

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

ONLINE LECTURE PROGRAM
Date: 23/08/2021 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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Acknowledgements

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Since long time I have been working with Dr P Subba Rao CMD Ananth Technologies Limited Hyderabad in the areas of Communications Satellites, I take this opportunity to thank Dr Subba Rao.

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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)

I Introduction

II Enabling Factors for Orderly and Efficient Operations of Telecommunication Services

- **National Digital Communications Policy (NDCP) 2018**
- **National Telecommunications Regulations**
- **Regulatory and Institutional Structure for Telecom Sector**
- **Telecom Service Authorisation/Licensing regime**
- **Telecom Service License Conditions**
- **International Telecommunication Union**
- **National Level Spectrum Management**
- **IMT Bands – Spectrum for Terrestrial Mobile Services**
- **Satellite services**
- **Satcom Spectrum and Satellite Service Licence**
- **Satellite Communications – Policy Aspects**
- **Space Act**

Introduction to Telecom Industry in India

(Telecommunication Laws in India)

III Profile of Telecom Services

- **Status of Mobile Telephone Services**
- **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 Profile of Telecom Service Providers (TSP)

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

INTRODUCTION

- Telecom in India is seen more as a Service Industry.
- Telecom growth in India is phenomenon. Presently mobile phones: 1.2 billion; broadband users: 780 million.
- The topic of Telecom industry in India is discussed under three headings:
 - i) Enabling factors for orderly and efficient operation of Telecom Services
 - ii) Profile of Telecom Services and
 - iii) Profile of Telecom Service Providers (TSP)

We also touch upon

Telecom Vendors: Mobile Phone Manufacturers, Wireless Telecom Equipment Manufacturers, IT Organizations

INTRODUCTION (Contd.)

- Policy, Regulations, Licensing and Spectrum allocation Procedures are the enabling factors for orderly and efficient operation of Telecom Services.
- The Policy guidelines are to ensure that the advantages of new technologies are accessible to all equitably and affordably.
- The policy sets goals like
Universal Broadband Connectivity at 50 Mbps speed,
Fixed Internet Connectivity at Homes and Public places,
High speed Internet Broadband connectivity for Gram Panchayat / Developmental Institutions / Educational Institutions / Remote Areas
- The overall Objective of the National Policy on digital communications is to prepare the country and its citizens for the future

INTRODUCTION (Contd.)

Government Proactive Actions

In the immediate future there is a need to take actions to

- Improve the penetration of Telecom Services in rural areas/villages.
- Government is taking proactive actions for starting of 5G services in India.
- Satellite Communications Policy is being reviewed for adopting GSO and
- Non GSO Satellite based solutions for providing internet and broadband connectivity to villages/remote areas.

INTRODUCTION (Contd.)

Government Proactive Actions (Contd.)

New Technologies

- Technology is taken for granted.
- Telecom Equipment vendors play a major role in the Industry.
- Telecom Standardization work is done at international levels.
- It is therefore easy for the National Telecom Industry to absorb the latest technologies as and when it happens.

INTRODUCTION (Contd.)

Government Proactive Actions (Contd.)

Telecom Organisations

- However Home grown R&D work needs to be encouraged and enhanced.
- Such efforts are required not only in technical areas but also in areas like management, finance, legal, etc.

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 over a billion mobile phones and half a billion 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: 780 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-PSTN 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 and 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 Broadband Policy 2004; 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, thus, 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 and circulated, 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 wireline 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).
- 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).

ITU IMT FREQUENCY BANDS FOR TERRESTRIAL MOBILE SERVICES

- ITU identifies common frequency bands for Mobile Services (IMT) at international level and this facilitates worldwide transportability and use of Mobile Phones operating in the IMT bands.
- IMT Bands are also included in the NFAP (National Frequency Allocation Plan)
- NFAP Footnote IND 16: Spectrum for IMT Bands (2G, 3G, 4G-LTE Cellular Mobile) is allocated through the Auction process.

IND 16 The following frequency bands, or parts thereof, have been identified for implementation of International Mobile Telecommunications (IMT):

Sl. No.	Band as mentioned in RR	Relevant RR Footnotes
1	450-455 MHz	5.286AA
2	455-456 MHz	
3	456-459 MHz	
4	459-460 MHz	
5	460-470 MHz	
6	470-585 MHz*	5.296A
7	585-610 MHz*	
8	610-890 MHz	5.313A, 5.317A
9	890-942 MHz	
10	942-960 MHz	

ITU IMT FREQUENCY BANDS FOR TERRESTRIAL MOBILE SERVICES

NFAP Footnote IND 16 - IMT Bands (Contd.)

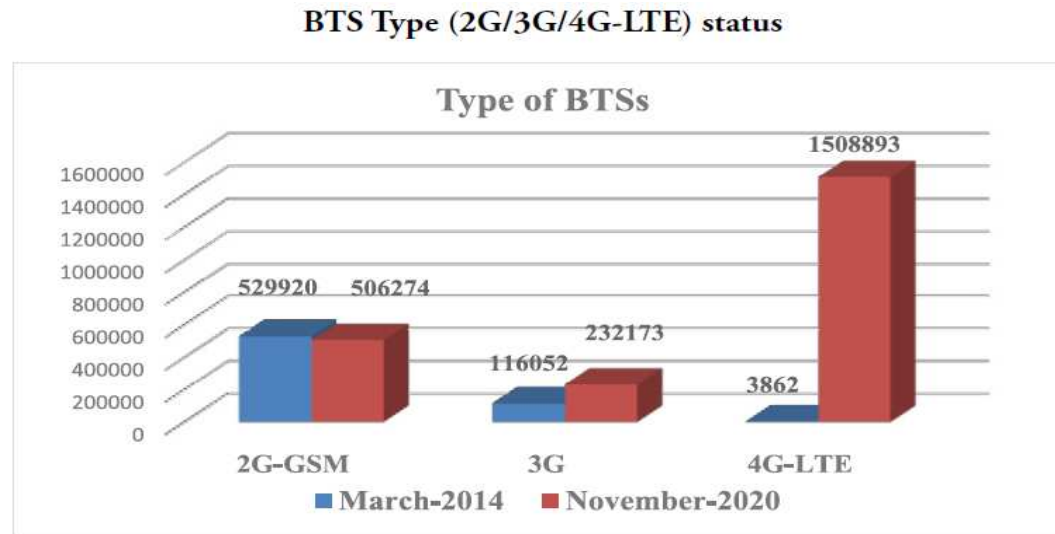
11	1427-1429 MHz	5.341C, 5.346A
12	1429-1452 MHz	
13	1452-1492 MHz	
14	1492-1518 MHz	
15	1710-1930 MHz	5.384A, 5.388
16	1930-1970 MHz	
17	1970-1980 MHz	
18	1980-2010 MHz	
19	2010-2025 MHz	5.388
20	2025-2110 MHz	
21	2110-2120 MHz	
22	2120-2160 MHz	
23	2160-2170 MHz	5.384A
24	2170-2200 MHz	
25	2300-2450 MHz	
26	2500-2520 MHz	
27	2520-2535 MHz	5.384A
28	2535-2655 MHz	
29	2655-2670 MHz	
30	2670-2690 MHz	
31	3300-3400 MHz	5.429F
32	3400-3500 MHz	5.432A, 5.432B, 5.433A
33	3500-3600	

* Part of the band 470-698 MHz would be made available for IMT once the current and future usage of the band 470-698 MHz by the broadcasting service is finalized.

(WRC- 19 identified five additional frequency bands for IMT between **24.25 and 71 GHz**. Totally 17.25 GHz bandwidth spectrum: 14.75 GHz worldwide (24.25-27.5 GHz, 37-43.5 GHz, 66-71 GHz) and 2.5 GHz on regional and country basis (45.5-47 GHz, 47.2-48.2 GHz). In future these frequency bands will be considered for inclusion in the NFAP.)

2G/3G/4G-LTE Infrastructure Growth Pattern

<https://dot.gov.in/sites/default/files/Annual%20Report%202020-21%20English%20Version.pdf>



(Source TARANG Sanchar Portal & CoAI)

Comparison 3G and 4G-LTE Technologies

This Figure shows that 4G-LTE system is more successful and versatile as compared to 3G.

Therefore Telecom Services Provider (Jio) who Jumped directly to 4G-LTE has significant financial and operational advantage over other TSPs (like AirTel, Vodafone) which went through the highly competitive auction process for 3G Services way back in 2010.

Frequency bands for 2G, 3G, 4G Mobile in India

<https://www.nepalitelecom.com/2017/02/frequency-bands-2g-3g-4g-mobile-india.html>

S.N	Mobile Technology in India	Frequency bands in India	Major Operators
1	GSM (2G)	900 MHz, 1800 MHz	Airtel , Idea Vodafone, Aircel , BSNL
2	CDMA	850 MHz	Reliance, BSNL, Tata
3	WCDMA (3G)	2100 MHz, 900 MHz	Airtel , Idea Vodafone
4	WiMAX	2300 MHz	BSNL
5	4G LTE (4G)	1800MHz	Airtel , Idea Vodafone, Jio
		850 MHz	Jio
		2300 MHz	Airtel , Idea Vodafone, Jio
		2500 MHz	BSNL, Idea Vodafone
5G: 700 MHz, 3.3-3.6 GHz, and 24.25-28.5 GHz; 4G spectrum for trials in the 900 MHz, 1800 MHz, and 2300 MHz bands.			

Internet Connectivity Services

Optical Fibre based internet connectivity services are highly competitive in India.

India's Fastest Broadband Internet service providers 2021 are:

Airtel; Reliance Jio Fiber; Excitel Broadband; BSNL; Hathway's Broadband; ACT Fibernet Broadband; You Broadband

(<https://freekaamaal.com/miscellaneous/best-internet-service-provider-in-india>)

Satellite based internet services are expensive but Technology brings down the price;

GSO and NON GSO Satellite Based Internet Access Services – Examples

Provider	Best For	Price	Download speed	Details
	Fastest satellite internet speeds	\$30.00– \$150.00/mo.*	12–100 Mbps	12–300 GB
	Budget-friendly low-end plans	\$59.99– \$149.99/mo.**	25 Mbps	10–50 GB

Non GSO Satellite Based Internet Access Services may bring down the price and the availability:

SpaceX /  satellite internet price

Plan	Price	Downlink Speed	Data Cap
	\$99/mo.	50–150 Mbps	Unlimited

Other Non GSO Systems like mO3b, OneWeb, etc are likely to offer similar highly competitive satellite based internet service services and prices.

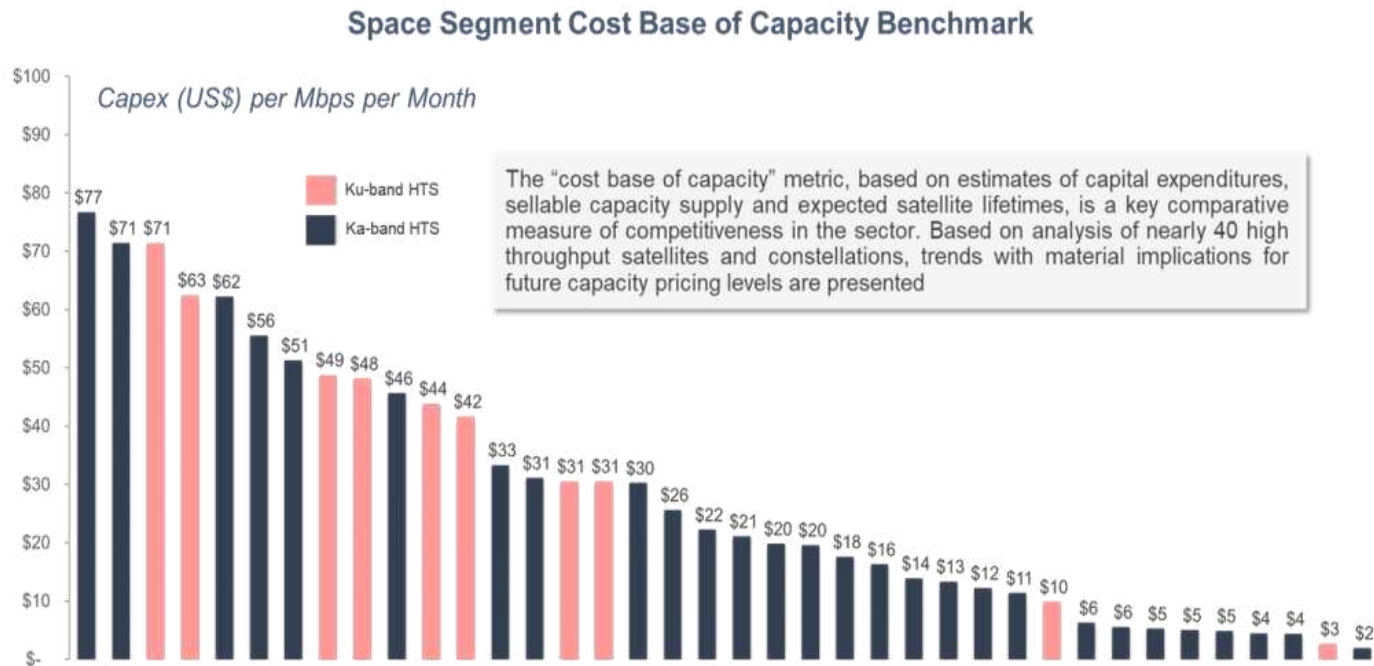
Satellite capacity pricing declines slow, but price pressure expected to increase with new supply entering service in 2023

Seeing the on-going pricing disruption of successive generations of HTS,

With the scheduled 2021 launch of Viasat-3,

it is estimated that the base cost will be just \$5 per Mbps per month, when accounting for satellite, launch and ground segment CAPEX.

In comparison, Viasat-2, which launched in 2017, has a cost base roughly three times higher than Viasat-3.



Source: Euroconsult 2020 research "FSS Capacity Pricing Trends"

<https://www.geospatialworld.net/news/satellite-capacity-pricing-declines-slow-but-price-pressure-expected-to-increase-with-new-supply-entering-service-in-2023/>

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).
- On the other hand Telecom Service Providers like Jio and Vodafone wanted that assignment of Ka/Ku/C band spectrum for Geo/Meo satellite must be done through auction only.

Satellite Spectrum and Satellite Service License (Contd.)

- In the mean time, in August 2021, Department of Telecommunications (DOT) has issued a letter of intent (LOI) to Bharti Group backed OneWeb for satellite services in India.
- OneWeb is eyeing a full global coverage including India market by the middle of 2022 with a constellation of 648 low earth orbit (LEO) satellites.
- On completing the formalities, the licensee will be issued to the Company.
- This trend indicates that there may be no auction for Satellite Spectrum.
- The existing Satcom Policy is also not for conventional way of auctioning.

Another Boost to Satellite Services

Existing VSAT Infrastructure to provide Back-haul Connectivity

<https://economictimes.indiatimes.com/industry/telecom/telecom-news/dcc-allows-vsats-operators-to-provide-satellite-based-backhaul-connectivity-to-telcos/articleshow/84145904.cms?from=mdr>

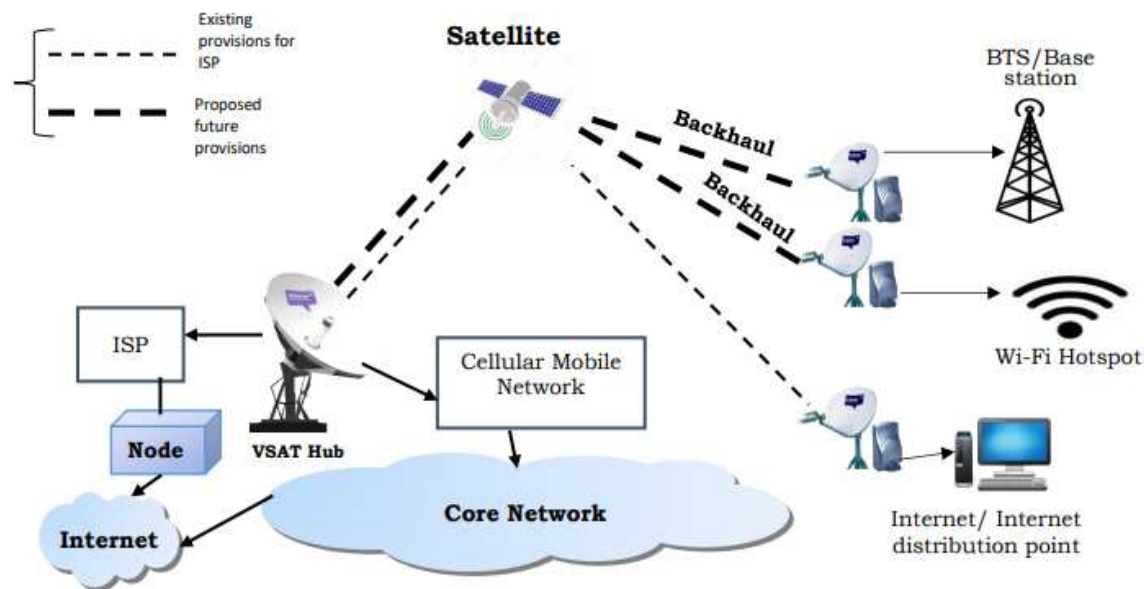
- Digital Communications Commission (DCC) has accepted TRAI recommendation to allow VSAT operators to provide satellite based cellular backbone connectivity to telcos to ensure uninterrupted mobile broadband coverage in remote and far-flung regions.
- This move to allow carriers to use satellite-based cellular backhaul connectivity would pave way for Jio, Bharti Airtel and Vodafone/Idea to use satellite capacity of the existing VSAT licence holders such as HNS, Nelco and BSNL to provide 4G/5G services and Wi-Fi based broadband in rural regions.
- This decision is also significant for Bharti backed OneWeb and Elon Musk's Starlink as they prepare to start high speed internet from space services in India next year
- In this situation Satcom Policy is being reviewed.

Another Boost to Satellite Services (Contd.)

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

Extract from TRAI Report: Consultation Paper on 'Provision of Cellular backhaul connectivity via Satellite through VSAT under Commercial VSAT CUG Service Authorization'

Fig 1.4: Proposed backhaul provisioning by Commercial VSAT licensee



SATCOM Policy

- In 1997-2000 time frame, the Department of Space, in partnership with the Department of Telecommunication and the Department of Science and Technology, framed the Satellite Communication Policy in 1997 (**SATCOM Policy**).
- Through the SATCOM Policy, the government aimed to develop a strong satellite communication service industry in India
- Policy to enable private companies in India to own and operate Satellite Systems known as Indian Satellite Systems (ISS).

Recommendations on Satcom Policy in the National Digital Communication Policy, 2018

- There has been lot of discussions to review and revise the 1997 /2000 Year SATCOM Policy to make it at par with the emerging trends
- Consequently, the National Digital Communication Policy, 2018 (NDCP 2018) agreed to a long standing demand of the industry to review the SATCOM Policy developed in 1997 and 2000 time frame.
- NDCP 2018 accordingly suggested several measures by which the satellite communication technology can be strengthened in India.

New Satcom Policy (Draft)

- Draft Space Based Communication Policy of India-2020 (Spacecom Policy- 2020) and draft Norms, Guidelines and Procedures for implementation of Spacecom Policy-2020 (Spacecom NGP-2020) are published for public consultation by DOS.

https://www.isro.gov.in/sites/default/files/draft_spacecom_policy_2020.pdf

- The new Policy fosters promotion of Indian industry as co-traveller with DOS towards meeting the objectives.

New Satcom Policy (Draft)

Under the ambit of Spacecom Policy-2020, the Government of India shall –

- - adopt measures to monitor and authorize use of space assets for communication to or from Indian territory.
- - ensure protection of space assets already put in place and adopt measures to bring in more space assets under the administrative control for enhancing ability to utilize space based communication for national needs.
- - promote increased participation of commercial Indian industry to provide space based communications both within the country and outside.
- - concentrate on realization of space based communication systems for addressing the requirements that cannot be effectively, affordably and reliably satisfied by commercial Indian Industry either because of national security concerns or economic factors.
- - provide a timely and responsive regulatory environment for the commercial Indian industry to establish and operate space based communication systems

What is the Important Addition in the New Draft Satcom Policy?

Creation of IN-SPACe:Satcom Authorization Centre

- As per Draft Space Based Communication Policy of India – 2020 (Spacecom Policy - 2020), Indian National Space Promotion & Authorization Center (IN-SPACe), an independent body, under Department of Space (DOS), shall accord necessary authorizations and permissions for all satcom related activities, to or from Indian territory, as per the applicable acts, regulatory provisions & exemptions and statutory guidelines.

IN-SPACe is to Ensure Independent Actions on Regulations

Web References:

- <https://www.isro.gov.in/sites/default/files/article-files/indias-space-policy-0/satcom-policy.pdf>
- <https://www.isro.gov.in/sites/default/files/article-files/indias-space-policy-0/satcom-ngp.pdf>
- <https://www.ilntoday.com/2020/07/indian-satellite-communication-policy-the-recent-reforms/>
- https://www.isro.gov.in/sites/default/files/draft_spacecom_policy_2020.pdf

Space Act

Background Information on Space Activities Bill

International Treaty Obligations on Outer Space Activities:

- Internationally, the outer space activities are governed by relevant chapters of international law in general and by United Nations' (UN) Treaties and principles evolved under UN Committee on Peaceful Uses of Outer Space (UNCOPUOS) in particular.
- Obligations of a State Party under international treaties on outer space activities are expected to be complied/ discharged through national mechanisms, namely domestic space legislations.

Space Act

Background Information on Space Activities Bill

International Treaty Obligations on Outer Space Activities:

- Basic tenets of treaty obligations, namely, ‘bearing International responsibility’ and ‘liability for damages caused by space activities and space objects’ are more applicable to a State Party, where space activities are performed by non-governmental/ private sectors.
- Hence, non-governmental space activities are required to be licensed / authorized and continuously supervised by a State in order to comply with treaty obligations.

Drafting Space Activities Bill

<https://www.thehindu.com/sci-tech/science/the-hindu-explains-what-is-the-space-activities-bill-2017/article20680984.ece>

https://www.prindia.org/sites/default/files/bill_files/Draft%20Space%20Activities%20Bill%202017.pdf

- Applications and services for national needs and beyond have been rapidly growing.
- This scenario also encourages the participation of Indian industry and service providers at much higher levels in all round space activities
- Need for national space legislation for supporting the overall growth of the space activities in India especially Indian Non Government Entities to own, launch and operate space assets in particular satellites.

Drafting Space Activities Bill

<https://www.thehindu.com/sci-tech/science/the-hindu-explains-what-is-the-space-activities-bill-2017/article20680984.ece>

https://www.prsindia.org/sites/default/files/bill_files/Draft%20Space%20Activities%20Bill%202017.pdf

- Efforts included studies on Model Law on National Space Legislation formulated by the International Law Association (ILA), to the UN Committee on Peaceful Uses of Outer Space (UNCOPUOS) serves as a useful reference.
- A draft Space Activities Bill has been formulated with due preliminary consultations with a few relevant Ministries. It is intended to have a basic framework with very essential provisions for treaty obligations.

Draft Scope of Space Activities Bill

- The provisions of this Act shall apply to every citizen of India and to all sectors engaged in any space activity in India or outside India
- A non-transferable licence shall be provided by the Central Government to any person carrying out commercial space activity
- The Central Government will formulate the appropriate mechanism for licensing, eligibility criteria, and fees for licence.

Draft Scope of Space Activities Bill

- The government will maintain a register of all space objects (any object launched or intended to be launched around the earth) and develop more space activity plans for the country
- It will provide professional and technical support for commercial space activity and regulate the procedures for conduct and operation of space activities
- It will ensure safety requirements and supervise the conduct of every space activity of India and investigate any incident or accident in connection with the operation of a space activity.

Profile of Telecom Services

In India Telecom is seen more as a Service Industry. Technology is taken for granted. Telecom Equipment vendors play a major role in the Industry.

Telecom Standardization work is done at international levels.

International Standardization Organisations - Examples:

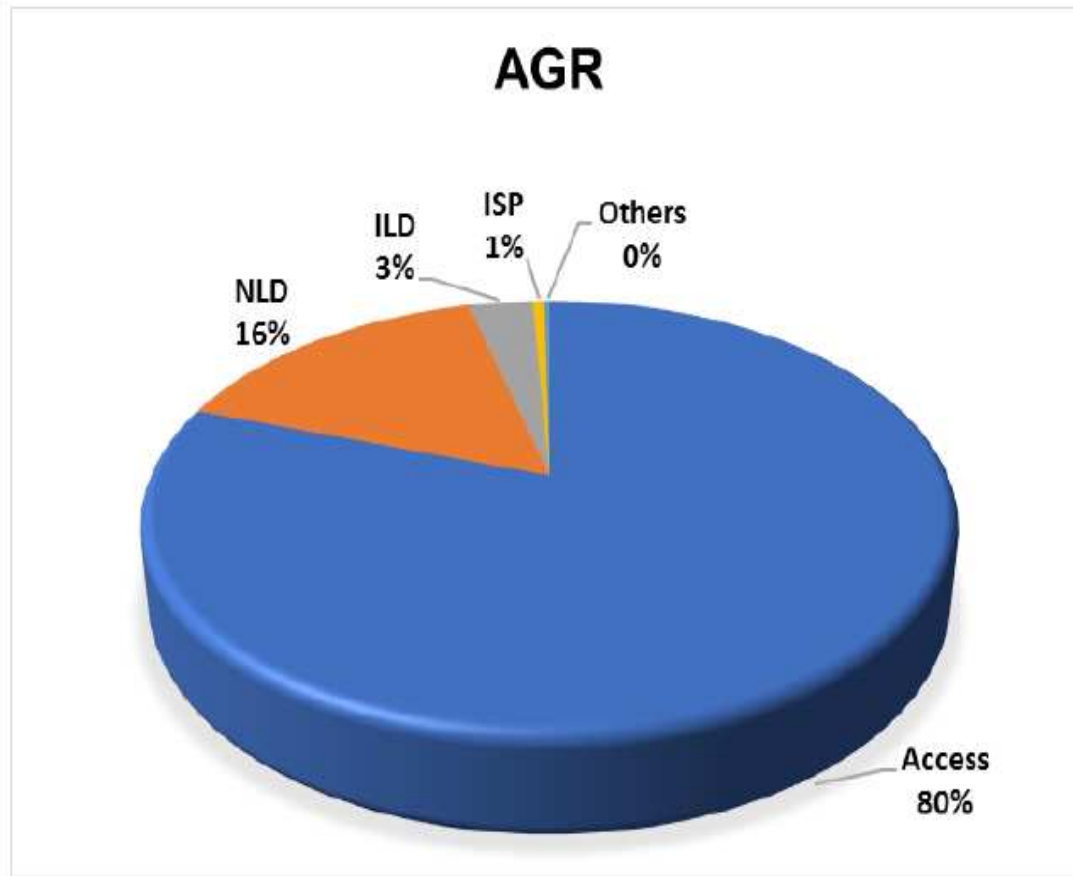
[3GPP](#) – 3rd Generation Partnership Project; [3GPP2](#) – 3rd Generation Partnership Project 2;
[IEEE](#) – Institute of Electrical and Electronics Engineers; [IETF](#) – Internet Engineering Task Force;
[ITU](#) – The International Telecommunication Union; [W3C](#) – World Wide Web Consortium;
[TIA](#) – Telecommunications Industry Association;
[ETSI](#) – European Telecommunications Standards Institute;
[India](#) – BIS – [Bureau of Indian Standards](#);
(https://en.wikipedia.org/wiki/List_of_technical_standard_organizations)

It is therefore easy for the National Telecom Industry to absorb the latest technologies as and when it happens.

A lot of advances in technology happen for Mobile / Access Services. Mobile / Access Services dominate the Telecom Industry.

80% of the AGR Revenue comes from the Access Services

Service-wise composition of Adjusted Gross Revenue



Status of Mobile Telephone Services

Extract From DOT Annual Report 2020-21

BOX 2.1	
Snapshot of present status at the end of November, 2020	
•	Indian telecom network is 2 nd largest in the world in terms of telephone connections
•	The country has 1175.22 million telephone connections
•	There are 1155.15 million wireless telephone connections
•	Overall tele-density in the country is 86.55%
•	Urban tele-density is 139.01%
•	Rural tele-density is 59.08%
•	Share of wireless telephones in total telephones is 98.29%
•	The share of private sector in total telephones is 88.71%
•	Number of Broadband connections is 734.82 million (October 2020)

Immediate needs like improving the rural tele-density and broadband connections.

In this regard, while acceleration of the work for expansion of optical fibre Circuits, 4G Mobile, Wi-Fi based mobile networks, International Satellite Operators are pitching for GSO and Non GSO Satellite based solutions.

In the mean time, in August 2021, Department of Telecommunications (DOT) has issued a letter of intent (LOI) to Bharti Group backed OneWeb for satellite services in India.

National Long Distance (NLD) by Optical Fibre Circuits

- Currently, India has approximately 1.5 million kilometres of OFC

OFC Route Km: Reliance Jio: 3.25 lakh Km;

Airtel: 2.5 lakh Km; Vodafone: 1.5 lakh Km;

BSNL: 8 lakh Km

- 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 **fivefold** by 2022

<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 overground 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 Tele globe) ¹²³	India	6453	8	700,000 ¹²⁴	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

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.)

- 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. Following are the broad guidelines for issue of Licence for provision of GMPCS Service in India.
- It may be noted that in August 2021, Department of Telecommunications (DOT) has issued a letter of intent (LOI) to Bharti Group backed OneWeb for satellite services in India. OneWeb is eyeing a full global coverage including India market by the middle of 2022 with a constellation of 648 low earth orbit (LEO) satellites.

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.)

5G in India: DoT allocates spectrum for 5G trials to telecom service providers
Department of Telecom (DoT) has allocated spectrum to telecom operators to start 5G trials at locations including Delhi, Mumbai, Kolkata, Bengaluru, and Hyderabad, according to industry sources.

The operators have been allocated spectrum in the 700 MHz, 3.3-3.6 GHz, and 24.25-28.5 GHz bands in various locations.

According to sources, the telecom service providers can use their existing 4G spectrum for trials in the 900 MHz, 1800 MHz, and 2300 MHz bands.

After completing the trials, preparation for [5G spectrum](#) auctions will begin.

The department had approved trials of 5G with Ericsson, Nokia, Samsung, and C-DoT.

Reliance Jio Can Launch India's 1st 5G Network At 1 Gbps Speed!

Reliance Jio has claimed that it will be the first telecom operator to introduce 5G network to the citizens of India. At the 44th annual general meeting, the company also made an announcement about the launch of the JioPhone Next, which will be one of the most affordable 4G phones.

Jio has reportedly acquired a spectrum in the 800 MHz, 1,800 MHz and 2,300 MHz bands in 22 circles across India.

5G (Contd.)

Jio Partners With Qualcomm To Build 5G Network Infrastructure

Also, Jio has partnered with Qualcomm to build its own 5G network infrastructure and virtualized Radio Access Network (RAN).

Virtualized RAN enables a company's 5G software to operate on conventional off-the-shelf servers as opposed to requiring exclusively-built dedicated servers.

This technology accelerates the process of rolling out a 5G network.

These telcos have now joined hands with original equipment manufacturers and technology providers which include Ericsson, Nokia, Samsung, and C-DOT.

Also, Reliance Jio will also be conducting the trials with the help of its indigenous technology.

In short, Chinese gear makers will not be included in the 5G trials.

To Sum up:

5G is one of the most sophisticated wireless technologies we have ever developed so far.

It will revolutionize the entire area where wireless network can be used for efficient and secure communication.

The socio economics impact of 5G has yet to be analyzed.

However, it will make significant impact on every areas where wireless transmission is inevitable.

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

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

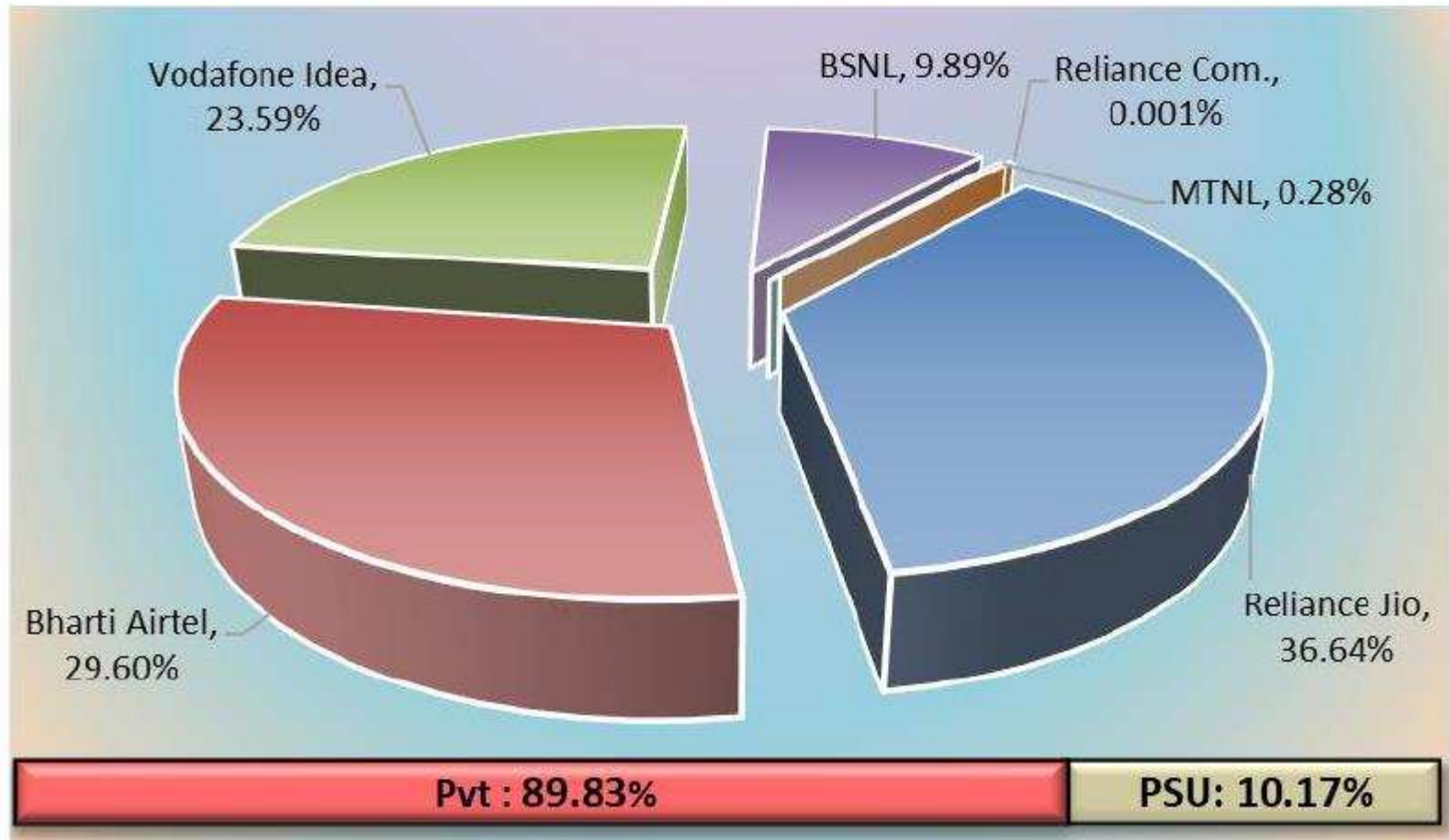
Autonomous Driving and Drone Operation

Security and surveillance

Profile of Telecom Service Providers (TSP)

TRAI REPORT

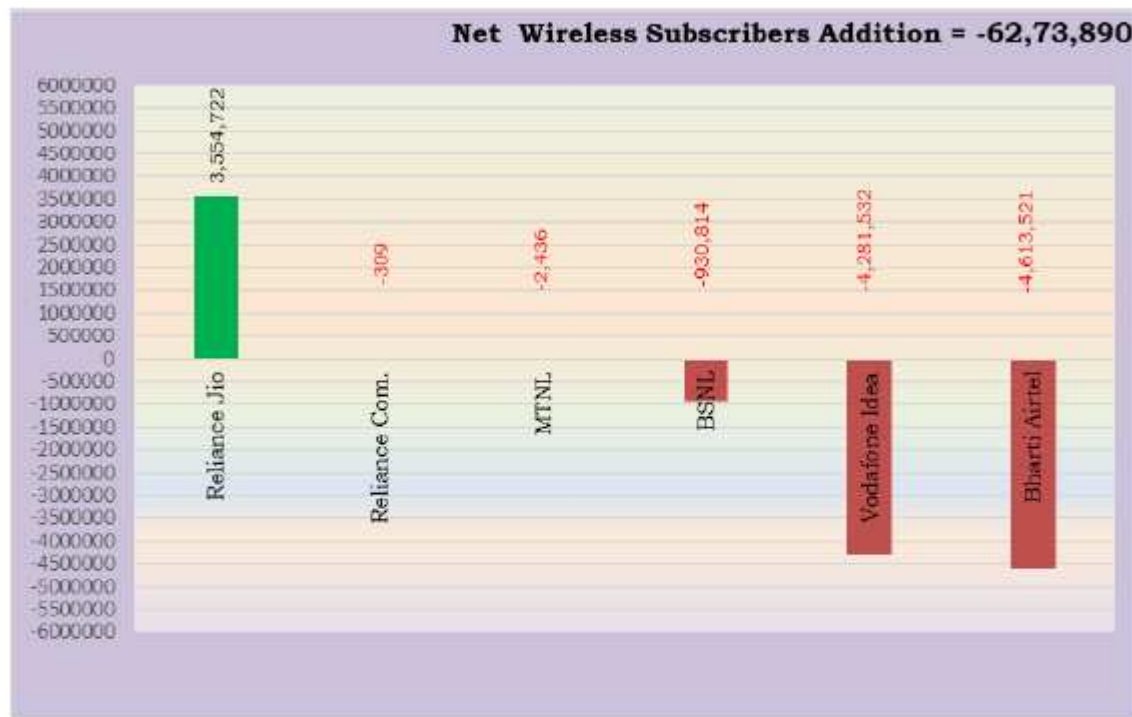
Access Service Provider-wise Market Shares in term of Wireless Subscribers as on 31st May, 2021



Profile of Telecom Service Providers (TSP)

TRAI REPORT

Net Additions/decline in Wireless Subscribers of Access Service Providers in the month of May 2021



- Note:** 1. M/s Bharti Airtel Ltd has reported the wireless subscribers including the subscribers of M/s Tata Teleservices Ltd.
2. Virtual Network Operator (VNO) of BSNL has started reporting of its subscribers from the month of October, 2018 and the same has been included in the subscriber base of BSNL.

Profile of Telecom Service Providers (TSP)

TRAI REPORT

Access Service Provider-wise Monthly Growth Rate of Wireless Subscribers in the month of May, 2021



Note: BSNL includes its Virtual Network Operator (VNO).

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

Profile of Telecom Service Providers (TSP)

TRAI REPORT April 2021

Table 1.33 : 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 (%) Dec-20
		Sep-20	Dec-20			
1	Hughes Communications Ltd.	123,154	125,371	2,217	1.80	42.34
2	Bharti Airtel Limited	76,702	75,978	-724	-0.94	25.66
3	Tatanet Services	73,749	75,743	1,994	2.70	25.58
4	HCL Comnet	10,181	8,036	-2,145	-21.07	2.71
5	BSNL	8,863	8,322	-541	-6.10	2.81
6	Infotel Satcom	2,562	2,579	17	0.66	0.87
7	Cloudcast Digital Ltd	50	50	0	0.00	0.02
Total		295,261	296,079	818	0.28	100

Profile of Telecom Service Providers (TSP)

TRAI REPORT April 2021

Table 1.30: Internet Subscriber Base and Market Share of top 10 Service Providers

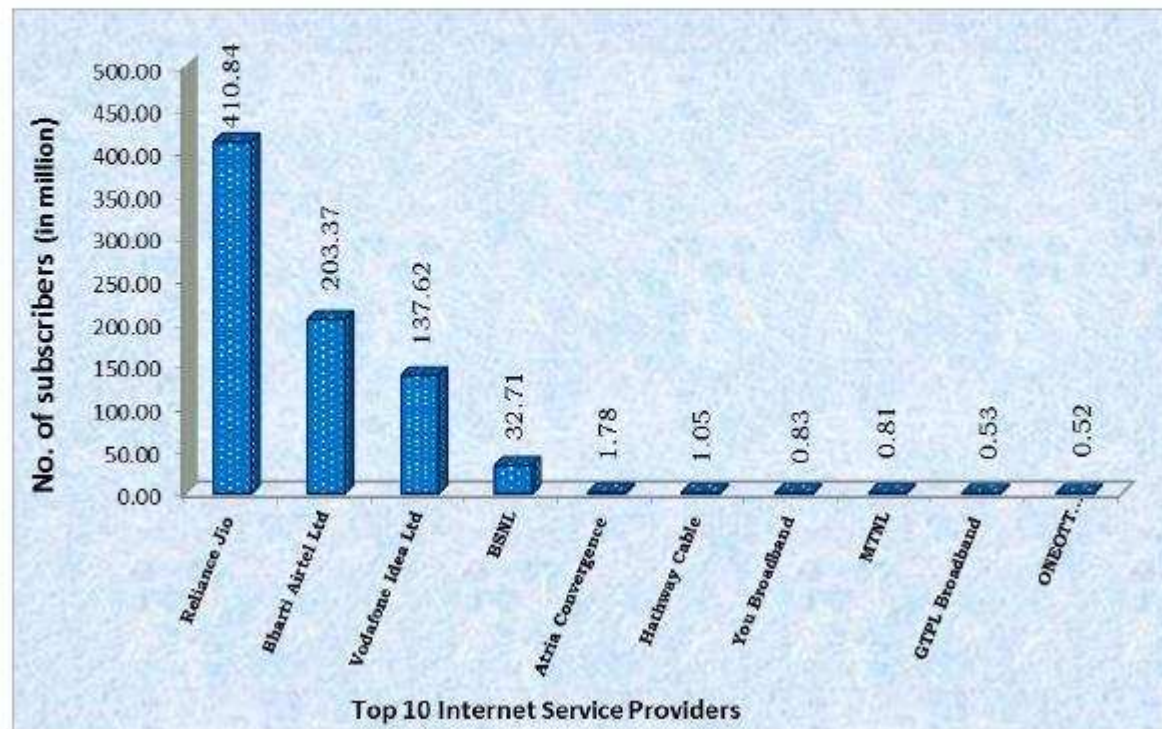
S.No	ISP	No. of Subscribers (In million)	Share (%)
1	Reliance Jio Infocomm Ltd	410.84	51.67
2	Bharti Airtel Ltd.	203.37	25.58
3	Vodafone Idea Limited	137.62	17.31
4	Bharat Sanchar Nigam Ltd.	32.71	4.11
5	Atria Convergence Technologies Pvt. Ltd.	1.78	0.22
6	Hathway Cable & Datacom Pvt. Ltd.	1.05	0.13
7	You Broadband India Pvt. Ltd.	0.83	0.10
8	Mahanagar Telephone Nigam Ltd.	0.81	0.10
9	GTPL Broadband Pvt. Ltd.	0.53	0.07
10	ONEOTT iNTERTAINMENT LTD	0.52	0.06
Total of Top 10 ISPs		790.06	99.36
Others		5.12	0.64
Grand Total		795.18	100

Profile of Telecom Service Providers (TSP)

TRAI Report

1.49 The following chart depicts the internet subscriber base of top ten Internet Service Providers (ISPs) in the QE Dec-20.

Chart 1.17 : Subscriber base of top ten ISPs



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 Manufacturers

www.google.com/search?q=MOBILE+PHONE+VENDORS+MANUFACTURERS+BRANDS&oq=MOBILE+PHONE+VENDORS+MANUFACTURERS+BRANDS&aqs=chrome..69i57j33i160.16742j0j7&sourceid=chrome&ie=UTF-8

Top 10 Mobile Phone Manufacturers Companies in the World

Samsung (27.48% Market Share in 2021)

Apple (26.35% Market Share in 2021) ...

Xiaomi (10.8% Market Share in 2021) ...

Huawei (8.66% Market Share in 2021) ...

Oppo (5.67% Market Share in 2021) ...

Motorola (2.23% Market Share in 2021) ...

LG (1.55% Market Share in 2021)

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 /Operators

**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**

**This is an Important Subject
There is a need to analyse and study these aspects in detail.**