulations in India

Indian Telegraph Act 1885

<https://dot.gov.in/act-rules-content/2442>

India Wireless Act, 1933

<https://dot.gov.in/act-rules-content/2419>

Information Technology Act

<https://www.meity.gov.in/content/information-technology-act>

GOVERNMENT OF INDIA ACTS AND RULES

Telecom Regulatory Authority of India (TRAI) Act, 1997

<https://dot.gov.in/act-rules-content/2716>

Telecom Regulatory Authority of India (TRAI) Act, 1997

<https://dot.gov.in/act-rules-content/2426>

Telecom Dispute Settlement and Appellate Tribunal

(TDSAT) <https://www.tdsat.gov.in>

Indian Telegraph Right of Way Rules

<https://dot.gov.in/act-rules-content/3057>

Mobile Banking

TELECOM REGULATORY AUTHORITY OF INDIA NOTIFICATION

New Delhi, the 22nd November, 2016

<https://dot.gov.in/sites/default/files/Mobile%20Banking%20%28QoS%29%202nd%20Amendment%20Regulations%202016.pdf?download=1>

Draft Indian Telecommunication Bill, 2022

The Proposed New Telecom Bill provides a Road Map for Restructuring Telecom Sector; Promotes Innovation.

21st September 2022

Now there is a Draft Indian Telecommunication Bill, 2022

Ministry of Communications had initiated a public consultative process to develop a modern and future-ready legal framework in telecommunication.

We need to wait for the Deliberations and Decisions./ Approvals

<https://dot.gov.in/sites/default/files/Draft%20Indian%20Telecommunication%20Bill%2C%202022.pdf>

Deliberations on the Draft Bill:

Inviting comments on the draft Indian Telecommunication Bill, 2022

<https://dot.gov.in/sites/default/files/Inviting%20Comments%20on%20the%20draft%20Indian%20Telecommunication%20Bill%2C%202022.pdf>

Explanatory note to the draft Indian Telecommunication Bill, 2022

<https://dot.gov.in/sites/default/files/Explanatory%20Note%20to%20the%20draft%20Indian%20Telecommunication%20Bill%2C%202022.pdf>

GOVERNMENT OF INDIA POLICIES FOR TELECOMMUNICATIONS SECTOR NATIONAL DIGITAL COMMUNICATIONS POLICY- 2018

The NDCP 2018 seeks to unlock the transformative power of digital communications networks - to achieve the goal of digital empowerment and well-being of the people of India; and towards this end, attempts to outline a set of goals, initiatives, strategies and intended policy outcomes.

https://dot.gov.in/sites/default/files/2018_10_29%20NDCP%202018_0.pdf

National Broadband Mission - December 2019

Enabling Broadband connectivity across the country is essential to bridge the Digital divide between rural-urban and rich-poor. In this context Department of Telecommunications has taken a step by launching the National Broadband Mission with a vision to provide affordable and universal access of Broadband connectivity to all.

https://dot.gov.in/sites/default/files/National%20Broadband%20Mission%20-%20Booklet_0.pdf?download=1

Space Infrastructure / Satellite Based Telecommunications

Indian National Space Promotion and Authorization Center (IN-SPACe)

Recently Government of India has established IN-SPACe

IN-SPACe is an independent nodal agency under Department of Space for allowing space activities and usage of DOS owned facilities by NGPEs as well as to prioritise the launch manifest.

The Policies and Guidelines formulated and adopted by

IN-SPACe will be applicable for establishing and operating space infrastructures for providing **Satellite Based Telecommunication Services** in the Country.

<https://www.isro.gov.in/indian-national-space-promotion-and-authorization-center-space>

Space Infrastructure / Satellite Based Telecommunications

Indian National Space Promotion and Authorization Center (IN-SPACe)

IN-SPACe has already started taken actions on the usage of DOS owned facilities by NGPEs and the Launch Manifest.

IN-SPAC is expected to make formal announcements on SATCOM Policy and other space matters.

<https://www.isro.gov.in/indian-national-space-promotion-and-authorization-center-space>

Additional Reference

In brief: telecoms regulation in India =

Seth Dua & Associates

<https://www.lexology.com/library/detail.aspx?g=45ac7f16-f40c-42ea-b3df-dfe6e357e2c0#>

National Digital Communications Policy (NDCP)2018

A Good Starting Point for the Discussions on Telecom:

Government of India National Digital Communications Policy (NDCP) 2018

Document available at the DOT website <https://dot.gov.in › files › EnglishPolicy-NDCP>

The Policy Recognizes Digital Infrastructure and Services are Key Enablers of Country's growth and well being.

The Policy considers Telecommunications as Vital Service to people.

NDCP 2018 lays out a consistent policy and principles framework.

We see rapid technological developments happening in the field of Telecommunications (example 2G, 3G, 4G, LTE, 5G)

Advances like High throughput GSO and NGSO Satellite Networks for providing country wide internet connectivity, etc.

The Policy guideline is to ensure that the advantages of new technologies are accessible to all equitably and affordably.

National Digital Communications Policy (NDCP)2018 (Contd.)

With more than a billion mobile phones and nearly 800 million broadband users, **Indians regularly use** mobile phones, internet, social media platforms, transmit/receive audio/video streams, data consumption / generation across India, mobile banking/digital payments.

Clearly Digital communication services are no longer the prerogative of the privileged few.

The Policy aims Universal Service rather than just revenue generation.

(Presently mobile phones: 1.2 billion; broadband users: 788 million)

The overall Objective of the National Policy on digital communications is **to prepare the country and its citizens for the future**

National Digital Communications Policy (NDCP)2018 (Contd.)

National Communications Policy Aims

National Communications Policy aims to accomplish the following Strategic Objectives by 2022:

- Provisioning of Broadband for All
- Creating 4 Million additional jobs in the Digital Communications sector
- Enhancing the contribution of the Digital Communications sector to 8% of India's GDP from ~ 6% in 2017
- Propelling India to the Top 50 Nations in the ICT Development Index of ITU from 134 in 2017
- Enhancing India's contribution to Global Value Chains
- Ensuring Digital Sovereignty

National Digital Communications Policy (NDCP)2018 (Contd.)

Vision is for:

- Establishment of Digital Communication Infrastructure
- Creation of Universally Accessible and Affordable Digital Communications Services

What about Missions?

National Digital Communications Policy (NDCP)2018 (Contd.)

Missions

NDCP 2018 envisages three missions:

- **Connect India:** Creating Robust **Digital Communication Infrastructure** to promote ‘Broadband for All’ as a tool for socio-economic development, while ensuring service quality and environmental sustainability;
- **Propel India: Enabling Next Generation Technologies and Services** through Investment, Innovation and IPR generation to harness the power of emerging digital technologies, including 5G, AI, IoT, cloud and big data to enable provision of future ready products and services; and to catalyse the fourth industrial revolution (Industry 4.0); and
- **Secure India: Ensuring Sovereignty, Safety and Security** of Digital Communications to secure the interests of citizens and safeguard the digital sovereignty of India with a focus on ensuring individual autonomy and choice, data ownership, privacy and security, while recognising data as a crucial economic resource.

Goals: Policy Framework identifies Goals to be accomplished by 2022 under the aegis of these Three Missions.

National Digital Communications Policy (NDCP)2018 (Contd.)

Goals

The Policy provides exhaustive information on various time bound goals to be accomplished in order to meet the objectives of the Policy.

Topics covered by the Goals include:

- Universal Broadband Connectivity at 50 Mbps speed
- Fixed Internet Connectivity at Homes / Offices /Buildings / Public Utility / Mobile Network Base Stations
- High speed Internet Broadband connectivity for Gram Panchayat / Developmental Institutions / Educational Institutions / Remote Areas

National Digital Communications Policy (NDCP)2018 (Contd.)

Goals (Contd.)

- Sharing Telecom Infrastructure and IP - Switching, and International Connectivity
- Optical Fibre Cable based Connectivity Solutions and Establishment of National Fibre Authority
- Promoting alternate technologies
- Optimum use of Spectrum for public benefit and ensuring allocation of Spectrum for new Telecom Services
- Data Protection and Security, Building Secure, Safe and Robust Infrastructure and Safety of Citizens
- Reforms in the Licensing and Regulatory Regime of Telecommunications

National Digital Communications Policy (NDCP)2018 (Contd.)

Topics covered by the Goals (contd.)

- Promoting Next Generation Technologies
- Enabling Hi-speed internet, Internet of Things and M2M by rollout of 5G technologies:
- Establishing India as a global hub for cloud computing, content hosting and delivery, and data communication systems and services
- Leveraging Artificial Intelligence and Big Data in a synchronized and effective manner to enhance the overall quality of service, spectrum management, network security and reliability
- Strengthening Satellite Communication Technologies in India - Review the **regulatory regime for satellite communication** technologies - **Optimise Satellite communications** technologies in India - Developing **ecosystem for satellite communications** in India

National Digital Communications Policy (NDCP)2018 (Contd.)

Topics covered by the Goals (contd.)

- Widening the scope of Telecom Infrastructure Providers, **Attracting Investments and Capacity Building, Ensuring a holistic and harmonised approach for harnessing Emerging Technologies**
- Channelizing the Universal Service Obligation Fund (USOF) for various deserving Developmental Activities
- Ensuring Standards and Quality Assurances for Telecom Services
- Facilitating the establishment of a Pan-India network for Public Protection and Disaster Relief (PPDR)
- Research and Development and Local Manufacturing and Value Additions
- Creating Job Opportunities and Training Personnel in the Digital Communications Sector

National Telecommunications Regulations

In India, Government of India ensures development and application of National Telecommunication Regulations through

DOT, WPC, SACFA, NFAP, TEC, MI&B, etc.

This includes Roles of Service Providers in private sector.

- TRAI: TRAI is the Telecom Regulatory Authority of India (TRAI).
- DOT is Licensing Authority for Telecommunication Services.
- TEC deals with equipment specifications and quality requirements.
- MI&B is the Licensing Authority for Broadcast Services (DTH, FM Radio, TV Channels, Uplink, Downlink, Cable TV, etc.)
- WPC, SACFA and NFAP deal with Radio Frequency Spectrum matters.
- Regarding TRAI, Please see the web reference <https://www.trai.gov.in/about-us/history>
- Web sites of DOT, WPC, MI&B, etc. provide information on National Regulations.
- [Seth Dua & Associates](#) provide information in the article “In brief: telecoms regulation in India” Please see the web reference:
- <https://www.lexology.com/library/detail.aspx?g=45ac7f16-f40c-42ea-b3df-dfe6e357e2c0#>

Regulatory Institutional Structure for Telecom Sector

<https://www.lexology.com/library/detail.aspx?g=45ac7f16-f40c-42ea-b3df-dfe6e357e2c0#>

The regulatory and policy framework encompassing the communications sector in India comprises a number of statutes, rules, regulations, guidelines, etc, laid down by the government of India. The primary statutes regulating the sector include:

- the Indian Telegraph Act 1885 (the Telegraph Act);
- the Indian Wireless Telegraphy Act 1933 (the Wireless Act);
- the Telecom Regulatory Authority of India (TRAI) Act 1997 (the TRAI Act);
- TDSAT (Telecom Disputes Settlement and Appellate Tribunal) - TRAI Act of 1997 was amended in the year 2000 and TDSAT was set up to adjudicate disputes and dispose of appeals with a view to protect the interests of service providers and consumers of the telecom sector and to promote and ensure orderly growth of the telecom sector.
- the telecoms policy amended from time to time, the latest being the National Digital Communications Policy 2018 (the NDCP 2018), which was approved in September 2018;
- the National Broadband Mission 2019; and
- the Information Technology Act 2000 (the IT Act).

Telecom Regulatory Authority of India (TRAI)

(<https://www.trai.gov.in/about-us/history>)

The **Telecom Regulatory Authority of India (TRAI)** was established with effect from 20th February **1997** by an Act of Parliament, called the Telecom Regulatory Authority of India Act, 1997, to regulate telecom services, including fixation/revision of tariffs for telecom services which were earlier vested in the Central Government.

TRAI's mission is to **create and nurture conditions for growth of telecommunications** in the country in a manner and at a pace which will enable India to play a leading role in emerging global information society.

On various subjects, TRAI prepared Consultation Papers (CP) and circulated for consultation process with stake holders.

These Consultation Papers form very good source of information on technology, regulations, tariff and various other Telecom matters.

Telecom Regulatory Authority of India (TRAI)

(<https://www.trai.gov.in/about-us/history>)

One of the main objectives of TRAI is to provide a **fair and transparent policy environment** which promotes a level playing field and facilitates fair competition.

In pursuance of above objective TRAI has issued from time to time recommendations on a large number of **regulations, orders and directives** to deal with issues coming before it and provided the required direction to the evolution of Indian telecom market from a Government owned monopoly to a multi operator multi service open competitive market.

The directions, orders and regulations issued cover a wide range of subjects including **tariff, interconnection and quality of service** as well as governance of the Authority.

Telecom Service Authorisation/Licensing regime

<https://dot.gov.in/sites/default/files/UL.pdf>

Access Services: The licensing regime for the provision of the telecoms sector witnessed a sea change in 2013 with the introduction and implementation of the ‘**unified licence regime**’.

The unified licence regime has been implemented primarily with the objective of ‘one nation, one licence’, as envisaged under the NTP 2012. It replaces the earlier regime where the players were required to obtain separate licences for different telecoms services in India, such as internet services, national long-distance (NLD) services, international long-distance (ILD) services and so on.

The unified licence regime for the first time allows telecoms operators to offer all telecoms services under one licence, subject to separate service authorisation for the provision of different telecoms services, covered by the unified licence

The unified licence covers within its ambit all the fixed, mobile and satellite services and communication both on wire line and wireless media with full mobility, limited mobility and fixed wireless access.

Telecom Service Authorisation/Licensing regime

<https://dot.gov.in/sites/default/files/UL.pdf>

The service authorisations covered by the unified licence are:

- unified licence (All Services)
- access service;
- internet service;
- NLD service;
- ILD service;
- global mobile personal communication by satellite service;
- public mobile radio trunking service;
- very small aperture terminal (VSAT) closed user group (CUG) service;
- Indian national satellite system mobile satellite system reporting service; and
- resale of international private leased circuit service.

Telecom Service Authorisation/Licensing regime

Carrier Services

<https://dot.gov.in/carrier-services>

Carrier Services could be also for B2B services for applications like Core Networks, Back Haul, Closed User Group communications, etc.

- [PMRTS](#) (Public Mobile Trunking Service)
- [GMPCS](#) (GLOBAL MOBILE PERSONAL COMMUNICATION BY SATELLITE)
- [International Long Distance](#)
- [National Long Distance](#)
- [CMRTS](#)
- [Infrastructure Provider](#)
- [Voice Mail /Audiotext /UMS](#)
- [Voice Mail /Audiotext /UMS](#); [NOC for Reselling of International SIM Cards](#)
- [Other Services Providers\(Including BPO\)](#) ; [Telemarketing](#); [Resale OF IPLC](#)
- [Restrictions on the use of Satellite Phone](#)
- [EMF Radiation Issues](#)

Telecom Service Authorisation/Licensing regime

Data Services

ISP Authorisation under Unified License

<https://dot.gov.in/dataservices/data-services>

DOT Letter [No. 20-281/2010-AS-I \(Vol VI\) dated 28.03.2016](#)

Presently, all the licenses including Internet Service Provider (ISP) Licenses for category 'A', 'B' and 'C' are being issued under Unified License.

Telecom Service License Conditions

Telecom Service License Structure and format may be more or less same for all Services

But actual Licensing conditions vary with respect to Services.

To give some idea Typical Licensing Conditions are presented.

However the Latest information needs to be obtained from DOT Websites.

Telecom Service License Conditions (Contd.)

Typical Licensing Conditions pertaining to Unified License

- The licensing regime for the provision of the telecoms sector witnessed a sea change in 2013 with the introduction and implementation of the **‘unified licence regime’**.
- The unified licence regime has been implemented primarily with the objective of ‘one nation, one licence’, as envisaged under the NTP 2012.
- It replaces the earlier regime where the players were required to obtain separate licences for different telecoms services in India, such as Access Services, Internet services, national long-distance (NLD) services, international long-distance (ILD) services and so on.
- The service areas for each of the service authorisations have also been defined.
- The unified licence is granted for a period of **20 years** from the effective date of the licence.
- **Applicant must be an Indian Company registered under Indian Companies Act 1956.**
- Application must be submitted as per the prescribed format.
- Applicant must be at least for one of the Services identified by DOT

Telecom Service License Conditions (Contd.)

Telecom Service Provider (TSP) Entry Conditions, Duration of the License, Net worth, License Fee (as the percentage of AGR), FBG, PBG

After successful processing, DOT will issue **LOI (Letter of Intent)** to the Applicant.

Payment of Non Refundable Entry Fee

Submission of FBG and PBG (FBG-Financial Bank Guarantee; PBG-Performance Bank Guarantee)

In addition to the Entry Fee, an annual License fee as a percentage of Adjusted Gross Revenue (AGR) shall be paid by the Licensee as per procedure prescribed.

The License fee is at present 8% of the AGR, inclusive of USO Levy which is presently 5% of AGR.

Telecom Service License Conditions (Contd.)

Telecom Service Provider (TSP) Entry Conditions, Duration of the License, Net worth, License Fee (as the percentage of AGR), FBG, PBG (Contd.)

Terms of License including Technical Specifications and Standards and Type Approvals of User Terminal and other Equipment as Recommended by TEC.

Provision of Telecommunication services using satellite media - Conditions subject to satellite communication policy, V-SAT policy etc

Security Conditions – **Monitoring of Calls originated and terminated In India**, Suspending of Services in the geographical areas identified by the GOI, Location of Gateway Stations in India, etc.

Telecom Service License Conditions (Contd.)

- The general, operating, monitoring, **financial and security** conditions for each of the service authorisations have been divided into the general unified licence conditions (applicable irrespective of the service authorisation) and the specific service authorisation-related conditions (applicable only if the said authorisation has been granted).
- Apart from freeing up the spectrum from the licence, the unified licence also bars cross-holding in different telecommunications companies.
- With regard to the official fees, the charging heads have been defined separately under the unified licence with different limits for entry fees, net worth, paid-up capital, bank guarantees and processing fees.
- However when a licensee applies for authorization for more than one service, the unified licence sets out the upper limits for financial implications accordingly. The prescribed upper limits are also the amounts applicable in cases of the licensee applying for all the services covered by the unified licence.

Telecom Service License Conditions (Contd.)

- The official fees have been fixed at 250 million rupees (Rs 25 Crores) each for the minimum equity and **net worth** of the licensee company, 150 million rupees for **the entry fees** and 100,000 rupees for the application **processing charges**.
- For the provision of the services, an amount of 2.2 billion rupees has been fixed as the performance bank guarantee (**PBG**) and 440 million rupees as the financial bank guarantee (**FBG**). (**Recently some relaxations were given**)
- In addition, 8 per cent of the adjusted gross revenue (**AGR**) shall be annually charged from the service providers as the licence fee, which includes the levy for universal service obligations, currently **5 per cent of AGR**. However, it should be noted that the mechanism for computation of AGR has been specified for different service authorisations.

Telecom Service License Conditions (Contd.)

Infrastructure provider

- In addition to the unified licence, the DOT has also prescribed a registration process for infrastructure provider entities wishing to do business in India.
- This registration process covers the providers of telecoms infrastructure such as dark fibre, right of way, duct space and tower.
- The financial requirement for the registration includes a small processing fee and does away with the entry fees and bank guarantee.
- The infrastructure providers engaging in India would have an easier entry as they would merely have to register themselves rather than obtaining a licence.

Allocation of Spectrum

- Allocation of Spectrum is delinked from Licenses.
- Spectrum for IMT Bands (Cellular Mobile) is allocated through **Auction process**. For other Bands/Services,
- Spectrum is allocated as per the procedures prescribed by WPC/DOT keeping in view the ITU Radio Regulations and the international regulatory obligations. India is a signatory to ITU Radio Regulations which has the force of International Treaty.

International Telecommunication Union (ITU)

- At international level, it is considered that the natural resource Radio Frequency Spectrum belongs to the humanity.
- Accordingly, International Telecommunication, a specialized Agency of the United Nations facilitates the use of the spectrum by all countries efficiently and equitably
- **While countries have the right to use the spectrum to meet their own requirements but they also have obligations not to cause interference into others. ITU ensures harmonized usage of spectrum through the regulatory procedures outlined in the ITU Radio Regulations.**
- ITU Radio Regulations include Table of Frequency Allocations. Usually Frequency bands are allocated for more than one service for example Fixed Satellite Service (FSS) and Fixed Service (FS) and ITU Radio Regulations define the sharing criteria for achieving compatibility among different services for operations in the same band.
- The Tables of Frequency Allocations are discussed and developed at the ITU Conferences and Meetings taking into account the requirements of various countries, technical considerations like propagation, technology developments, standardization of equipment and criteria for sharing the spectrum by different services.

National Level Management of Spectrum

- At national level, in accordance with the ITU regulatory framework, **National Frequency Allocation Plan (NFAP)** and other procedures are developed and applied for National Management of Spectrum. On the basis of NFAP, Spectrum / Frequencies are put into use in India.
- The ITU issues the international frequency table for the purpose of giving the member countries a basis on which they can formulate their own frequency allocation plan.
- With ITU Table of Frequency Allocations as the basis, NFAP is developed for frequency allocations in India.
- This plan clearly allocates different frequency bands for different radio communication services. Although it allocates same frequency bands for certain services on a shared basis.

National Level Management of Spectrum (Contd.)

- Like ITU, NFAP does not give individual ownership rights to services/departments, Government of India manages the use of radio frequency spectrum.
- NFAP-81 was in force till December 31, 1999 for commercial and other uses. NFAP-81 was formulated for a time, when usage of frequency bands was primarily done by the government agencies
- From January 1, 2000, in order to better manage the increased use of Spectrum, the revised version of NFAP (NFAP-2000) replaced NFAP-81 and this document is kept in public domain.
- Currently NFAP-2018 is available in the DOT/WPC website:
<https://dot.gov.in/sites/default/files/NFAP%202018.pdf?download=1>
- **While frequency allocations for various services, a lot of attention is given to the frequency bands identified for Mobile services. The frequency bands identified for Mobile Services are referred to as International Mobile Telecommunications (IMT Bands).**

Satellite Spectrum and Satellite Service License

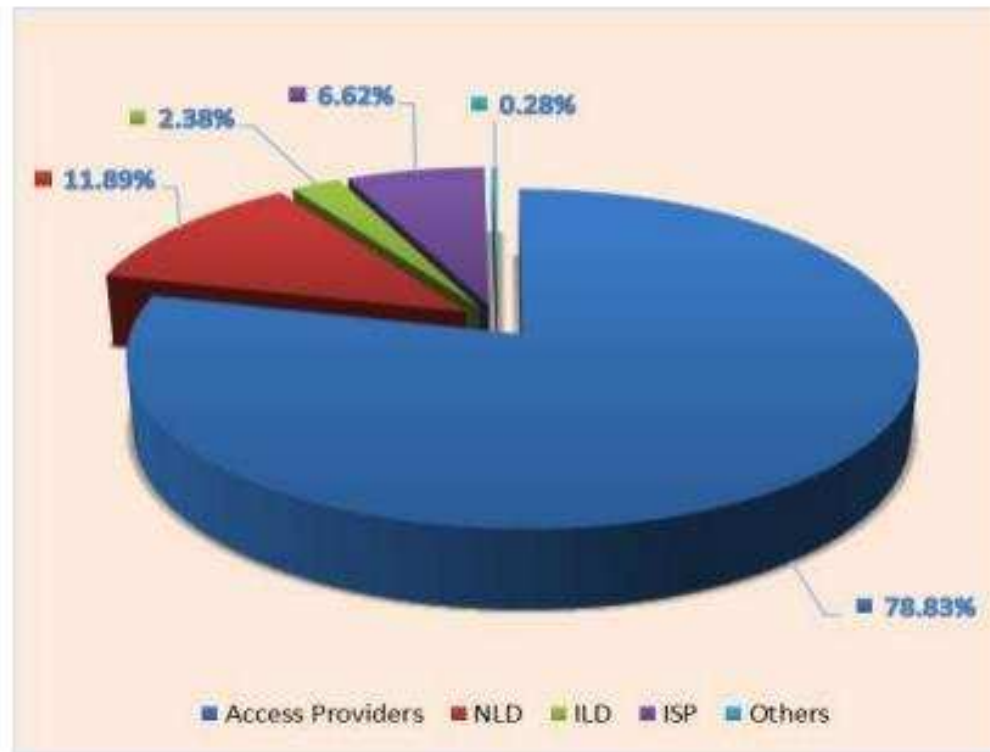
- 2G/3G/4G/LTE/5G are terrestrial wireless services. Of late a lot of interest is being shown for Space Spectrum and Space Services especially because of the price and universal service availability for internet connectivity expectations due to LEO/MEO Satellite Constellations.
- Broadband India Forum, an association of technology players like [Google](#), Hughes, etc, is opposed to Spectrum Auctions and feels that since spectrum for Satcom is not exclusive to an operator as is the case with terrestrial spectrum used for mobile services, auctioning makes no sense.
- **It is argued that World over, satellite spectrum is authorised for ‘right-to-use’ by all administrations and is allocated only by administrative process at charges essentially covering the cost of administration.**

Satellite Spectrum and Satellite Service License (Contd.)

- Unlike terrestrial spectrum, satellite spectrum is never exclusively assigned to the operator but coordinated internationally and shared among multiple operators for different orbital slots and all types of satellites. Thus, the terrestrial concept of exclusivity does not apply and auctioning therefore is not applicable according to India Broadband India Forum (BIF).
- TRAI has recently started consultation process with stakeholders on the question of auctioning Satellite Spectrum.
- TRAI is expected to come out soon with a Consultation Paper on this subject.

Profiles of Telecom Services and Service Providers in India

Chart 3.1: Composition of Adjusted Gross Revenue



Access Services contributed 78.83% of the total Adjusted Gross Revenue (AGR) of telecom services.

Access Services and Access Service Providers (TSPs) play a predominant role in the Telecom Industry.

Table 3.1: Gross Revenue (GR), Adjusted Gross Revenue (AGR), License Fee (LF) & Spectrum Charges

Particulars	QE Mar-21 (Rs. in Crore)	QE Dec-21 (Rs. in Crore)	QE Mar-22 (Rs. in Crore)	Q-O-Q % Change	Y-O-Y % Change
Gross Revenue (GR)	66,784	69,695	76,387	9.60	14.38
Adjusted Gross Revenue (AGR)	48,587	55,151	58,886	6.77	21.20
Pass Through Charges (GR-AGR)	18,196	14,544	17,501	20.33	-3.82
License Fee (LF)	3,979	4,541	4,712	3.76	18.44
Spectrum Usage Charges (SUC)	1,540	1,760	1,926	9.44	25.04

Table 3.2: Service-wise Gross Revenue, Adjusted Gross Revenue, License Fee, Spectrum Charges and PTC for QE Mar-22
(in Rs. Crore)

Service	GR	AGR	LF	SUC	PTC
Access Providers	59,709.94	46,421.09	3,715.06	1,921.76	13,288.86
NLD	8,273.56	7,001.09	560.08	-	1,272.47
ILD	3,034.60	1,399.84	113.08	-	1,634.76
ISP	5,190.75	3,898.60	311.99	-	1,292.15
Others	177.98	165.66	11.96	4.34	12.31
Total	76,386.83	58,886.29	4,712.17	1,926.09	17,500.54

Table 3.3: Access Services - Service Provider wise Adjusted Gross Revenue
(Rs.in Crore)

Service Provider	QE Dec-21	QE Mar-22	% Change
Reliance Jio	19063.75	20659.90	8.37
Bharti Airtel	14484.48	16005.16	10.50
Vodafone Idea	6541.83	7209.57	10.21
BSNL	1984.94	1750.58	-11.81
Tata Tele.	530.21	533.74	0.67
MTNL	254.78	183.24	-28.08

Service Provider	QE Dec-21	QE Mar-22	% Change
Reliance Com.	61.69	68.80	11.52
V-Con Mobile & Infra Pvt. Ltd.	-4.80	14.69	406.18
Tata Play Fiber	0.00	0.95	0.00
Quadrant	13.22	-5.53	-141.86
Fusion Net	0.00	0.00	0.00
Grand Total (Access)	42930.10	46421.09	8.13

Reliance Jio, Bharti Airtel, Vodafone Idea and BSNL are the Major TSPs

Profile of Telecom Service Providers (TSP)

Reliance Jio tops the Mobile Wireless Infrastructure

BASE STATIONS BTS

RELIANCE JIO 930390

AIRTEL 622087

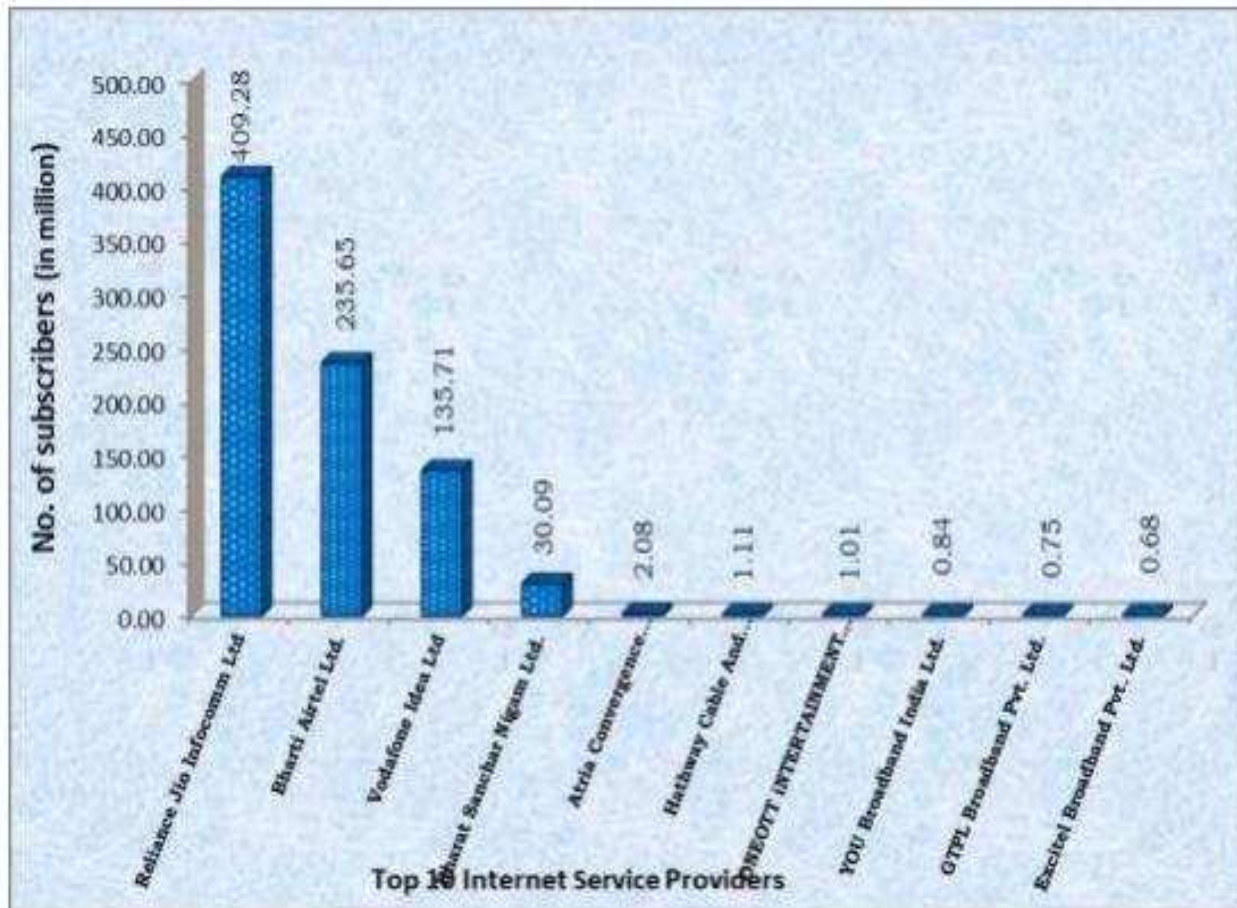
VODAFONE 529329

BSNL 153628

MTNL 4242

As per Reports there are about 2.3 million Mobile base stations in the country

Chart 1.17 : Subscriber base of top ten ISPs



Total Telecom Subscribers

(Data as on Q.E. 31 st March, 2022)	
Telecom Subscribers (Wireless+Wireline)	
Total Subscribers	1,166.93 Million
% change over the previous quarter	-0.97%
Urban Subscribers	647.11 Million
Rural Subscribers	519.82 Million
Market share of Private Operators	89.10%
Market share of PSU Operators	10.90%
Tele-density	84.88%
Urban Tele-density	134.94%
Rural Tele-density	58.07%

Total Internet Subscribers

Internet/Broadband Subscribers	
Total Internet Subscribers	824.89 Million
% change over previous quarter	-0.53%
Narrowband subscribers	36.59 Million
Broadband subscribers	788.30 Million
Wired Internet Subscribers	27.27 Million
Wireless Internet Subscribers	797.61 Million
Urban Internet Subscribers	493.08 Million
Rural Internet Subscribers	331.81 Million
Total Internet Subscribers per 100 population	60
Urban Internet Subscribers per 100 population	102.82
Rural Internet Subscribers per 100 population	37.06

Table 1.28: Trend of Internet subscriber base

Segment	Mode of Access								Total Subscribers (in million)	
	Wired Subscribers (in million)		Wireless Subscribers (in million)							
			Fixed Wireless (Wi-Fi, Wi-Max, Radio & VSAT)		Mobile Wireless (Phone + Dongle)		Total Wireless			
	Dec-21	Mar-22	Dec-21	Mar-22	Dec-21	Mar-22	Dec-21	Mar-22	Dec-21	Mar-22
Broadband	26.43	27.25	1.13	1.18	764.52	759.87	765.65	761.05	792.08	788.30
Narrowband	0.14	0.03	0.01	0.0060	37.06	36.56	37.07	36.57	37.21	36.59
Total	26.58	27.27	1.14	1.18	801.58	796.43	802.72	797.61	829.30	824.89

Table 1.31: Internet Subscriber Base and Market Share of top 10 Service Providers

S.No	ISP	No. of Subscribers (In million)	Share (%)
1	Reliance Jio Infocomm Ltd	409.28	49.62
2	Bharti Airtel Ltd.	235.65	28.57
3	Vodafone Idea Ltd	135.71	16.45
4	Bharat Sanchar Nigam Ltd.	30.09	3.65
5	Atria Convergence Technologies Pvt. Ltd.	2.08	0.25
6	Hathway Cable And Datacom Limited	1.11	0.13
7	ONEOTT iNTERTAINMENT LIMITED	1.01	0.12
8	YOU Broadband India Ltd.	0.84	0.10
9	GTPL Broadband Pvt. Ltd.	0.75	0.09
10	Excitel Broadband Pvt. Ltd.	0.68	0.08
Total of Top 10 ISPs		817.20	99.07
Others		7.69	0.93
Grand Total		824.89	100

Chart 1.20 : Technology trend for Wireless Internet Access

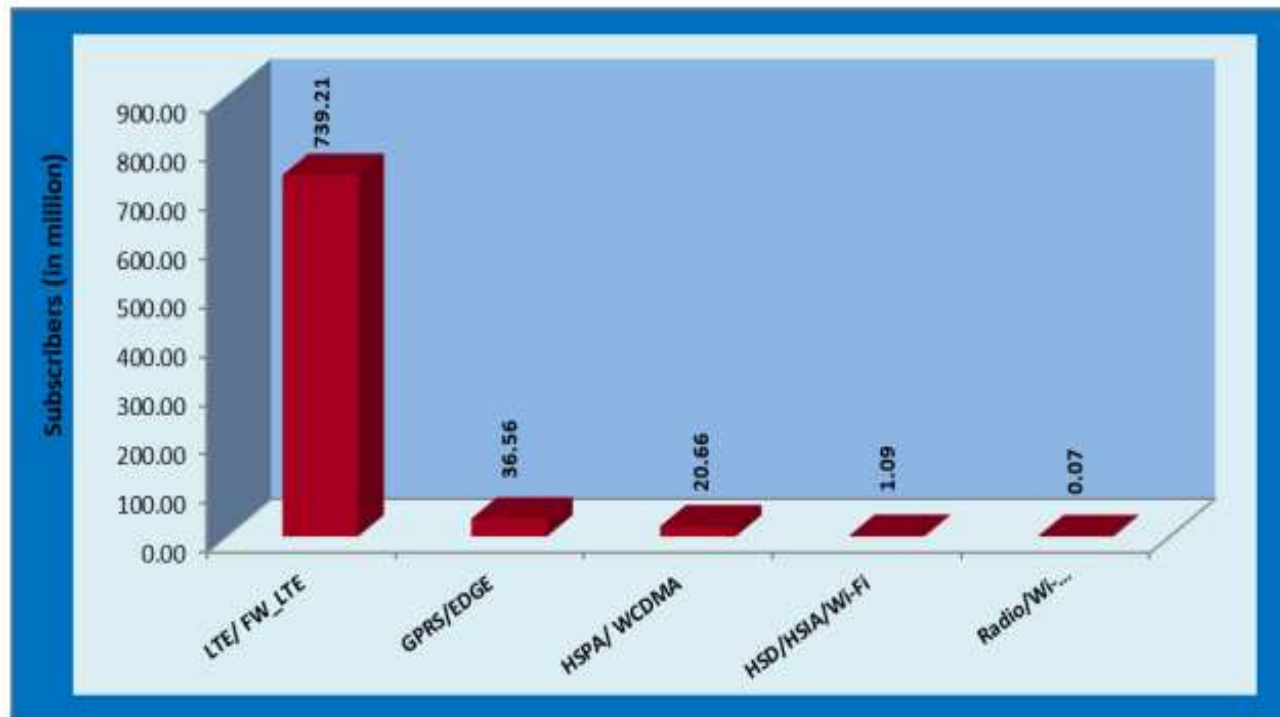
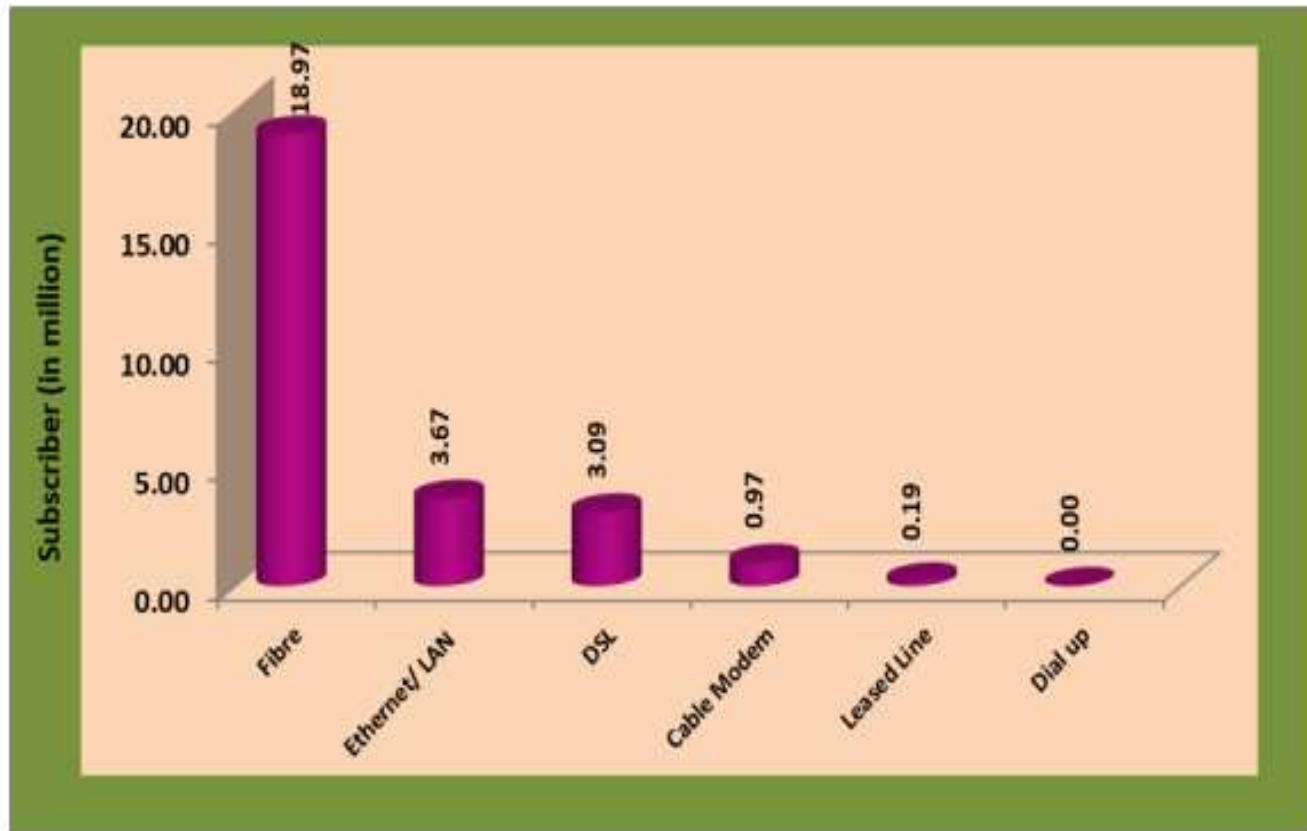


Chart 1.21: Technology trend for Wired Internet Access



Tele densities are low in States like Bihar, Jharkhand, Chhattisgarh, MP and UP.

Table 1.6 : State/UT wise total Tele-density

Sl.No.	State/UT	Total Tele-density (%)		
		Total	Rural	Urban
1	Andhra Pradesh	84.05	122.29	229.04
2	Arunachal Pradesh	82.83	67.59	127.58
3	Assam	68.50	50.72	165.83
4	Bihar	51.42	41.11	125.53
5	Chhattisgarh	68.15	44.87	131.66
6	Goa	138.97	196.59	119.58
7	Gujarat	95.36	72.45	119.89
8	Haryana	112.05	70.21	170.88
9	Himachal Pradesh	138.44	101.51	460.65
10	Jharkhand	57.55	42.38	100.70
11	Karnataka	100.10	68.42	140.47
12	Kerala	125.20	210.12	94.37
13	Madhya Pradesh	67.08	41.12	130.97
14	Maharashtra Incl. Mumbai	102.70	66.72	141.25
15	Manipur	73.29	48.45	125.64
16	Meghalaya	73.02	53.79	147.05
17	Mizoram	113.73	111.95	115.20
18	Nagaland	71.15	73.36	68.40
19	Odisha	74.38	59.67	138.32
20	Punjab	118.02	71.08	184.23
21	Rajasthan	79.62	58.29	138.83
22	Sikkim	141.18	157.87	122.48
23	Tamil Nadu (incl. Chennai)	104.46	64.89	139.16
24	Telangana	106.75	84.66	131.56
25	Tripura	74.42	57.42	101.95
26	Uttar Pradesh (UPE +UPW)	68.84	48.85	132.51
27	Uttarakhand	113.90	87.20	162.50
28	West Bengal Incl. Kolkata	81.04	56.36	124.17
Union Territories				
1	Andaman & Nicobar Islands	132.56	87.16	191.33
2	Chandigarh	154.04	-	-
3	Dadra and Nagar Haveli and Daman and Diu	78.65	148.13	63.15
4	Delhi	201.23	-	-
5	Jammu & Kashmir	86.30	57.66	152.15
6	Ladakh	190.27	115.29	363.85
7	Lakshdweep	99.98	-	-
8	Puduchery	70.49	67.44	71.80
Total		84.88	58.07	134.94

14

TV

FreeDish

Registering unparalleled growth in the TV distribution industry, Doordarshan FreeDish has become the largest DTH platform with reach to more than 43 Million households.

Satellite DTH

According to figures published by the Telecom Regulatory Authority of India (TRAI), DTH subscribers marginally decreased from 68.89 million in Q3 to **68.52 million at the end of Q4 in 2022**

Cable TV

According to TRAI, the top players in the cable TV industry saw a drop in over half a million active subscribers during the quarter. The total active subscriber base of 9 MSOs & 1 HITS operator has dropped to **45.5 million** in September 2021 from 46.1 million in June 2021

Broadcasting & Cable Services	
Number of private satellite TV channels permitted by the Ministry of I&B for uplinking only/downlinking only/both uplinking and downlinking	898
Number of Pay TV Channels as reported by broadcasters	345
Number of private FM Radio Stations (excluding All India Radio)	386
Number of total active subscribers with pay DTH operators	66.92 Million
Number of Operational Community Radio Stations	349
Number of pay DTH Operators	4

Chart 5.4: - Total active subscriber base of pay DTH sector (in millions)

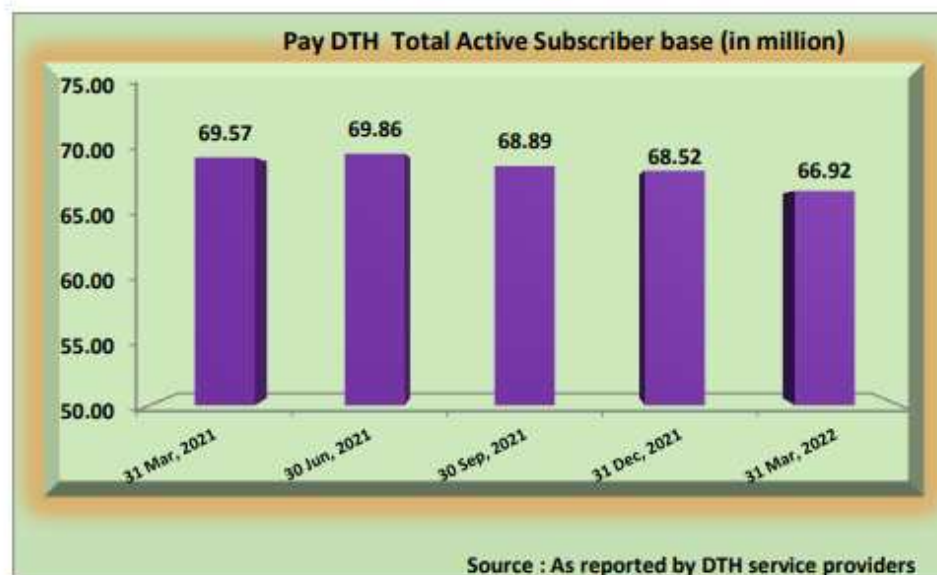
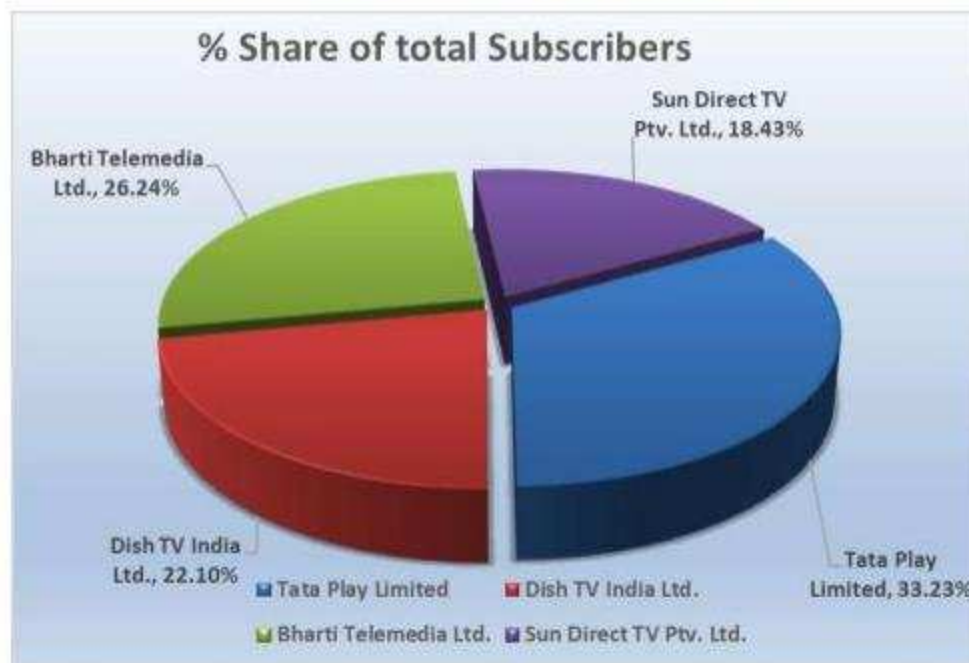


Chart 5.5 : Market share of DTH Operators



Source : As reported by DTH service providers

Section E : Other Value Added Services - PMRTS & VSAT

Public Mobile Radio Trunk Services (PMRTS)

- 1.66 The subscriber base of PMRTS increased from 63,417 at the end of Dec-21 to 66,392 at the end of Mar-22 with quarterly growth rate of 4.69%.

Table 1.34 : PMRTS Subscriber base - Service Provider wise

Sl. No	Name of the Service Provider	Subscriber Base as on 31.12.2021	Subscriber Base as on 31.03.2022	Net Addition	% Growth in subscribers in QE Mar-22
1	Arya Omnitalk Radio Trunking Services Pvt. Ltd.	52,294	54,838	2,544	4.86
2	Procall Ltd.	3,475	3,510	35	1.01
3	Quick Call	2,026	2,033	7	0.35
4	Inative Networks Pvt Ltd	1,820	1,820	0	0.00
5	Smartalk Pvt Ltd	1,578	1,699	121	7.67
6	Bhilwara Telenet Services Pvt Ltd	872	926	54	6.19
7	Wiwonet Solutions Pvt Ltd	857	1,041	184	21.47
8	Airtalk Solutions & Services Pvt Ltd	495	525	30	6.06
Total		63,417	66,392	2975	4.69

Very Small Aperture Terminal (VSAT)

1.68 The total number of VSAT subscribers decreased from 2,88,848 at the end of Dec-21 to 2,79,333 at the end of Mar-22. Net decrease during the quarter has been 9,515 at the decline rate of 3.29%.

Chart 1.26 : Number of VSAT Subscribers & Rate of Growth (%)



Table 1.35 : VSAT Service Providers currently providing service & their subscriber base

Sr. No	Name of Service Providers	Subscriber base at the Quarter ending		Net Addition	%age Growth	Market Share (%) Mar-22
		Dec-21	Mar-22			
1	Hughes Communications Ltd.	135,374	194,823	59,449	43.91%	69.75%
2	Bharti Airtel Limited	60,211	-	-60,211	-100.00%	0.00%
3	Nelco Ltd.	76,166	74,710	-1,456	-1.91%	26.75%
4	BSNL	6,709	7,122	413	6.16%	2.55%
5	HCL Comnet	7,784	63	-7,721	-99.19%	0.02%
6	Infotel Satcom	2,554	2,565	11	0.43%	0.92%
7	Cloudcast Digital (earthwhile Planetcast Media Services)	50	50	0	0.00%	0.02%
Total		2,88,848	2,79,333	-9,515	-3.29	100

Note: Transfer/Merger of VSAT CUG Service Authorizations under Unified License held by M/s Bharti Airtel Limited and the satellite spectrum assets relating to VSAT CUG Service Authorizations and NLD Service Authorization under Unified License held by M/s Bharti Airtel Limited to M/s Hughes Communications India Private Limited, w.e.f. 04.01.2022 vide DoT letter File No.AS-21/1/2020-Office of DIR (AS-V)-Part-1, dated 14.01.2022.

1.69 Hughes Communications Ltd. is the market leader having 194,823 subscribers with market share of 69.75% followed by Nelco Ltd. having 74,710 subscribers with market share of 26.75% at the end of Mar-22.

National Long Distance (NLD) by Optical Fibre Circuits

- Currently, India has an optical fibre-based network spanning across 2.8 million kilometres as against the target set up by the National Broadband Mission to deploy as much as 5 million kilometres of optical fibre by 2024.
- Only less than one-fourth of the Towers are fibre-connected
- There are some far-flung remote villages (around 43,000) in India, still devoid of having any mobile services
- Aim is to increase the fibre foot print by **five fold**

<https://techblog.comsoc.org/2020/11/15/indias-telco-and-infrastructure-groups-fiber-optic-network-growth-essential/>

<https://economictimes.indiatimes.com/industry/telecom/telecom-news/trai-paper-to-explore-better-fibre-network-capacity-in-5g/articleshow/69334322.cms?from=mdr>

<https://www2.deloitte.com/content/dam/Deloitte/in/Documents/technology-media-telecommunications/in-tmt-broadband-infrastructure-for-transforming-india-noexp.pdf>

https://www.trai.gov.in/sites/default/files/CP_29012020.pdf

National Long Distance (NLD) by Optical Fibre Circuits

- In order to expand mobile and broadband connectivity across the country, it is necessary to explore and utilise the opportunities presented by next-generation-networks like **5G and satellite communications**
- It would be critical to focus on fibre deployment and Right of Way clearances, for both over ground and underground infrastructure,
- OFC Infrastructure will form the bedrock of next generation technologies

<https://economictimes.indiatimes.com/industry/telecom/telecom-news/trai-paper-to-explore-better-fibre-network-capacity-in-5g/articleshow/69334322.cms?from=mdr>

<https://www2.deloitte.com/content/dam/Deloitte/in/Documents/technology-media-telecommunications/in-tmt-broadband-infrastructure-for-transforming-india-noexp.pdf>

https://www.trai.gov.in/sites/default/files/CP_29012020.pdf

International Long Distance (ILD)

- The New Telecom Policy'99 envisaged the opening up of the International long distance service to the private operators.
- The Government has opened the International Long Distance Service without any restriction on the number of operators.
- Applicant must be an Indian company, registered under the Companies Act'1956
- ILD operators include Reliance Communications Limited, Airtel, BSNL, Tata Communications Ltd., Vodafone and others.

Autonomous System (AS)?

https://en.wikipedia.org/wiki/Tier_1_network

- [The Internet](#) is a network of networks*, and autonomous systems are the big networks that make up the Internet.
- More specifically, an autonomous system (AS) is a large network or group of networks that has a unified [routing](#) policy.
- Every computer or device that connects to the Internet is connected to an AS.

India Based “ AS “ as an Example: Tata Communications

NAME	HQ	AS NO	RANK	ROUTE KM	
Tata Communications (formerly Teleglob) ^[2]	India	6453	8	700,000 ^[2]	Peering Policy

Internet and Broadband Services

Internet Service Provider (ISP) Licensing started in 1998 and Unified License (UL) regime started in 2014. These Licenses were issued in DOT field offices.

ISP Authorization Granted Under Unified License and Unified License (VNO)

As on December 2020, there are 324 Unified Licenses (VNO) have been issued with ISP authorization which include 30 Category “A”, 241 Category “B” and 53 Category “C”.

VSAT Service

VSAT service Licenses are granted on non-exclusive basis for Very Small Aperture Terminal (VSAT) service using INSAT satellite system within the territorial boundaries of India.

Under the VSAT licence, the Licences provide data connectivity within CUG amongst various sites throughout India using VSATs and central hub. There are two categories:
VSAT CUG: As on October 2020: 9 licences; 4 VNO licences

Captive CUG VSAT: As on October 2020: 24 Captive CUG VSAT networks

VSAT Service

As per TRAI Recommendations recently some changes have been introduced permitting:

Provision of Cellular Backhaul Connectivity via Satellite through Very Small Aperture Terminal under Commercial Very Small Aperture Terminal (VSAT) CUG Service Authorization.

VSAT Service

The main features of TRAI Recommendations include:

VSAT CUG Service provider permitted to provide backhaul connectivity for cellular mobile services through satellite and establish Wi-fi hotspots using VSAT terminal located in the service area of the Access Service Providers.

The VSAT terminal can be located anywhere in the country
Enabling provisions of backhaul connectivity to be made in stand-alone Commercial VSAT CUG Service License, Unified License and Unified License (Virtual Network Operators).

Global Mobile Personal Communication by Satellite (GMPCS) Service in India

- The New Telecom Policy'99 envisages introduction of Global Mobile Personal Communication by Satellite (GMPCS) Service in India.
- With GMPCS Service a subscriber can communicate from any point on earth through hand-held terminal. The subscriber will have one telephone number irrespective of his location.
- The mobile satellite networks can operate with satellites either in Low Earth Orbit (LEO) upto 1000 KMs, Medium Earth Orbit (MEO) upto 10,000 KMs or GSO Stationery Earth Orbit (GSO) at 36,000 KMs. from the surface of the earth.

Global Mobile Personal Communication by Satellite (GMPCS) Service in India (Contd.)

- Reliance Jio and Bharti Airtel are in the process of obtaining GMPCS Licence to operate in India.
- GMPCS having global reach with the help of a network of Gateway Earth Stations will provide connectivity towards satellite as well as PSTN.
- With GMPCS easy, flexible and convenient communication will be possible with more economical use of radio frequency spectrum.

Public Mobile Radio Trunking Services (PMRTS)

Public Mobile Radio Trunking Services (PMRTS) is a two-way land mobile service in which the users communicate among themselves through a pair of Radio Frequencies out of a pool in a designated band assigned to the system. This license is used to provide Public Mobile Radio Trunking Service on a commercial basis.

PMRTS comes under Unified License since 2013.

Service Areas for PMRTS: Metro or Circle-wise

As of on November 2020, there are 41 PMRTS licenses in existence providing PMRTS service in the country.

Captive Mobile Radio Trunking Service (CMRTS)

Captive Mobile Radio Trunking Service (CMRTS) is similar to PMRTS service and the difference is that it used for non commercial captive purpose.

CMRTS is not covered under Unified License.

DOT issues license only for agencies/companies like Police, Metro Rail Services, etc.

As of November 2020, there are 111 CMRTS licenses existence to provide CMRTS service

Public Protection and Disaster Relief (PPDR) Networks

Enhancing the Public Protection and Disaster Relief (PPDR) plan for India by:

<https://dot.gov.in › files › EnglishPolicy-NDCP>

Facilitating the establishment of a Pan-India network for Public Protection and Disaster Relief (PPDR)

Making necessary spectrum available for PPDR including by establishing INSAT satellite-based mobile communication systems

Implementing global and regional harmonized spectrum Plans for PPDR

Broadband PPDR Networks(3GPP) <https://dcpw.gov.in/session1.php>

Today, voice is the primary mode of communication within Public Protection & Disaster Relief (PPDR) agencies, which is provided by dedicated PPDR communication networks such as TETRA, APCO 25 or DMR etc. Until now, PPDR agencies (e.g. Police, Fire brigades, Medical emergencies, etc.) rely on these narrow band LMR (Land Mobile Radio) systems, in the field for day to day operations.

The LMR communication networks provide reliable and resilient mobile voice services, as well as basic data services.

However, these traditional communication networks show substantial limitations, when matched against modern requirements of PPDR agencies:

**Narrowband; No Interoperability among various PPDR Agencies;
Inefficient use of Spectrum**

Advantages of Next Generation Technologies for PPDR communications:

4G(LTE /LTE-Advanced) and 5G network Features;

Rich multimedia content like live video or high quality resolution images;

PPDR agencies to use the common communication platform without any boundary limitations and significantly improve the speed and reliable communications across multiple Govt. departments like Fire, Police, Ambulance, Security Forces, etc.

Universal Service Obligation Fund

Extracts From DOT Annual Report 2020-21

4.4.1.4 Functions and Objectives

The USO Fund was established with the fundamental objective of providing access to 'basic' telecom services to people in the rural and remote areas at affordable and reasonable prices. Subsequently the scope was widened to provide subsidy support for enabling access to all types of telecom services, including mobile services, broadband connectivity and creation of infrastructure like OFC in rural and remote areas.

The implementation of the USO related activities is carried out by the "eligible operators", i.e. the entities having valid license or registration or authorization from Central Government/ Department of Telecommunication for providing telecom services or infrastructure or any other entities as specified by the Central Government from time to time.

DOT USOF Office determines cost figures for implementation of various types of infrastructure for utilizing USOF Fund.

USOF Ongoing Activity – Migration to 4G and Introducing Satellite Solutions

- (xx) The following proposal of USOF scheme for Provision of mobile services in Left Wing Extremism (LWE) Phase-II areas:
- a. Revision of technology from '2G+4G' to 4G for LWE-II project.
 - b. Floating of RFP on 4G technology for 2542 tower locations at the estimated cost of Rs. 2,288 crore @ ₹0.90 crore per tower (CAPEX ₹1307 crore + OPEX ₹981 crore for 5 years), as benchmark cost.
 - c. Total cost estimate will be ₹2,745.60 crore including cost of 20% additional towers as per quantity variation clause.
- (xxi) The proposal for increase in number of GPs through Satellite based connectivity at difficult places like NER, J&K, HP, Uttarakhand, Islands etc. and for two additional Gateways and Last Mile Connectivity at these GPs, along with its consequent Cost revision under BharatNet project Phase-II with a revised cost of ₹973.37 crores exclusive of GST and other statutory charges / infra lease charges which shall be paid on actuals.

Further, provision of Last Mile connectivity at 5521 locations for an overall cost of ₹77.064 crore for 9633 Access Points excluding taxes.

Satellite Operators may propose use of USOF Funds for providing Satellite Based Services to Villages in future?

5G

https://www.business-standard.com/article/companies/dot-allocates-spectrum-for-5g-trials-to-telecom-service-providers-121052801737_1.html

5G is the 5th generation mobile network.

5G enables a new kind of network that is designed to connect virtually everyone and everything together including machines, objects, and devices.

5G wireless technology is meant to deliver higher multi-Gbps peak data speeds, ultra low latency, more reliability, massive network capacity, increased availability, and a more uniform user experience to more users.

Higher performance and improved efficiency empower new user experiences and connects new industries.

5G is based on OFDM (Orthogonal frequency-division multiplexing), a method of modulating a digital signal across several different channels to reduce interference.

5G uses 5G NR air interface alongside OFDM principles.

5G also uses wider bandwidth technologies such as sub-6 GHz and mm Wave.

5G (Contd.)

Applications of 5G technology

<https://www.rfpage.com/applications-5g-technology/>

High-speed mobile network – 20 to 30 Gbps; Latency 1 milli second

Entertainment and multimedia – HD Video

Internet of Things – Connecting everything

Smart Home

Logistics and shipping – RFID, GPS

Industrial IoT

Smart farming; Fleet management

Healthcare and mission critical applications – SHARING LARGE FILES LIKE MRI SCAN REPORTS

Autonomous Driving and Drone Operation

Security and surveillance

5G (Contd.)

Products/Solutions/Applications

There are a lot of expectations of what 5G can do for the country. 5G data speeds will jump from 30 MBPS of 4G to 60 MBPS -1 GBPS range enabling Faster OTT Platform, high end TV (8K TV), Virtual Reality Games, advance Health Care applications, mobile banking, new e-governance and online education applications, speedy shopping, new and innovative applications in agriculture, manufacturing and transport sectors and introduction of new private networks with higher bandwidths.

5G (Contd.)

Spectrum

5G Auctions are over. Government received Rs 1.5 lakh Crores worth of Auction bids from TSPs. Government had put about 72000 of MHz of spectrum in auction, of which about 51000 MHz of spectrum has been sold with a bid amounting to Rs 1.5 lakh Crores.

(Comparison with GSO Satellite: The large quantum of 5G spectrum indicates the potential for enormous capacity in terms of throughputs. Such large spectrum availability for 5G is due to well established cellular frequency reuse technologies. Spectrum/Capacity available for GSO HTS System is limited as satellites need to be kept at least 5 or 6 degrees apart in GSO for a given service area.

Comparison with LEO/MEO Satellite Constellations: Large Spectrum/Higher Capacities are possible for Non-GSO Systems like LEO/MEO Satellite constellation but these satellite systems are essentially global systems and only a few operators can gather international support and internationally coordinate the orbit-spectrum resources, build, launch and operate such systems successfully.)

5G (Contd.)

Alliances

Airtel has tie-up with Tech Mahindra.

Jio is talking to Samsung as a third party service provider. Jio is also collaborating with Google Cloud.

Vodafone partners with US based Ciena to construct a future ready network for 5G.

Vodafone has also tie-up with L&T.

C-Dot may work with BSNL.

Multinationals

Google, Microsoft and Amazon may extend their public data networks to enter into Private Network markets. SingTel and Verizon may see 5G has an opportunity to enter B2B Platforms/Services markets.

Mobile Phones, Telecom Equipment and Infrastructure

Manufacturers of Telecom Equipment and 5G Phones will be also active in working with TSPs.

The country has over 700,000 towers and this has to be doubled for a smooth rollout for 5G.

Fiberisation is only 30 percent at present and needs to increase to 80 percent for meaningful rollout of 5G.

Profile of Telecom Equipment Vendors

**Foreign Vendors Dominate in the Indian Telecom Industry in
the areas of**

**Mobile Phone Manufacturing
Wireless Infrastructure/ Equipment Manufacturing
IT Products and Services**

•

Mobile Phone Manufacturing and Marketing in India (Indications Only)

Due to the huge middle class and large population, India is one of the most attractive mobile markets for many top brands.

From June 2019 to June 2020,

Xiaomi has 26.02%,

Samsung has 21.13%,

Mobicel has 12.89%

Oppo has 11.16%,

Realme has 4.87% and

Apple has 3.54% market share in India.

Xiaomi Corporation has 7 factories in India. It has sold 99% of its phones made in India.

Other Brands: Huawei, OnePlus, Vivo, Lenova, LG, etc.

Mobile Brands in the World



Top wireless infrastructure companies

<https://www.rcrwireless.com/20160531/network-infrastructure/top-5-wireless-infrastructure-makers-tag4-tag99>

- 1. Huawei**
- 2. Ericsson**
- 3. Nokia**
- 4. ZTE**
- 5. Samsung**

IT Companies

IT Companies like Infosys, TCS, IBM and others provide IT support to Telecom Service Providers.

**Impetus needs to be given to Domestic Telecom
Manufacturing and Production.**

**DOT Notification asks Government agencies to buy from
Domestic Equipment Manufacturers**

**NDCP 2018 Aims Enhancing India's contribution to Global
Value Chains**

Draft Indian Telecommunication Bill, 2022

This is an Important Subject

There is a need to analyse and study these aspects in detail.