**International Journal of Environmental Sciences**
ISSN: 2229-7359
Vol. 11 No. 19s, 2025
https://www.theaspd.com/ijes.php

# Network Parameters For Telecom Service Providers In India: A Comparative Analysis

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***Abstract:***
*This study aims at identifying and comparing network parameters of various Mobile operators in India. Cell phones are systems having small cells, with a base station and also a cell phone tower. The huge range of frequencies allow several people to use cell phones simultaneously. As the user moves from cell to cell, the cellular calls get transferred from one base station to other thus maintaining continuity. For example, if you were traveling from Hyderabad to Warangal, your call would be transferred from several base stations along the way. The Network/Signal strength of any Telecom Service Operator (TSP) will always be a function of the MHz frequency they are using or being allocated and the number of Base Stations the TSP has installed to better serve the customers of the area. All this information about frequency and Base Stations is not readily available in any public domain and it can only be found out by a detailed interview with Senior Managers (General Manager & above) of all the key Telecom Operators of the area. A comparison of Frequency and Base stations of all main Telecom operations will be a significant indicator about the strength of their Signal/Network in the selected area.*

***Key Words:*** *Signal Strength, Telecom Operators, Base Stations, Call Drop, MHz Frequency, Spectrum Allocation*

## INTRODUCTION

To understand Network strength better, a basic understanding of key elements is needed, as detailed in Fig. 1.

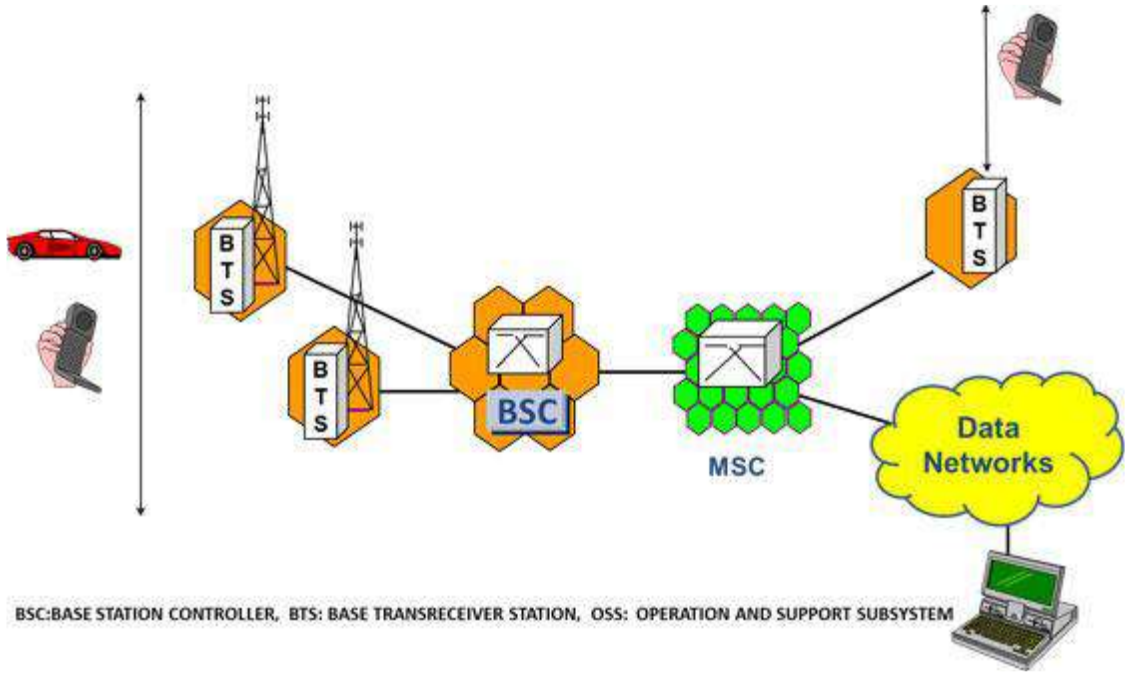


**Figure 1: Key elements of a network**

**Mobile Equipment (ME) –**It is the mobile phone. It should be able to work on cellular network. Earlier phones had single-band, new ones are dual-band, triple-band and even capable of operating on quad-band. The last one operates on all networks. Every mobile has a unique IMEI number.
**Base Transceiver Station (BTS) –** It is the antenna erected on top of tower. It is the entry point to the network and it carries the radio communication. A BTS typically covers a 120degree area and hence a tower with 3BTS can cover a 360degree area. Every BTS has a unique Cell identity which denotes the location area it is covering
**What is a Cell –** A Cell is a base station transmitter having multiple RF channels. There is limit to the mobile subscribers a Cell can cover. It covers a cell radius ranging from start up30kms to mature-1km
**Capacity and Cell Size –** The number of cells available to cover a geographic area is what constitutes as Cell Size and it is the capacity for the users. Depending on the prevailing customer traffic, the mobile operator varies the cell size.
**Base Station Controller–** Multiple BTS are controlled by a Base Station Controller (BSC). It controls the handovers from one BTS to other BTS within its range and also helps in administration of frequency, signal & power measurements etc. It acts as a Funnel to MSC.
**Mobile Switching Centre -**(MSC) – A MSC is the base of entire GSM network as it handles all routing, setup of calls & all basic functions related to switching. Multiple BSCs are handled by an MSC which also handles the handovers between 2 BSCs

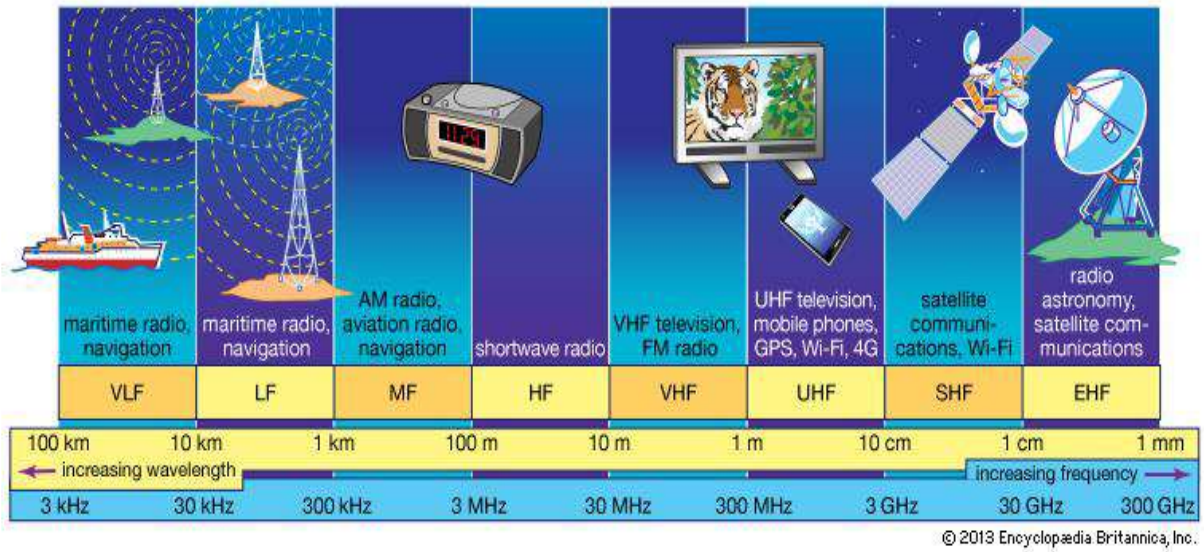


**Figure 2: Various frequencies & their use**

**SPECTRUM ALLOCATION**:
Collection of different types of electromagnetic radiations is Spectrum. They are the radio frequencies on the signal communications travel. In India, radio frequencies are used in mobile communication, radio navigation, defence communication, space etc. (Fig. 2). We have to make optimum use of radio frequency since it is will deplete on excess usage but will get wasted if not used properly. The allocated spectrum to Indian mobile operators is not sufficient and hence their issues in call quality.

All Nations have right of use over the spectrum they have but to facilitate a standardization, all countries follow the guidelines set by International Telecommunication Union (ITU). This helps in matters related to International roaming. Also, this is in sync with mobile handsets which are aligned to GSM 1800/900bands.
Tri-band and quad-band phones are also available to provide better roaming coverage. European triband mobiles use the GSM 900, 1800 and 1900 bands giving good coverage in Europe. Similarly, North America tri-band phones use the 900, 1800 and 1900 GSM frequencies. Quad band phones use 850, 900, 1800 and 1900 MHz GSM frequency bands, i.e. the four bands and that allows global use. The details are provided in Table 1 below.

**Table 1: Spectrum Bands & their Characteristics**

| | 800MHz | 900MHz | 1800MHz | 2100MHz | 2600MHz |
|---|---|---|---|---|---|
| Technology Options | 3GPP and WiMAX | 3GPP only | | | 3GPP and WiMAX |
| Amount of Spectrum available | Mobile operators are likely to have access to smaller contiguous bands | | Mobile operators are likely to have access to larger contiguous bands | | |
| Coverage | Higher | | Lower | | |
| User Experience | Lower speeds and less capacity available | | Higher speeds and more capacity available | | |
| Cell Size | Greater Cell Size | | Smaller Cell Size | | |
| Cost | Lowest cost deployment of national network | | Deployment up to 15 times more expensive than sub-1 GHz | | |
| Value of Spectrum | High value | | Lower value | | |

Spectrum band and their Characteristics 800MHz 900MHz 1800MHz 2100MHz 2600MHz Technology Options 3GPP and WiMAX 3GPP only 3GPP and WiMAX Amount of Spectrum available Mobile operators are likely to have access to smaller contiguous bands Mobile operators are likely to have access to larger contiguous bands Coverage Higher Lower User experience Lower speeds and less capacity available Higher speeds and more capacity available Cell size Greater Cell Size Smaller Cell Size Cost Lowest cost deployment of national network Deployment up to 15 times more

With existing technologies, the 900MHz is more superior to 1800MHz because of following:

As per laws of physics, higher the wavelength, lower the frequency. This signifies that signals on bands of higher frequency will travel a lesser distance as compared to signals on lower frequency bands ϖ This propagation characteristic also makes signals transmitted on 900 MHz more potent when it comes to indoor coverage. It has been proven that 900 MHz band has 30-40 per cent better coverage than 1800 MHz band. ϖ To make up for this, mobile companies on 1800 MHz have to invest more in setting up larger number of base stations for similar coverage as in the 900 MHz band. (Analysis Mason report) Analysis Mason report says: o Very high investment for movement from 900Mhz ecosystem to 1800Mhz ecosystem. o Additional installation of 1,71,954 base stations o Incremental capital expenditure of Rs.54,739crores o Another investment of Rs.26,653cr for new tower deployment 900 MHz band has a superior commercial ecosystem than 1800 Mhz. That's because 900 MHz frequency band has been in use for mobile communications globally for over 20 years and, as a result, technology standards have been better developed compared with 1800 MHz band, which has been in use only recently.

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**ANALYSYS MASON REPORT:**

1. Very high investment for movement from 900Mhz ecosystem to 1800Mhz ecosystem.
2. Additional installation of 1,71,954 base stations
3. Incremental capital expenditure of Rs.54,739crores

4. Another investment of Rs.26,653cr for new tower deployment

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**LITERATURE REVIEW:**

Chadha and Kapoor (2009) opined that consumers tend to become more and more demanding with the competitive market place. Indian telecommunication service sector has been experiencing the highest growth rate in terms of subscribers and revenues.

Economic Times (November 15, 2012) expressed that for the telecom sector it is the regulatory extension, has got partly addressed. One, on spectrum reframing and the associated cost for the 900 MHz spectrum, and the second is license fee that the government will charge whenever the license renewal is completed in two-year time

Bansal and Gupta (2013) explained that the Indian telecom sector experienced drastic growth and diversification in par with other industrial sector in the country. With this view authors have taken up the research on Customer Satisfaction of Mobile Phone Service Users Operating in the Malwa Region of Punjab. Sample size of the study was 75 respondents and structured questionnaire and unstructured interviews was used for collection of opinion from the respondents. Cronbach's Alpha, Weighted Average, Ranking, Chi Square and the Percentage method have been used for analysing the collected data. The results revealed that the main reason of changing the service provider, with a weighed score of 3.53, followed by Poor Network and Poor Customer Care Service, having weighted scores of 3.21 and 2.20 respectively. It has been found that SMS is the most widely used Value Added Service followed by Caller Tones having weighted scores of 3.56 and 2.25 respectively.

Butt & Run (2009) mentioned that the intensified competition in cellular phone market is depicting a pattern of customer churn while the companies are still enjoying growth. This creates serious challenges for organizations in managing their existing customer while striving for growth. The common answer to such challenges is retaining customers through satisfaction. The study also talked about customer satisfaction plays a key step in improving service quality and retaining customers in cellular phone market. This study aims at answering what factors are contributing towards customer satisfaction in Pakistani mobile cellular services. The findings suggest that customer satisfaction constitute of four factors these are price, transmission quality, usage ease and service support.

Chakraborty (2013) analysed customer satisfaction & expectation towards a telecom company. Results of the study revealed that the dimensions which influence customer's satisfaction level are: tariffs and core services (like good coverage, good connectivity and network quality). Thus, author recommended that telecom companies should focus on connectivity, tariffs, network coverage and quality.

Kamath (2011) worked on a sample of 597 mobile telephone users from Pune city to study a critical evaluation of customer satisfaction of cellular phone services. He stated four parameters on which customer satisfaction depends are Network Coverage, Call Economy, Value Added Services and Instinct. Study concluded that local voice calls being most important service used by the user followed by SMS.

Hao et al. (2009) analysed kinds of specific and concrete operational factors having an important impact on Chinese mobile telecom customer loyalty. For the purpose of the study author established a model to represent the relationship between customer loyalty and its influencing factors (customer satisfaction, perceived quality, customer value, switching cost and corporate image). Further he described that out of eleven factors there are nine factors which have an important impact on customer loyalty in telecom industry in China. These factors are call quality, coverage of network, SMS quality, the convenience and reliability of Inquiring phone fee system, service quality of service centre and rating price of given quality, customer's worry of troubles after change cell phone number, social responsibility, advertisements about corporate image

Lee et. al. (2003) stated that for improving subscriber loyalty 'Network Coverage' needs to be improved over time. Moreover specifically, it was improvements in coverage, for within cities, rural areas and on highways that was most apparent to the subscribers. He added that among all the major 'brands' in the cellular business, image of the company was, and continues to be a strong 'Motivator' with most service providers.

Afsheen and Khan (2012) examined those factors which have a major influence on customer satisfaction. Data was collected from 150 students of five universities randomly in Peshawar region and data was analysed using

correlation and regression analysis. Results of the study indicate that customer satisfaction has significant relationship with customer service, price fairness, sales promotion, coverage, signal strength & promotion.
Amulya and Anand (2012) have conducted empirical study on select telecom service providers that is BSNL, Airtel, Vodafone and Idea. The paper highlights the demographic trend along with the changes in traditional values and lifestyle of an individual. An important socio-demographic factor of mobile phone consumers, i.e., gender, age, income, occupation and qualification analysed for Mysore city. The study underlined the 10 different purposes for which mobile phones are used by the respondents these are voice calls, internet, SMS, MMS, alerts, vice mails, caller tunes, movie/music download, participating in quiz and wake-up calls. Study also highlights the reasons for changing service providers and results shows that most prominent reasons are better service promises by the competitors followed by low talk time on recharge and high call tariff which are the cost component of the user's decisions. Whereas a small proportion of the respondents reasoned for change is non-availability of the recharge coupons. However, frequent network disruption, network congestion, poor network coverage is also responsible for the changes.

In fact, major studies are done on service quality, customer loyalty and customer satisfaction but literature does not categorically mention the importance of Network in selecting a mobile operator. It does not explore the resultants like call quality, call drop etc. and the key factor that causes them. Hence the importance of Network in being one of the key factors in the customer's decision-making process remains undermined.

**METHODOLOGY**:
It consisted of 2 critical and important parts.
A. Pilot Study of 100 customers (end-users) to find out the factors that the Customers think are most important in selecting a Telecom Operator. It clearly comes out that Network is one of the top-3 parameters for customer for Mobile Telecom Operator selection
B. A detailed Interview of 50 plus Senior Leaders of top management of Telecom companies – Airtel, Vodafone, Idea, DoCoMo

**A. Pilot Study:**
Before analysing the study objectives, pilot study was conducted on 100 customers (end Users) to find out the factors influencing selection of a particular telecom service operator. Based on data gathered it is concluded that factors influencing selection of service providers are discounts, value added services, customer care services, tariffs, network quality, celebrity endorsement availability and internet.
Factors influencing selection of service provider (Customer study)
The study aims at suggesting a set of parameters to customers to help them in making right choice of mobile operator and then use these parameters to suggest best mobile operator in Andhra Pradesh. In India customers have many options of service providers to choose one among them. Results based on the perception of the100 customers revealed the key influencing factors of selection of service providers are Network quality which was ranked first, Tariff concerned with call rates was ranked second. It is followed by availability and Discounts. The factor Value Added Services was ranked fifth is, which precise the fact that Indian consumers search for value for money to make a choice of service provider. Results stated that collectively as well as for all four companies separately, network quality is ranked first by the customers followed by tariffs. This result was base to the further analyses of the network parameter of all four companies. The factors such as Internet and Celebrity Endorsement were observed having positive influence on selection of service provider have got least rank. This shows that customers do consider these factors for assessment and selection of service provider but give least importance to these two factors in making choice their choices. Although companies are using these two factors as a weapon to compete with the competitors for creating brand image in the market and creating new customers. Researches in the telecommunication sector stated positive influence of these above-mentioned factors for creating satisfaction and loyalty in customer's mind as well as creating new customers. The result of the study is in line with studies done on customer satisfaction, loyalty and preferences patron

**B. Interviews with Senior managers of Telecom companies:**

The first objective of the study was to analyse the Network parameters of different operators in A.P. as it leads to call quality, call drops etc. is analysed based on data collected from the managers of all four service providers. Since the study for this objective was exploratory and mainly based on the primary data thus special care has been taken to prepare unstructured interview.

The information was collected in light of following points:

a) Mobile equipment capability
b) Base transceiver station
c) Cell and its capacity
d) Mobile switching canters and spectrum allocation
e) Spectrum Bands and their Characteristics

**RESULTS & DISCUSSION:**The Spectrum band used by Telecom operators and the number of Base Stations (HYDERABAD), as detailed in Table 2.

**Table 2: Number of base stations**

| | Spectrum Band (MHz frequency) | No of Base Stations |
|---|---|---|
| **AIRTEL** | **900/1800 (60:40)** | 4025 |
| **VODAFONE** | 1800 | 4989 |
| **IDEA** | 900 | 4028 |
| **TATA DOCOMO** | 1800 | 1800 |

Network Parameters of all four Service Providers Based on the data collected from manager's interview, analysis results indicate that in case of Hyderabad-Secunderabad city Airtel service provider operates at spectrum band 900 MHz and/or 1800 MHz and having 4025 base stations. The ratio of operation on these frequencies is 60 percent and 40 percent respectively.

Vodafone and DoCoMo operate at spectrum band 1800 MHz and having 4989 and 1800 base stations respectively.

Whereas Idea operates at spectrum band 900 MHz and having 4028 base stations.

As it is discussed in chapter five that 900 MHz band has a superior commercial ecosystem than 1800 Mhz. That's because 900 MHz frequency band has been in use for mobile communications globally for over 20 years and as a result technology standard have been better developed compared with 1800 MHz band, which has been in use only recently. The base station controls multiple BTSs (Base Transceiver Station). It controls the handovers from one BTS to other BTS within its range and also helps in administration of frequency, signal & power measurements etc. It acts as a Funnel to Mobile Switching Center (MSC). Multiples BSCs are handled by an MSC which also handles the handovers between 2 BSCs.

**CONCLUSION**

Thus, it can be concluded that for Hyderabad-Secunderabad city in terms of call clarity and call drops, Idea is a best service provider due to its maximum base stations and frequency operation followed by Airtel. Vodafone is on third position whereas for Vishakhapatnam city in terms of call clarity and call drops IDEA & AIRTEL are best due to same number of base station and operation at same frequency followed by Vodafone holding third position.

Based on the data gathered from interview of managers it can be concluded that in Hyderabad-Secunderabad city- IDEA is best in terms of call drops and call clarity followed by Airtel & Vodafone.

IDEA - No.1
AIRTEL- No.2
VODAFONE - No.3
DOCOMO - No.4

Competition in cellular mobile market in India is increasing day by day thus service providers are trying to build and maintain competitive advantages in the market.

Good network coverage will help to provide competitive benefit to the service providers. Service providers should not compromise with the quality and the network facility. Service providers should provide sufficient geographic coverage, call clarity and avoid call drops. Service provider should not only focus on better services but also ensure performance of their network.

## MANAGERIAL IMPLICATIONS

✓ Need to educate customers on Network issues and build trust by being transparent.
Customers gained by huge promotions but weaker network will not stay for long and this will be hugely detrimental to the concerned TSP by way of negative word of mouth
✓ Need to make investments in Network by installing base stations for adequate coverage. The investment in promotions and celebrity endorsements should start only
ensuring basic network infrastructure.

✓ Need for availability in all areas having significant population so that no customer has to travel more than a km to get recharge.
✓ Quite a few TSPs focus hugely on ensuring availability in mobile hubs/zones overlooking the fact the over-availability in mobile zones will not lead to Sale increase (one Finding of our research).

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