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Telecom Regulatory Authority of India

Consultation Paper
on
Issues Relating to
Mobile Television Service

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Preface

1. Mobile screen is becoming the fourth screen to the consumers after cinema, TV and computers across the world. The emerging technologies would effectively expand the universe for television by allowing it to become more than just a stationary activity, one that lets consumers view while on the move. This is the best platform for delivering the benefits of television and mobile communications in one device. The TV content on mobile is an example of the convergence not only at the level of handset device but also at the level of networks which provide this service.
2. The key to making mobile TV a reality lies in combining traditional broadcast standards with features specific to handheld devices: mobility, smaller screens and antennas, indoor coverage, and reliance on battery power. Two forces are currently driving mobile TV development and its commercialization. Network providers/Mobile TV service providers see it as an additional possible revenue over and above voice income flow, and cell phone manufacturers see an opportunity to sell new, more expensive TV-capable handsets.
3. In India, Doordarshan, a public service broadcaster, has already launched its mobile TV service in Delhi recently. Ministry of Information & Broadcasting has requested TRAI to make recommendations on various issues involved in introduction of mobile TV service in India. This consultation paper raises various issues relating to mobile Television service. The Telecom Regulatory Authority of India (TRAI) solicits the views of all the stakeholders on the issues raised in the consultation paper.

Written comments on the issues raised for consultation may please be furnished to Secretary, TRAI by 30th September, 2007. The comments may preferably be sent in electronic form. [E-mail: traicable@yahoo.co.in or pvt_1967@yahoo.com]. The Fax numbers of TRAI are 011-23220442/ 011-23213294.

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Chapter I: Introduction

1.1 The Ministry of Information & Broadcasting, Government of India, have sought recommendations of the Telecom Regulatory Authority of India (TRAI) under Section 11(1)(a)(i) & (ii) of the Telecom Regulatory Authority of India Act, 1997 with respect to various issues related to mobile television services. The specific issues enumerated in the letter are as under:-

- (a) International practice,
- (b) Eligibility criteria, net-worth requirement,
- (c) Foreign direct and indirect investment levels,
- (d) Technology to be adopted,
- (e) Revenue sharing, entry fees and bank guarantee, and
- (f) Spectrum to be used.

In line with its consultative approach, this consultation paper is being issued by TRAI to have the benefit of the views of the stake-holders before it gives its recommendations to the Government.

1.2 Chapter - II of the paper gives an introduction to mobile television system. This chapter also briefly covers the earlier recommendations of the Authority on issues relating to Private Terrestrial TV Broadcast Service (August 29, 2005) and on issues relating to Convergence and Competition in Broadcasting and Telecommunications (March 20, 2006), as these issues are closely linked with mobile television.

1.3 Convergence means providing different services through the same delivery technology. Convergence of broadcasting and telecommunications has made it possible to deliver mobile television services using broadcasting technologies as well as through wireless telecommunication networks. A number of technologies are being used across the world for delivery of these services. Chapter – III of the paper gives an overview of

different technologies available for provision of mobile television service and their relative advantages and disadvantages.

1.4 Provision of mobile television services would require utilization of spectrum, irrespective of the technology used. Since, the spectrum requirements will be different for different technologies, it is necessary to have a look at the spectrum requirements and the present status regarding availability of spectrum with reference to different technologies. The spectrum related issues are discussed in Chapter-IV of the paper.

1.5 Regulatory framework for mobile television services should cover the licensing issues such as eligibility criteria, net-worth requirement, foreign direct and indirect investment levels, revenue sharing, entry fees and bank guarantee etc. These issues are discussed in Chapter –V of the paper.

1.6 Although many operators across the world have launched mobile television broadcasting services, the service is still in its evolutionary stage. Different countries have followed different regulatory paths for launching the mobile television services and more importantly, different technologies have been adopted by different countries. Chapter – VI of the paper covers the international practices relating to mobile television.

1.7 Chapter – VII covers the issues for consultation for the policy framework for the mobile TV service in India.

Chapter – II: Mobile Television System

2.1. Mobile Television Services

As the name suggests, mobile television services refer to provision of television services to subscribers for viewing on handheld or portable devices. Technically, there are two main ways of delivering television content to mobile devices. The television content could be provided via the mobile telecommunications networks or by using the broadcasting technologies. Both the methodologies are being used by different service providers across the world. Both have their inherent advantages and disadvantages.

2.2. Mobile Television through Telecommunications Network

2.2.1 A mobile telecommunication network subscriber has a two way communication link with the network. This telecom link is used for carrying voice (and very often data) to and from the subscriber. The telecom link is also used for delivery of video content to the subscriber in this methodology. Higher data transfer requirement associated with video implies that 3G mobile telecommunications networks, capable of supporting broadband wireless data, are better suited for mobile television services as compared to 2G or 2.5G mobile telecommunications networks.

2.2.2 In its simplest form, a mobile phone user can access the video content stored on the server of the Service Provider on demand. This liberates the subscriber from the program schedules. Moreover, it is also possible to deliver and store the video content in the mobile hand set or the portable device (in the memory chip on the handset/ device). The subscriber can view the content at his convenience even when there is no network coverage. The delivery of content can be scheduled during off-peak hours.

2.2.3 Use of separate dedicated channels for delivery of same content to different users renders these techniques rather spectrum inefficient. This methodology also suffers from network congestion if several users are using the service simultaneously. Therefore, such mobile television services based on point to point transmission of content on mobile telecommunication network have limited transmission capacity as far as covering large

number of subscribers is concerned. However, because this service is possible on existing spectrum allocated to the mobile telecommunications networks, it is the fastest method of rolling out of mobile television services.

2.2.4 As per Clause No. 2.2 (a)(i) & 2.2 (a)(iii) of United Access Service License (UASL) agreement, the telecom licensee can offer the SERVICES that cover collection, carriage, transmission and delivery of voice and/or non-voice MESSAGES over LICENSEE's network in the designated SERVICE AREA and includes provision of all types of access services. Access Service Provider can also provide Internet Telephony, Internet Services and Broadband Services. The access service providers can provide Broadband services including triple play i.e voice, video and data. Similar clause also exists in Cellular Mobile Telephone Service (CMTS) license agreement. These clauses already permit the delivery of video contents over their networks.

2.2.5 Some of the telecom players are offering TV content on mobile using unicast mode. The mobile service providers are using the allotted spectrum for offering these high-data rate services. The present spectrum allocation criterion is based on subscriber base along with prescribed averaged traffic generated per subscriber. The spectrum allocation criterion is also agnostic to the service being offered as long as the service is permitted by the license.

2.3. Mobile Television through Broadcasting Technologies

2.3.1 A one way broadcast network can also provide the mobile television services. In such a scenario, the display screen of the mobile handset is used for viewing the television programs. However, delivery of content does not use the mobile telecommunications network and its related spectrum. The method of content delivery here is very similar to the FM radio tuner provided in many mobile telephone handsets. A mobile telephone subscriber listening to the FM radio on a mobile telephone handset uses the battery and speakers of the telephone, but the content is carried on the FM broadcast spectrum. Similarly, the handset can be used for viewing mobile television by using television broadcasting frequencies.

2.3.2 This methodology has the advantage of efficient use of spectrum. The video content is delivered using one-to-many distribution topology. Thus, different viewers do not require dedicated channels for delivery of video content to them. Increase in number of subscribers does not place any additional burden on the system. This is very similar to traditional broadcasting services and the subscriber can view the television programmes as per the schedule of broadcast.

2.3.3 However, the subscriber can not personalize his television viewing and is only able to access the content being broadcast at a given point of time. Moreover, the broadcasting technologies require separate allocation of spectrum for carriage of broadcasting content. It is also possible to have encrypted signals and pay television services using broadcasting technologies. The encryption system for broadcasting has to be integrated with the subscriber management system of the mobile telecommunications network for billing and customer-care. The billing system would normally bill a subscriber for access to content rather than for utilization of the same because a unidirectional broadcast system cannot keep track of what a subscriber watches and for how long.

2.4. Mobile Television Hybrid Technologies

Apart from the two major technologies mentioned above, there are some hybrid technologies also which are coming up. These technologies use one-to-many distribution topology over mobile telecommunications networks such that they allow a traffic-channel to be shared by all the users that are simultaneously watching the same program in the same area. These technologies support higher throughput of video content in dense areas and ensure more efficient network utilization. However, these result in limiting the number of channels available at any given point of time. These technologies are also covered by the existing United Access Service License (UASL) and Cellular Mobile Telephone Service (CMTS) licence.

Even amongst broadcasting technologies, there are hybrid satellite and terrestrial systems. These employ satellite based multimedia broadcasts using terrestrial repeaters for ensuring quality of service.

2.5. Earlier Recommendations of the Authority

While looking at the possible policy alternatives for introduction of mobile television services in the country, it is necessary to keep in mind that mobile television broadcasting (referred to in para 2.3 above) is a kind of terrestrial broadcasting only. Even though about 270 television channels are available on cable and satellite television networks in the country, terrestrial television broadcasting remains the exclusive domain of Doordarshan under Prasar Bharati. The issues relating to regulation of terrestrial television services and convergence in broadcasting and telecommunications were covered by the Authority in its earlier recommendations on issues related to Private Terrestrial TV Broadcast Service (August 29, 2005) and on issues relating to Convergence and competition in Broadcasting and Telecommunications (March 20, 2006).

2.6. Recommendations on issues related to Private Terrestrial TV Broadcast Service

2.6.1 The Authority in its recommendations on the subject had recommended that Terrestrial television broadcasting in India should be allowed in the private sector also, including community television. The Authority had recommended allowing both analogue and digital transmission as it was felt that there would be sufficient spectrum to support a few players even in the analogue mode. Some broad recommendations were also made regarding licensing as indicated below, which broadly followed the pattern of FM radio licensing.

2.6.2 It was suggested that no detailed eligibility conditions need be laid down and the general disqualifications adopted for Private FM Radio may be used for private terrestrial television broadcasting also. The Authority had reiterated its earlier recommendations regarding foreign ownership (made in the context of FM Radio) that the rules regarding foreign investment need to be reviewed to bring about a greater consistency in the rules of various segments of the media sector. As regards license fee, it was recommended that the structure of the license fee should be the same as for Private FM Radio, with an entry fee related to the level of competition and size of the market along with an annual fee on the basis of a revenue share of the gross revenue. Apart from these issues, the recommendations also covered other licensing issues such as the period of license and area of license. A summary of these recommendations is placed at Annexure-I to this consultation paper.

2.7. Recommendations on issues relating to Convergence and Competition in Broadcasting and Telecommunications

2.7.1 It has been pointed out in these recommendations that convergence of technologies is rapidly blurring the boundaries between telecommunications and broadcasting and that it is necessary for the legal and regulatory framework to adapt to this convergence and actively promote such convergence. This would also help in facilitating competition.

2.7.2 Accordingly, it was recommended that:

- The Unified Licensing Regime as recommended by the TRAI vide its recommendations dated 13th January 2005 must be adopted at the earliest albeit with some modifications.
- The entry fee for the unified license should be brought down to Rs. 5 crores (as against Rs. 107 crores recommended earlier) and further to Rs. 30 lakh after five years (as recommended earlier).

- Flexibility in spectrum allocation to take full advantage of new services and new technologies for existing services that may evolve with time.
- The spectrum allocation should be technology and service neutral to the extent possible so as to avail the full benefits of a converged licensing regime.
- Reiterated its earlier recommendations to the Government on FDI limits and again urged the Government to undertake a complete review of the FDI policy for the various sub sectors in telecommunications and broadcasting so that there is consistency in policy and a level playing field among competing technologies. A summary of these recommendations is placed at Annexure-II to this consultation paper.

2.8. Mobile TV Operator: A new class of operator

It needs to be clearly understood that depending upon the final recommendations by TRAI and the Government's decision, the mobile TV operator would be a new class of operator, in a manner similar to a DTH operator, a cable operator or different types of telecom operators. Thus, there would be separate guidelines and licensing conditions which would give a formal legal status to mobile TV operator. However, since the delivery of video content over mobile telecommunication network is already permitted as per the licensing conditions of UASL and CMTS licencees, it is felt that these telecom licencees should not again be required to obtain mobile TV operator's license to provide the TV channels on mobile handset using their network. Thus, the mobile TV licensing framework is expected to cover operators other than UASL and CMTS licensees. However, these telecom operators as well as the new mobile TV operators are already included as distributor of TV channels under the Interconnection Regulations of TRAI, which would ensure that acquiring content for these operators would not be a problem.

Chapter – III: Available Technologies

3.1. Overview

The methodologies available for delivery of mobile television services has been discussed in Chapter-II of this consultation paper. There are several technologies deployed across the world based on the two methodologies, namely, method using mobile telecommunications networks and the broadcasting method. No methodology is ideal, as all have drawbacks of one kind or another based on spectrum required, transmission power required, new infrastructure (antennas and towers) required, network capacity or business model. The various technologies and their relative advantages and disadvantages have been covered in this chapter.

3.2. Technologies in Mobile Telecommunications Network for Mobile TV

3.2.1 The mobile telecommunication networks are being used in many countries for provision of mobile television services. Mobile television services using mobile telecommunication networks are provided in unicast mode (one source to one destination, like from a server to one mobile handset). However, the unicast technology is sufficient in many cases, especially since mobile users prefer to access content on-demand, rather than following a fixed schedule.

3.2.2 In its most common form, mobile television is being made available on the 2.5G or 3G mobile telecommunications network in the form of video-on-demand/ video streaming. As already discussed in Chapter-II, such services are based on use of separate dedicated transmission channels (virtual circuits) for each user and as a result, there are chances of congestion in the system as the number of users grows. The main reasons for widespread adoption of this technology are:-

- a. Infrastructure in place: - Very little additional infrastructure related capital expenditure is required for roll out of mobile television services by the service providers using the existing mobile telecommunication networks. However, this is true for 3G networks only because of higher data transmission capacity.

- b. No additional spectrum requirement:- Theoretically, no additional spectrum is required for roll out of the mobile television services as the content is carried by the mobile telecommunications network on the existing spectrum allocated to it. However, in practice, the need for additional spectrum would be linked to subscriber base being serviced by the mobile network.
- c. Handsets available off the shelf:- Most of the existing handsets can be used for viewing mobile television services and no new/ separate handsets are required by subscribers of 3G mobile telecommunications networks.
- d. Pay per download possible:- Use of this technology is based on delivery of content as data download by the subscriber and accordingly, billing by way of pay per download is possible.

3.2.3 The 3G technologies are well suited for delivery of user specific and personalized content utilizing the interactivity. However, in so far as India is concerned, the roll out of 3G networks has not begun and accordingly, roll out of mobile television services riding on a 3G network is possible for India only when 3G services are rolled out. Moreover, even the existing 2G/ 2.5G networks are already unable to meet the Quality of Service standards and the main reason cited by the service providers is shortage of spectrum.

3.2.4 A new technology, known as Multimedia Broadcast Multicast Service (MBMS), which is an extension of Universal Mobile Telecommunications System (UMTS), has been designed to operate over the 3G platform. This technology will allow a traffic channel to be shared by all the users that are simultaneously watching the same program in the same area. However, presently, there are uncertainties about the timeframe for availability of equipment for deploying this technology.

3.2.5 As stated earlier, the unified access service licensees and cellular mobile telephone service licensees in India are allowed to deliver video over their network as per their license conditions. Once these service providers launch 3G services, it is expected that the high quality television viewing experience over mobile handset will be available to the viewers.

3.3. Technologies in Broadcasting Method for Mobile TV

3.3.1 There are a number of technologies in the broadcasting method being tried for mobile television services in different parts of the world. While Digital Video Broadcasting–Handheld (DVB-H) is more popular in Europe, Media Forward Link Only (Media FLO) has been widely deployed in the United States. Closer home, Korea has adopted Terrestrial-Digital Multimedia Broadcasting (T-DMB) and Satellite-Digital Multimedia Broadcasting (S-DMB) as against One Segment Broadcasting (OSB) introduced in Japan. The use of broadcasting technologies for mobile television services delivers better picture quality as compared to 3G video streaming. However, these technologies deliver live programming with little interactivity or personalization.

3.3.2 Digital Video Broadcasting–Handheld (DVB-H) is an extension of Digital Video Broadcasting–Terrestrial (DVB-T) standard with features designed for significant power saving in the receiver (due to limited battery life of mobile devices) and for good performance in a cellular environment. The main technique used for power saving is time-slicing in which signals of different television services are transmitted in bursts. This allows the receiver to go into sleep mode and it wakes up only when the signals of the service to which it is tuned are transmitted.

The main advantages of DVB-H are:-

- a. It is an open standard and has been deployed commercially;
- b. It is a flexible standard with a wide range of options for network design;
- c. It can also support digital radio and audio services and is complementary to clip download services available on the cellular network;
- d. It has low power consumption with a high data throughput;
- e. It can share spectrum and infrastructure with existing DVB-T networks.

The main disadvantages of DVB-H are:-

- a. It is susceptible to signal variations and synchronization problems;
- b. The channel transition time is high;

- c. The handsets required for the service are expensive;
- d. It requires higher transmitter power;
- e. UHF frequencies are ideal for DVB-H but these are tied up with analog terrestrial television transmission in India.

With specific reference to India, it may be noted that UHF spectrum is not being utilized in a big way for analog terrestrial television transmission as only one or two channels are being broadcast terrestrially at any given location in the country. DVB-T transmitters were set up by Doordarshan in the four metros of Delhi, Mumbai, Kolkata and Chennai. Doordarshan has been carrying out trials of DVB-H system using the DVB-T transmitter in Delhi.

3.3.3 Digital Multimedia Broadcasting (DMB) is a technology based on the Eureka 147 system for Digital Audio Broadcasting. There are two versions of DMB, namely T-DMB and S-DMB. T-DMB is the terrestrial mode of DMB as against S-DMB, which refers to satellite based DMB. DMB employs time division multiplexing, which allows the receiver to be shut down in between sampling intervals to save power. DMB standard is based on 1.5 MHz spectrum allocations as against the 8 MHz spectrum allocations for DVB-H or DVB-T.

The main advantages of DMB are:-

- a. It is an open standard and has been deployed commercially;
- b. It is relatively immune to interference;
- c. Transmission power required for T-DMB is low;
- d. Channel switching time is less as compared to DVB-H;
- e. Existing Digital Audio Broadcasting (DAB) networks based on Eureka 147 technology, which are no longer being used can be utilized for T-DMB;
- f. VHF and L band spectrum set apart for DAB can be utilized for DMB applications.

The main disadvantages of DMB are:-

- a. The number of television channels that can be provided is less than the number that can be provided by DVB-H;
- b. Additional spectrum is required if a larger number of channels are to be carried;
- c. A large number of transmitters are required to provide adequate coverage.

In the context of India, it is important to remember that there are no DAB networks or spectrum allocations for DAB in India.

3.3.4 Media Forward Link Only (Media FLO) is a mobile television technology developed by M/s. Qualcomm and standardized by FLO Forum. Currently, several specifications are available via Telecommunications Industry Association (TIA) and process is underway to publish these standards via other organizations. This technology is commercially deployed nationwide in the United States. MediaFLO is also being tried around the world. British Sky Broadcasting (BskyB) has conducted two trials in the UK. Hongkong and Taiwan are also undertaking trials of this technology. Media FLO uses Time Division Multiplexing like DMB to conserve power. Being a proprietary technology, only limited information is available about this technology. This has generated very limited interest across the world in spite of many claimed advantages as compared to DVB-H (although DVB-H organization disputes it). The claimed average channel switching time of 1.5 seconds is much superior to the DVB-H and Media FLO is also claimed to be spectrally more efficient as compared to DVB-H. MediaFLO has good Carrier to Noise(C/N) performance and better link margins and works with various transmission power. Due to better link margins, it can provide much better coverages. The major disadvantage of MediaFLO is that it is a late starter and wider ecosystem is still evolving.

3.3.5 One Segment Broadcasting (OSB) has been developed in Japan as an extension of the Integrated Services Digital Broadcasting-Terrestrial (ISDB-T) system. This system utilizes one of the thirteen segments in the ISDB-T signal for provision of mobile

television services. Brazil is the only other country which has gone in for the ISDB-T system. The advantage of the system is that the roll out utilizes the existing terrestrial broadcasting network in Japan. The disadvantage is that only a very limited capacity is available for mobile television services.

3.3.6 Apart from the abovementioned technologies, there are other standards also being developed and tried across the world. These include the Advanced Vestigial Side Band (A-VSB) system and China Multimedia Mobile Broadcasting system.

3.4. Combination of Technologies

It can be seen that network capacity and investments can be optimized by using a combination of mobile telecommunications network technology and broadcasting technology. Broadcast signals can be used for the most popular programs, and an unlimited number of additional programs and on-demand content can continue to be delivered efficiently using the mobile telecommunications network in unicast mode. In the combined technology solution, the user will have a single device to access all content irrespective of the method of content delivery. This combination provides personalization as well as spectral efficiency.

It is also too early to say which technology emerges as the clear winner since majority of the networks across the world are in trial stages and most of network players are trying multiple technologies in their networks.

Chapter IV: Spectrum Related Issues

Introduction

4.1. The issue of how television content can reach the mobile equipment users has been discussed in the chapter 2. It was noted that there are essentially two ways for transmitting TV contents over handheld devices (including mobile phones). One way is to transmit through the cellular mobile network, the second is broadcast through dedicated terrestrial network or through the satellites.

4.2. For all sectors using wireless technologies such as broadcast media, mobile communications, defence, civil aviation etc., access to the radio spectrum is a critical requirement. In the telecom sector, decisions related to spectrum allocation, spectrum standardization and spectrum availability are important to both equipment vendors and operators. For mobile network equipment vendors, spectrum frequency harmonization across countries has a major impact on costs for the handheld devices and networks. The decisions on technology standards for mobile TV and the requirements of spectrum are closely linked to one another. Furthermore, new technologies can only be deployed efficiently once the frequency bands have been allocated.

4.3. This chapter discusses the issues relating to the requirements and availability of spectrum for mobile TV with reference to standards adopted and the infrastructure used.

Cellular networks approach

4.4. In case of mobile TV transmission using cellular network, the networks use the existing equipments such as base stations, network controllers, routers etc. dedicated to the cellular network and transmit TV signals just like other types of data. The transmission of TV channels is a high data rate application. Though some of the existing 2G/2.5G networks in India are offering TV channels or video clips on mobile handset, the service would be more effective in networks with 3G and higher capability. The cellular network mostly transmits the TV channels in unicasting mode in which network makes a dedicated transmission to each viewer.

4.5. Since mobile TV is a data intensive application, access to mobile TV by large number of viewers simultaneously could overwhelm the networks. As stated earlier, the transmission in cellular network is in unicast mode. Therefore, on the positive side, the cellular network can offer large number of TV channels to the subscribers. On the negative side, this method suffers from capacity constraints in serving large number of subscribers at a time. Recently Third Generation Partner Project (3GPP) has defined Multimedia Broadcast and Multicast Services (MBMS) standards that enable multicasting over 3G networks also.

4.6. As stated in earlier chapter, the telecom players are already permitted to offer triple play (voice, video and data) over broadband over their network using their allocated spectrum. TRAI has already made its recommendations to Government of India on the issue of allocation and pricing of spectrum for 3G services and broadband wireless access services on 27th September 2006 covering both the technologies i.e. GSM and CDMA.

Dedicated Terrestrial Network Approach

4.7. In the dedicated terrestrial broadcast network method, the technology and the network designed to carry TV content for terrestrial broadcasting is put to use. The principal advantage of the use of such network is the economical and scalable way to deliver content to any number of recipients within the area of coverage. Unlike unicasting, the broadcasting method lets a mobile TV operator transmit channels and have it reach large number of viewers simultaneously. However, on the negative side, there is a limit on the choices to be offered to the subscribers in terms of number of channels in a given spectrum bandwidth.

Satellite Network Approach

4.8. In this type of network approach, the TV signals are straightaway available to the handheld devices from the satellite. Due to high path losses in the signal from the

satellite, the handheld devices need high gain antenna system to receive the TV signals from the satellite. This service suffers with poor in-building reception.

4.9. As per the available information, the deployments of dedicated terrestrial broadcast mobile TV technologies are mainly in the UHF band and partially in L band across the world. The satellite-based technologies are operating in S-band. The details are as follows: -

Technology Standard	Trial/deployment in countries/Jurisdictions	Spectrum Used
DVB-H	Finland, Italy, Australia, France, Germany, Hongkong, Singapore, UK, USA	UHF Band
MediaFLO	UK, USA	UHF band
T-DMB	South Korea, China, Germany	Band III and L Band
ISBT-T	Japan	UHF band
DAB-IP	UK	L-Band
CMMB	China	S-Band
S-DMB	Japan, South Korea	S-Band

Availability of spectrum in Indian context

4.10. Before discussing the possibility of the spectrum allocation for these dedicated mobile TV broadcast technologies in their band of operations, an analysis has to be made of the availability of spectrum in the context of current analogue and digital terrestrial television (DTT) broadcasting and future requirements for analogue and DTT transmissions.

4.11. The following spectrum is available for terrestrial TV broadcasting in the country in NFAP-2002:

Band	Spectrum	Number of TV Channels available in analogue mode	TV Channel Number
VHF Band I	47-68 MHz	3	2 to 4
VHF Band III	174-230 MHz	8	5 to 12
UHF Band IV	470-582 MHz	14	21 to 34
UHF Band V	582-806 MHz 806-960 MHz	28 ---	35 to 62 ----

4.12. The RF bandwidth requirement for terrestrial TV transmission is 7 MHz in VHF bands and 8 MHz per channel in UHF bands. This is primarily because in India, the only terrestrial TV broadcaster Doordarshan has adopted PAL ‘B’ system for analogue TV transmission in VHF bands and PAL ‘G’ system for transmission in UHF bands.

4.13. TV broadcasting shares these bands with other users of spectrum such as fixed and mobile services. For example, in UHF band V, spectrum beyond 806 MHz has been extensively assigned for cellular mobile services etc.

4.14. The ongoing trials and deployments of DVB-H and MediaFLO technologies across the world are using bandwidth equivalent to at least one analogue channel bandwidth in UHF band (for India it would be 8 MHz). In case of T-DMB, the minimum radio frequency bandwidth requirement is 1.54 MHz.

4.15. In case of DVB-H and MediaFLO technologies, around 20-25 mobile TV channels can be digitally placed on the spectrum band of 8 MHz in UHF band (equivalent

to one analogue channel bandwidth). Carrying capacity of channels varies depending upon the resolution level required at the receiving end and the level of video compression used for digital transmission in the system. In the case of T-DMB technology, 2-3 digital channels can be carried in one multiplex of 1.54 MHz in band III of VHF or in band L. High level of compression has the chances of deteriorating the reception of video quality.

4.16. According to some assessments, carrying 8 to 11 channels is good enough initially for a mobile service to take off. Hence assigning one channel of 8 MHz spectrum in case of MediaFLO and DVB-H technology, and 4 multiplex of 1.54 MHz in the case of T-DMB may be appropriate for the launch of the mobile TV service by an operator in broadcasting mode.

4.17. Presently Doordarshan is broadcasting terrestrial TV service in analogue mode across the country in these broadcasting bands. Doordarshan is also offering its Digital Terrestrial Television (DTT) service in 3 Metros (Mumbai, Chennai and Kolkata). Recently it has started its mobile TV service using DVB-H technology in UHF band IV in Delhi.

4.18. *VHF Band I*: Presently, Doordarshan has been assigned only one channel (channel No.4) out of three channels available in the VHF Band-I (47 to 68 Mhz) for conventional terrestrial broadcast. Doordarshan is using this channel only in 10 cities for analogue transmission in terrestrial mode and it has plans to vacate this frequency and move the transmission to a channel in the VHF band III. Thus, this band (VHF Band I), which is presently highly underutilized, is expected to be completely free in the near future. This band supports large coverage of area, but has drawbacks such as large- size receiving antennas, comparatively large manmade noise and co-channel interference from long distance sporadic-E and anomalous propagation. The mobile TV technologies are also not looking at this band for their operation.

4.19. *VHF Band III*: The VHF band III is considered the most suitable band for TV broadcasting all over the world due to the following reasons.

- A TV transmitter operating in this band can cover a larger area than the one operating in UHF band.
- The VHF Band-III is free from propagation impairments, which are encountered in VHF Band-I.
- The physical dimensions of the receiving antennas are reasonable.
- The impact of man-made noise is insignificant.

4.20. *VHF Band-III (174-230 MHz)* provides a total of 8 numbers of TV channels each with 7 MHz bandwidth. Doordarshan has been assigned all the 8 channels in the country. A total of around 450 frequency assignments specific to different geographical locations within the country have been made to Doordarshan in this band. Since these frequencies can be repeated there is scope to assign more than 450 frequencies also. Thus, at different locations, there would be a possibility to use some of the spectrum in this band for mobile TV operation.

4.21. *UHF Band IV*: There are 14 TV channels available in the UHF Band-IV (470 - 582 MHz) with 8 MHz channel bandwidth. Doordarshan has been assigned to operate about 330 transmitters in this band. Doordarshan's three digital TV transmitters at Kolkata, Chennai and Mumbai are also operating on an experimental basis in this band. Recently Doordarshan has started its mobile TV service in Delhi using DVB-H technology in this band at channel 26. Additionally Doordarshan has received a few more frequency assignments for the digital transmission.

4.22. *UHF Band-V*: In this frequency band, there are 28 channels available with 8 MHz bandwidth in the sub-band from 582 to 806 MHz. Doordarshan has not been assigned any channel in this sub-band for analogue TV transmission. However, frequency earmarking has been made in favour of Doordarshan to operate a digital transmitter, one each for four metros. These bands (above 806 Mhz) meant for TV broadcasting is shared with other

users of spectrum such as fixed and mobile services for transmission of data/voice and video. For example, in UHF band V, spectrum beyond 806 MHz has been extensively assigned to cellular mobile services etc.

4.23. *L Band(1452MHz to 1492MHz)*: This band is being utilized extensively by the terrestrial point-to-point and point-to-multipoint microwave links by private organizations and public sector undertaking across the country.

4.24. *S-Band(2500Mhz to 2690MHz)*- The S-DMB services in Japan and South Korea operate in sub-band from 2630 to 2655 MHz. The satellite based technology of China is also being planned in this band with initial occupying bandwidth of 25 MHz. This band is being used for last mile connectivity by some ISPs in India. Moreover, this band is also recognized as the expansion band for 3G mobile services.

4.25. There is already a move to shift the terrestrial TV transmission from analogue to digital mode across the world. Doordarshan is also in the process of planning for upgradation of its analog transmission to digital terrestrial transmission. The requirement for spectrum for digital terrestrial transmission is to be met within these broadcasting bands. Moreover, during the transition period from analog to digital terrestrial transmission, the spectrum requirements could be heavy making the availability a constraint.

4.26. Earlier, keeping in mind the need for spreading Broadband Wireless Access (BWA) technologies, TRAI has also recommended some assignment in 700 MHz band from broadcasting band for BWA technologies.

4.27. One of the special features of digital TV transmission and mobile TV transmission, which is different from analogue TV, is that large parts of the country (for example a State) may be covered by using a number of low power transmitters using the same frequency. Such network is called Single Frequency Network or SFN. Thus SFN is highly frequency efficient as compared to Analogue TV where several frequency

channels may be needed to cover the same area. Thus, SFN network is ideal for the linguistically homogeneous area. The other way for transmission is through Multi Frequency Network (MFN), where different spectrum is assigned for the transmitters covering a given service area.

4.28. As far as allotment of the spectrum is concern, there are various methods for allocation of the spectrum such as fixed price, beauty contest, auction etc. The auction method is widely accepted across the world for allocation of the spectrum. TRAI also has been in favour of auction for the spectrum in its various earlier recommendations.

4.29. It could thus be seen that the use of spectrum band for mobile TV transmission has to be seen and examined in the context of spectrum availability, its current usage by the public service broadcaster and its future plans. This would need extensive coordination with Doordarshan's existing analogue service and the future planning of Digital terrestrial Transmission, which are also in the same band.

Chapter V: Licensing Issues

5.1 Introduction

Licensing process is used to regulate the entry of service providers in a particular industry. So far as mobile television services are concerned, these are presently being provided by Doordarshan, the Public Service Broadcaster, in New Delhi on a trial basis using DVB-H technology. Apart from this, some mobile cellular networks are offering video clip download services. However, in the absence of roll out of 3G services in the country, data transmission speeds of mobile telecommunications networks are severely limited and such video clip download services can not be called mobile television services. At present, there is no policy framework for licensing of mobile television service providers in the country. However, the issues relating to formulation of a policy framework for licensing of mobile television service providers are similar to such issues in other sectors of electronic media.

At present, Doordarshan is the only broadcaster providing terrestrial TV broadcast service. The terrestrial TV broadcasting has not been opened up for the private sector by the Government. On this issue, TRAI has already submitted its recommendations to the Government of India on 29th August, 2005, suggesting that terrestrial broadcasting for TV should be opened up to include private sector also. Government has not taken any decision on these recommendations yet. The restriction on terrestrial TV broadcasting will require at least a limited relaxation to permit mobile TV operation, pending a decision on the larger issue of allowing private participation in analogue and digital terrestrial broadcasting by the government.

5.2 Eligibility

Television is a powerful medium of mass communication and it can influence and mould public opinion to a great extent. This is especially true in the case of India on account of low literacy levels. However, mobile television services are likely to be concentrated initially in urban areas which will have a smaller viewership as compared to conventional television services. Still, it is necessary to lay down eligibility conditions for licensing of mobile television service providers to ensure orderly growth of the mobile television services.

5.2.1 The eligibility criteria specified for licensing of service providers for different broadcasting services give some idea about possible approaches.

Phase-II of Private FM Radio Licensing

As per the tender document for Phase-II of Private FM radio licensing, the following norms were prescribed regarding eligibility/ ineligibility of applicants:-

2.1 ELIGIBILITY FOR APPLICANTS

2.1.1 Only companies registered in India under The Companies Act, 1956 satisfying the eligibility criteria specified below in this section are eligible to apply.

2.2 DISQUALIFICATIONS

2.2.1 The following types of companies shall not be eligible to apply:

- (a) Companies not incorporated in India.
- (b) Any company controlled by a person convicted of an offence involving moral turpitude or declared as insolvent or applied for being declared insolvent;
- (c) A company which is an associate of or controlled by a Trust, Society or Non Profit Organization;
- (d) A company controlled by or associated with a religious body;
- (e) A company controlled by or associated with a political body;
- (f) Any company which is functioning as an advertising agency or is an associate of an advertising agency or is controlled by an advertising agency or person associated with an advertising agency;
- (g) Subsidiary company of any applicant in the same City;
- (h) Holding company of any applicant in the same City;
- (i) Companies with the Same Management within a City;
- (j) More than one Inter-Connected Undertaking at the same City.
- (k) A company that has been debarred from taking part in the bidding process or its associate company with the same management.
- (l) The defaulters of conditions under Phase-I, who have contested the revocation of their Letters of Intent/License Agreements, thereby continue to be debarred from participating in any future bidding process as per Phase I policy.

5.2.2 The policy Guidelines for setting up Community Radio Stations in India (December, 2006) also list some eligibility/ ineligibility criteria. However, the criteria for a mobile television service provider may be very different from the criteria for a community radio station.

Community Radio Guidelines

(i) The following types of organisations shall be eligible to apply for Community Radio licences:

- a) Community based organisations, which satisfy the basic principles listed at para 1 above. These would include civil society and voluntary organisations, State Agriculture Universities (SAUs), ICAR institutions, Krishi Vigyan Kendras, Registered Societies and Autonomous Bodies and Public Trusts registered under Societies Act or any other such act relevant for the purpose. Registration at the time of application should at least be three years old.
- b) Educational institutions

(ii) The following shall not be eligible to run a CRS:

- a) Individuals;
- b) Political Parties and their affiliate organisations; [including students, women's, trade unions and such other wings affiliated to these parties.]
- c) Organisations operating with a motive to earn profit;
- d) Organisations expressly banned by the Union and State Governments.

5.2.3 In year 2001, the Union Government has decided to permit Direct-to-Home (DTH) TV service in Ku Band in India. The prohibition on the reception and distribution of television signal in Ku Band has been withdrawn by the Government vide notification No. GSR 18 (E) dated 9th January, 2001 of the Department of Telecommunications.

DTH

The salient feature of eligibility criteria for DTH

- Applicant Company to be an Indian Company registered under Indian Company's Act, 1956.
- Total foreign equity holding including FDI/NRI/OCB/FII in the applicant company not to exceed 49%.
- Within the foreign equity, the FDI component not to exceed 20%.
- The quantum represented by that proportion of the paid up equity share capital to the total issued equity capital of the Indian promoter Company, held or controlled by the foreign investors through FDI/NRI/OCB investments, shall form part of the above said FDI limit of 20%.
- The applicant company must have Indian Management Control with majority representatives on the board as well as the Chief Executive of the company being a resident Indian.
- Broadcasting companies and/or cable network companies shall not be eligible to collectively own more than 20% of the total equity of applicant company at any time during the license period. Similarly, the applicant company not to have more than 20% equity share in a broadcasting and/or cable network company.

5.2.4 At present, one teleport operator is having permission to operate HITS service on its network with certain conditions. TRAI had already issued a consultation paper on 24.07.2007 raising different policy issues for HITS operation.

The eligibility criteria for the permission for setting up of uplinking Hub/teleports are given below:

HUB/TELEPORT

1.1 Eligibility Criteria.

1.1.1 In the applicant company, the foreign equity holding including NRI/OCB/PIO should not exceed 49%.

1.1.2 The Company should have a minimum Net Worth as prescribed below:

Item Required	Net Worth
Teleport for single channel capacity	Rs. 1.00 Crore
Teleport for 6 channel capacity	Rs. 1.50 Crore
Teleport for 10 channel capacity	Rs. 2.50 Crore
Teleport for 15 channel capacity	Rs. 3.00 Crore

5.2.5 Similarly the eligibility criteria for the channel to get permission under downlinking guidelines are as follows:-

Downlinking Guidelines

- 1.1 The entity applying for permission for downlinking a channel, uplinked from abroad, (i.e. Applicant Company), must be a company registered in India under the Indian Companies Act, 1956, irrespective of its equity structure, foreign ownership or management control.
- 1.2 The applicant company must have a commercial presence in India with its principal place of business in India.
- 1.3 The applicant company must either own the channel it wants downlinked for public viewing, or must enjoy, for the territory of India, exclusive marketing/distribution rights for the same, inclusive of the rights to the advertising and subscription revenues for the channel and must submit adequate proof at the time of application.
- 1.4 In case the applicant company has exclusive marketing / distribution rights, it should also have the authority to conclude contracts on behalf of the channel for advertisements, subscription and programme content.

1.5 The applicant company should have a minimum net worth as prescribed below:

Item	Required net worth of the Co.
For downlinking one Channel	Rs 1.50 Crores
Every Additional Channel	Rs 1.00 Crores

1.6 The applicant company must provide names and details of all the Directors of the Company and key executives such as CEO, CFO and Head of Marketing etc to get their national security clearance.

1.7 The applicant company shall furnish, technical details such as Nomenclature, make, model, name and address of the manufacturers of the equipments/instruments to be used for downlinking and distribution, the Block schematic diagram of the downlinking and distribution system and also demonstrate the facilities for monitoring and storing record for 90 days.

1.8 The Applicant Company should not have been disqualified from holding such permission under these guidelines.

5.3 Net worth Requirements

Apart from the eligibility criteria, the tender document for Phase-II of Private FM radio licensing also listed different net worth requirements for companies to be eligible for bidding for licenses for different categories of cities. The relevant extracts of the tender document are reproduced below:-

“2.4.2 The financial eligibility of each applicant company shall be assessed on the basis of the following criteria:

Minimum Net Worth required for one Channel per City in each region:

§ D category Cities: Rs. 50 Lakhs.

§ C category Cities: Rs. 1 Crore.

§ B category Cities: Rs. 2 Crore.

<i>§ A category Cities:</i>	<i>Rs. 3 Crore.</i>
<i>§ A+ category Cities:</i>	<i>Rs. 3 Crore.</i>
<i>§ All categories of Cities in all regions:</i>	<i>Rs. 10 Crore.”</i>

Laying down a net worth requirements has the advantage of ensuring that only companies with a strong financial background participate in the licensing process. Such companies are likely to be in a position to roll out services at an early date. However, the flip side is that a new entrant with a low net worth but with a strong business case may not be able to participate in the process. For DTH and Teleport licenses, the requirement of net worth was not prescribed.

5.4 Foreign Holding

The rules regarding Foreign Direct Investment (FDI) today are highly divergent across sectors, applications and technologies. However, convergence of technologies is rapidly blurring the boundaries between telecommunications and broadcasting. With increasing digitalization and convergence, it is possible for the broadcasting and cable service providers as well as telecom service providers to provide “triple play” services (voice, video and data) to their subscribers. As already discussed mobile television services can be provided either through a mobile telecommunications network or by using broadcasting technologies.

The present FDI limits for various sectors are as follows:

FM Radio:	20%
DTH:	20%
TV News Broadcasters:	26%
Cable Services:	49%
Telecom:	74%
ISP:	100%
Non news TV Broadcasters:	No limits laid down

For mobile television service providers also some restriction on FDI has to be specified which is consistent with the other segments of the media sector. A similar approach is required for dealing with portfolio investment.

5.5 Period of License

The broadcast licenses have been issued in the case of Private FM Radio for a fixed term of 10 years. The mobile telecommunications networks have been licensed for a period of 20 years (UASL license has been issued for a period of 10 years with an option to seek 10 year extension). The mobile television service providers could be licensed for a term similar to the term of mobile telecommunications network license. However, different mobile telecommunications networks received their licenses on different dates and there are variations in remaining validity period of their licenses. Moreover, the technology is changing at a very fast pace and there may be complete reorganization of the mobile television services sector before expiry of term of license. The DTH and Teleport licenses are valid for 10 years.

5.6 License Fee

In case of telecom, the licenses for Cellular Mobile Telephony Services ('CMTS') were issued In 1994 by the Department of Telecommunications upon payment of fixed amounts as annual license fees and were valid for an initial period of 10 years. In addition, the service providers were required to pay a fixed amount for wireless and spectrum charges to the Wireless Planning Commission ('WPC') – a section of the Department of Telecommunications (DoT). Considering the drawbacks of fixed licensing fees for a nascent industry, the Government of India later changed the license fee structure. The Government approved the New Telecom Policy, 1999 ('NTP-99') on July 6, 1999, which came into effect from August 1, 1999, providing for the payment of a "one-time license entry fee" and annual fees payable under a revenue sharing arrangement.

Similarly, the license fee for Phase-I of licensing of Private FM Radio broadcasters was determined by a bidding process at the time of award of licenses and had a built in annual escalation clause. However, all Private FM Radio broadcasters were incurring a loss and the industry could not grow on this account. Out of the 108 frequencies put on bid, less than 25 could become operational. Some broadcasters who had been able to operationalise their stations had also given notice to close down. Accordingly, a revenue share based license fee regime has been recommended by the Authority in its recommendations made on Licensing Issues Relating to 2nd Phase of Private FM Radio Broadcasting. The same was accepted by the Government for Phase-II of licensing of private FM radio broadcasters.

Thus, as the experience shows the levy/ quantum of license fee can affect the viability of mobile television service providers also as an industry. This is more so because the investment is likely to be much more as compared to FM Radio Broadcasting service. Moreover, the initial viewership and consequently advertising and subscription revenue is likely to be very small on account of high cost of mobile television service compatible handsets.

A revenue share based license fee regime with a one time entry fee along with annual revenue share as recommended by the Authority and as adopted by the Government for 2nd Phase of Private FM Radio Broadcasting may be a viable option. The advantage of such a regime is that the license fee grows with the growth in the revenues of the mobile television service providers. However, in case there are very few applicants for mobile television service license, the bidding process may not be the best way to determine the entry fee.

For DTH services, the Licensee shall pay an initial non-refundable entry fee of Rs.10 crores before the issue of letter of intent to him by Licensor, and, after the issue of the Wireless Operational License by the Wireless Planning and Coordination (WPC) Wing of the Ministry of Communications, an annual fee equivalent to 10% of its gross revenue in that particular financial year within one month of the end of that year. The Licensee shall also, in addition, pay the license fee and royalty for the spectrum used as

prescribed by Wireless Planning & Coordination Authority (WPC), under the Department of Telecommunications.

For Teleport, License fee / royalty as prescribed by WPC from time to time, shall have to be paid by the Permission Holder towards grant of License for usage of frequency spectrum. However, the applicant is required to pay an amount of Rs. Ten thousands as processing fee. After being held eligible, the applicant company is required to pay a permission fee at the rate of Rs. Five Lakhs per teleport.

5.7 Bank Guarantee

Requirement of Bank Guarantee is also an integral part of any licensing process. The purpose of Bank Guarantee is to ensure compliance of the terms and conditions of license either in terms of performance (timely roll out and adequate coverage) or in terms of payments (license fee or other dues). Therefore, the entities interested in participating in licensing process or to whom a license is issued are required to furnish appropriate bank guarantees. This is true for licenses for Private FM Radio license, Direct To Home Services license as well as for Unified Access Service License. The details are as follows:-

- For Private FM Radio license, Performance Bank Guarantee (PBG) was for an amount equal to 50% of the financial bid valid for one year from the date of closure of the bidding process. There was a further requirement of furnishing a PBG for an amount equal to the annual fee [10% of Reserve One-Time Entry Fees (OTEF)].
- For DTH services, a bank guarantee for an amount of Rs. 40 crores valid for the duration of the license is required.
- For Unified Access Service License, a combination of financial bank guarantee (FBG) and a performance bank guarantee (PBG) is required. The details are at Annexure- V.

5.8 License Area and networking

- 5.8.1 The licenses for mobile television service can be awarded for coverage on national/ regional/ city level. Since, the coverage area of any terrestrial television transmitter or mobile communications network is limited, the national level licenses would mean transmitters or networks in different cities carrying the same program, i.e. networking.
- 5.8.2 Networking had not been allowed in Phase I of Private FM Radio Broadcasting except on important occasions with the prior permission of the Government. However, in Phase II of Private FM Radio Broadcasting, the Permission Holders are permitted to network their Channels in C & D category cities within a region only. No two Permission Holders are permitted to network any of their Channels in any category of cities.
- 5.8.3 Currently, the pay television services in the country are being broadcast through satellites only (either by way of DTH or by way of cable operators who in turn receive the signals through satellites). Accordingly, there is no bar on networking and whatever localization of content occurs, it is mainly on account of linguistic and cultural diversities of the country.
- 5.8.4 While considering the issue of networking, it is important to keep in mind the relative advantages of national/ regional/ city level licenses. The advantages of having regional or city level license is that localized content and programming is available to the viewers. The main advantage of regional/ national level licenses for a mobile television service is that the major cost of running a station is the cost of providing content. Sharing it with many viewers simultaneously will greatly encourage new investment to come in.

5.8.5 It may also be a good idea to have license area for mobile television services to be distributed in the same manner as the license area of mobile communications networks have been distributed.

Chapter –VI: International Experience

6.1. Status

Mobile TV operators across the world are using different technologies for provision of mobile television services. Various technologies being used for delivery of mobile television services have been described in Chapter II. Different countries have chosen different technologies for varying reasons. Moreover, countries have followed different regulatory paths for launching the mobile television services.

6.2. Europe

6.2.1 As per some reports, the European Commission in a draft document has favored the Digital Video Broadcasting–Handheld (DVB-H) standard for mobile television for its member countries. The lack of a single technology standard has held back wider roll out of mobile television services, but the European Commission's support for DVB-H technology may turn out to be the decisive factor in the battle among a large number of competing standards.

6.2.2 Presently, the main problem in roll out of mobile television services in Europe is the non availability of spectrum in the UHF Band. The spectrum in UHF Band is already being used for analog terrestrial television transmissions. However, the European Commission's decision will secure DVB-H's position in Europe, especially when some UHF spectrum gets released after digitalization of terrestrial television transmissions. DVB-H is already the preferred solution for mobile TV transmission in three out of the five biggest EU countries: Italy, France and Spain.

6.2.3 **Italy:-** The Italian Telecom Regulator AGCOM has introduced a “light touch” regulation for mobile television services which will be in line with the European regulatory project and its own institutional targets. As a result, Italy is the only European country in which almost all mobile operators are about to start commercial DVB-H related projects. These operators have opted for different routes for rolling out broadcasting services. The H3G mobile operator has decided to have its own network to

transmit contents using DVB-H standards and has acquired a TV station having a license for digital terrestrial broadcasting on the national territory. With some more such acquisitions, H3G has launched mobile TV services on part of the national territory. Some other operators (Vodafone and TIM in particular) have decided to lease a part of the transmission band of the DVB-H enabled network which is being developed by another company.

6.2.4 France:- The *Conseil supérieur de l'audiovisuel* (CSA) or the Higher Council of the Audiovisual is an independent administrative authority that was created by law to guarantee broadcasting freedom. The television services that are broadcast on mobile telephony networks are subject to a system of agreement or declaration with the CSA. Television services, whose annual budget is over €150,000, have to sign an agreement with the CSA. Those whose annual budget is lower than this figure have to make a simple declaration to the Council.

It has authorized four experiments in the Paris metropolitan area: three of the four authorized consortiums will use the DVB-H standard, while one will use the Korean Terrestrial Digital Multimedia Broadcasting (T-DMB) standard.

6.2.5 Spain:- In Spain, two experiments conducted on the DVB-H technology by Abertis Telecom, Nokia and Vodafone España have been concluded. These covered the areas of Madrid, Barcelona, Sevilla and Valencia.

6.2.6 Germany:- There have been trials of both DVB-H and T-DMB based mobile television services in Germany. The spectrum for DVB-H is currently not available on a nation-wide basis in Germany. Another important factor in favor of T-DMB is the existing DAB (Digital Audio Broadcast) infrastructure in Germany with about 90% coverage. DAB is a commercial failure in Germany but it is possible to upgrade the DAB infrastructure to support T-DMB.

In Germany, the 13 states, and not the federal government, claim to possess the sole legal authority to set which mobile television standards are used in their territories. There is

disagreement amongst the states, with Bavaria backing T-DMB, and Berlin, Brandenburg and North Rhine Westphalia backing DVB-H.

6.2.7 Finland:- The first experiment on DVB-H in Europe was conducted in Finland, where it involved mobile operators, equipment manufacturers, television broadcasters (Digita, Elisa, MTV, Nelonen, Nokia, TeliaSonera, and YLE) and 500 users of the city of Helsinki. Digita has won the first license assigned by the Ministry of Transportation and Communications for the commercial launch of mobile television services using the DVB-H standard.

6.2.8 United Kingdom:- Mobile TV is already being shown on 3G networks in UK. Experiments have also been done on many different technologies in the UK. Experiment on DVB-H technology was done in Oxford. Trials have also been done on MediaFLO and a new technology, Digital Audio Broadcasting Internet Protocol (DAB-IP). In 2005, British Telecom and Virgin Mobile tried the DAB-IP standard on around 1,000 users, to whom a packet of television and radio channels was transmitted.

6.3 Asia-Pacific

6.3.1 Many experts predict that Asia will overtake Europe's early lead in adopting mobile television broadcasting as Europe is finding it difficult to make the spectrum available for rolling out mobile television service. Spectrum availability is not a problem in many Asian countries. However, a lack of consensus on business models and the variety of different technologies are holding back the roll out of mobile TV in Asia.

6.3.2 Australia:- By late 2005, Australian consumers had access to four 3G network operators providing mobile TV services, mostly in metropolitan areas of capital cities. The 3G networks are providing mobile television content through a combination of live streaming and on-demand content. On the live streaming front, networks have utilized sports coverage to encourage user take-up. DVB-H trial broadcasts were done in Sydney for one year, starting in August 2005. Broadcast Australia is now hosting a new trial of DVB-H mobile TV services in Sydney. The 3-month trial, which commenced transmission on May 7, 2007 is a collaboration between Broadcast Australia, digital

video solutions group Thomson Grass Valley, and digital content protection specialist Irdeto, the trial license-holder.

This year, the Australian Communications and Media Authority (ACMA) will allocate two national licenses for television spectrum to be used to provide new digital services. The two licenses—referred to as Channel A and Channel B—will be for 10 years, with the possibility of a further five-year renewal. In particular, Channel B can be used for an expanded range of services including mobile television. Channel B will not be subject to an annual license fee. Instead, money will be paid up-front on allocation. This channel will not be permitted to be used for commercial television services or fixed subscription broadcasting services. A potential model for the use of this channel could be a mobile television offering, integrated with mobile phone services and internet services and made available on a subscription basis.

6.3.3 China:- The government is pushing for the availability of mobile TV for the 2008 Olympics. In 2006, State Administration of Radio, Film, and Television (SARFT) announced the approval for channel transmission using China Multimedia Mobile Broadcasting (CMMB), the nation's proprietary mobile TV standard. SARFT is responsible for overseeing broadcasting, controlling broadcast frequencies and licensing TV content.

However, mobile operators have themselves not been able to obtain mobile TV licences so far. Shanghai Media Group (SMG), a state-controlled media conglomerate, is the only company to have obtained the license. SMG is conducting trial of the service in co-operation with China Mobile in Shanghai, Fujian and Guangdong. The service is offered over the GPRS (2.5G) mobile network of China Mobile and is not very popular on account of limitation of the 2.5G network to offer high-quality viewing experience.

Besides CMMB, multiple trials of different mobile TV broadcast standards have been done in China, with small-scale regional launches in Beijing and Guangdong in late 2006. Mobile TV trials include three T-DMB trials and one DVB-H trial. Terrestrial digital

multimedia broadcasting (T-DMB) has been chosen by provincial broadcasters in Shanghai, Beijing and Foshan.

6.3.4 Hong Kong:- Presently 3G mobile telecommunications networks are already providing mobile television services in Hong Kong. On account of its small geographical area and dense population, the existing 3G networks have the necessary coverage and capacity to provide the service. Moreover, the provision of mobile television service over the existing 3G network does not require any additional capital investment on new infrastructure.

Hong Kong's PCCW-HKT Telephone Ltd, a wholly-owned subsidiary of PCCW and Motorola recently carried out a six-month mobile TV trial within Hong Kong's Quarry Bay district using DVB-H, which ran from September 2006 to March 2007. PCCW-HKT Telephone Ltd has also started conducting a technical trial of MediaFLO technology in Hong Kong. The technical trial period runs from May 14 to November 13, 2007 and is for testing purposes only.

Communications and Technology Branch of the Commerce, Industry and Technology Bureau of the Government of Hong Kong has begun a consultation in early 2007 on digital broadcasting and mobile television to seek comments on spectrum availability, its allocation and assignment and licensing arrangements relating to mobile television service.

6.3.5 Indonesia:- Indonesian Electronics Company PT Agis has recently announced its plans to construct a nationwide mobile television network based on the Terrestrial Digital Multimedia Broadcasting (T-DMB) technology in collaboration with IPTV systems integrator Broadband Network Systems (BNS) and Japanese company Toshiba. The project, if successfully completed, would make Indonesia only the third country--after Japan and South Korea--to adopt the T-DMB standard on a nationwide scale.

Indonesia's DVB-H trial started in second half of 2006. The program was undertaken by Nokia and EMTEK (Elang Mahkota Teknologi) Group, a local emerging

telecommunication player with the support of the Indonesian Regulatory Board under the Ministry of Communication and Information.

6.3.6 Japan:- Mobile television services using One-segment broadcasting (OSB) were launched in April 2006. The new service has been carrying test transmissions and will remain free while mobile operators assess its potential and the number of subscribers. As regulation prohibits content developers from producing exclusive programs for OSB until 2008, services are limited only to simultaneous relay of digital terrestrial programs.

Another mobile television service called MobaHo! based on the S-DMB standard is available in Japan. MobaHo! services began on 20th October 2004. The satellite providing this service is jointly owned by SK Telecom of Korea and MBCO of Japan. However, there is a limitation regarding receiver terminals as there are no mobile phones based on S-DMB standards which can be used for viewing video content. Although portable receivers with built in QVGA LCD screens for car-use and a laptop-use PC card receiver are available.

6.3.7 South Korea:- The mobile TV market is split between the two variants of DMB. T-DMB usage is reported to be 68% of the mobile TV market. T-DMB is a free to air service as against S-DMB, which is a subscription based service backed exclusively by TU Media. T-DMB consists of 11 video, 25 radio and 8 data channels. The TU Media S-DMB service currently provides 15 video, 22 audio and three data channels. However, S-DMB lacks popular domestic programs provided by terrestrial TV stations and is lagging behind T-DMB even though S-DMB was launched in May 2005 as against T-DMB which was launched in December 2005. However, the co-existence of the two DMB standards is likely to characterize the Korean Mobile TV market. The co-existence of the two standards has even led to introduction of dual DMB handsets in the Korean market.

6.3.8 Malaysia:- The industry regulator Malaysian Communications and Multimedia Commission has chosen DVB-H as the first mobile TV broadcast technology for commercial use. The subscription levels of 3G and other high speed services are low.

Therefore, it is unlikely that the mobile telecommunications networks will play a significant role in spread of mobile TV.

6.3.9 **Singapore:-** Test trials have been conducted for mobile TV services based on DVB-H and T-DMB. Trials have also been conducted for MDTV services by Innocus Technologies, which consist of receivers supporting DVB-H as well as T-DMB standards. Limited commercialization of mobile TV services has also started.

6.3.10 **Vietnam:-** Vietnam has adopted the DVB-H standard for launch of commercial mobile TV services in the country even as 3G mobile telecommunications networks are yet to be rolled out in the country.

6.4 North America

6.4.1 **Canada:-** The first mobile television services in Canada with real-time access to live television programming was launched in 2005 using the mobile telecommunications network route. Separately, there have been trials of DVB-H system also at Milton, Greater Toronto Area in Ontario.

CRTC, the Canadian Regulator, came out with an exemption order for mobile television broadcasting undertakings on February 7, 2007. In this exemption order the Commission has exempted the mobile television services that are received by way of mobile devices from licensing requirements and associated regulations. The exemption applies only to the undertakings that use point-to-point technology to deliver the service; that is, the undertaking transmits a separate stream of broadcast video and audio to each end-user.

6.4.2 **Mexico:-** As per recent news reports, Nortel is expanding Grupo Iusacell's wireless network to extend 3.5G mobile broadband services such as video, online gaming and TV to 10 new cities in Mexico. Thus, the services based on Nortel's EV-DO Rev A technology will use the Iusacell's existing CDMA mobile communication network to support growing demand for high-bandwidth wireless services like mobile VoIP, broadcast quality TV and real-time video monitoring.

6.4.3 **USA:-** The USA primarily uses MediaFLO technology for delivery of mobile television services. The MediaFLO technology has been utilized in the USA by mobile telecommunications networks based both on CDMA as well as on GSM. While there have been some trials of DVB-H also, no commercial launch has taken place so far, as per the available information.

For a few years now, rival MobiTV based on mobile telecommunications networks has offered live and on-demand programming via Sprint, Cingular and Alltel. MobiTV is also reported to be testing other technologies.

6.4.4 The standards used across the world for provision of mobile TV services can be summarized as under:-

Sl. No.	Name of Country	Transmission method			Standards Used	Whether trial or commercial
		Satellite	Terrestrial	Mobile Network		
1.	Italy		√		DVB-H	Commercial
2.	France		√ √		DVB-H/ T-DMB	Trial Trial
3.	Spain		√		DVB-H	Trial
4.	Germany		√ √		DVB-H/ T-DMB	Trial Trial
5.	Finland		√		DVB-H	Commercial
6.	U.K.		√ √ √	√	3G/ DVB-H/ MediaFLO/ DAB-IP	Commercial/ Trial/ Trial/ Trial
7.	Australia		√	√	3G/ DVB-H	Commercial/ Trial
8.	China		√ √	√	GPRS (2.5G)/ T-DMB/ DVB-H	Trial/ Trial/ Trial
9.	Hong Kong		√ √	√	3G/ MediaFLO/ DVB-H	Commercial/ Trial/ Trial
10.	Indonesia		√ √		DMB/ DVB-H	Trial/ Trial
11.	Japan	√	√		OSB/ S-DMB	Trial/ Commercial
12.	South Korea	√	√		S-DMB/ T-DMB	Commercial/ Commercial
13.	Malaysia		√		DVB-H	Commercial
14.	Singapore		√		DVB-H/ T-DMB	Trial/ Trial
15.	Vietnam		√		DVB-H	Commercial
16.	Canada		√	√	3G/ DVB-H	Commercial/ Trial
17.	Mexico	√			3.5G (EV-DO Rev A)	Commercial
18.	USA		√ √	√	MediaFLO/ DVB-H/ 3G	Commercial/ Trial/ Commercial

Chapter VII: Issues for consultation

Based on the discussion in the previous chapters, the following issues have emerged for consultation on the policy framework for the mobile TV service in India. As already pointed out, these issues are relevant for mobile TV service providers excluding CMTS and UASL licensees.

1. Whether the technology for mobile television service should be regulated or whether it should be left to the service provider.
2. If the technology is to be regulated, then please indicate which technology should be chosen and why. Please give reasons in support of your answer.
3. What will be the frequency requirement for different broadcast technological standards for terrestrial and satellite mobile television transmission in India?
4. Which route would be preferable for mobile TV transmission – dedicated terrestrial transmission route or the satellite route? Should the mobile TV operator be free to decide the appropriate route for transmission?
5. How should the spectrum requirements for analogue/ Digital/ Mobile TV terrestrial broadcasting be accommodated in the frequency bands of operation? Should mobile TV be earmarked some limited assignment in these broadcasting bands, leaving the rest for analog and digital terrestrial transmission?
6. In the case of terrestrial transmission route, how many channels of 8 MHz should be blocked for mobile TV services for initial and future demand of the services as there are nearly 270 TV channels permitted under downlinking guidelines by Ministry of Information and broadcasting?

7. Whether Digital Terrestrial Transmission should be given priority for the spectrum assignment over mobile TV, particularly in view of the fact that the Mobile TV all over the world is essentially at a trial stage.
8. Whether the frequency allocation for the mobile TV should be made based on the Single Frequency network (SFN) topology for the entire service area or it should follow Multi Frequency Network (MFN) approach.
9. Whether frequency spectrum should be assigned through a market led approach – auctions and roll out obligation or should there be a utilization fee?
10. What should be the eligibility conditions for grant of license for mobile television services?
11. Whether net worth requirements should be laid down for participation in licensing process for mobile television services? If yes, what should be the net worth requirements for participation in licensing process for mobile television services?
12. What should be the limit for FDI and portfolio investment for mobile television service providers?
13. What should be the tenure of license for the mobile television service providers?
14. What should be the license fee to be imposed on the mobile television service providers?
15. Whether in view of the high capital investment and risk associated with the establishment of mobile television service, a revenue share system would be more appropriate?

16. Whether any Bank Guarantee should be specified for licensing of the mobile television service providers. If yes, then what should be the amount of such bank guarantee? The basis for arriving at the amount should also be indicated.
17. Whether the licenses for mobile television service should be given on national/ regional/ city basis.

**Summary of the Recommendations on issues related to Private Terrestrial TV
Broadcast Service dated 29th August, 2005**

Private Sector participation in Terrestrial Television Broadcasting.

Spectrum and Technical Issues

Licensing

For the present some broad recommendations are being made without going into details. Broadly these recommendations follow the pattern of FM radio and detailed reasons for the same have already been given. Some departures may need to be made in view of the large penetration of cable and satellite – such a parallel does not exist in the case of Radio. Further details can be framed once an in principle decision is taken by the Government and it is known as to what is the extent of interest, at what locations and from what segments of business and the industry.

Eligibility

No detailed eligibility conditions need be laid for the present. However, the general disqualifications which have been adopted for Private FM Radio may be used for private terrestrial television broadcasting also. This would mean that the following would be disqualified from holding a licence :

- General disqualifications
 - o Companies not incorporated in India;
 - o Any company controlled by a person convicted of an offence involving turpitude or declared as insolvent or applied for being declared insolvent;
 - o Subsidiary company of any applicant in the same centre;
 - o Companies with the same management within a centre;
 - o More than one inter-connected undertaking at the same centre.
- Religious bodies
- Political bodies
- Advertising agencies
- Trusts, Societies, Non profit Organisations controlled/associated companies.

Foreign Ownership

As has been recommended earlier by the Authority in the context of Private FM Radio, the rules regarding foreign investment need to be reviewed to bring about a greater

consistency in the rules of various segments of the media sector. Given the interest of the telecom sector in this area, this review would also need to take note of the likely convergence in future between telecommunications and broadcasting.

Period of licence

The term for a licence would depend on whether it is being given for analogue or for digital. A longer term for digital licences may be given whereas for analogue the licences could be for a shorter period. However, this issue needs to be decided after a view is taken on whether analogue licences would at all be given or not.

Licence Fee

The structure of the licence fee should be the same as for Private FM Radio. There should be an entry fee which is related to the level of competition and size of the market and can be determined by an auction process similar to what had been decided in the case of FM Radio. The annual fee should be on the basis of a revenue share of the gross revenue of the licensee which could be at the same level as that proposed for Private FM Radio – 4%.

Area of licence

The licences could be for cities identified after an in principle announcement is made. However, in case there is interest shown in particular regions then those regions should also be allowed to be put on bid. In the case of FM Radio no networking was permitted. However, the case of television is different where there are already a large number of channels having national coverage and viewership. Therefore, networking for television should be permitted to allow for competition with established national cable and satellite networks.

Pilot Projects

The permission to run pilot projects on MMDS or other technologies should not be given before laying down a comprehensive policy and regulatory framework.

**Summary of the Recommendations on issues relating to Convergence and Competition in
Broadcasting and Telecommunications dated 20th March 2006**

- Regulation of carriage and content should be separated.
- Since the proposed legislative arrangements may take considerable time, the Unified Licensing Regime as recommended by the TRAI vide its recommendations dated 13th January 2005 must be adopted at the earliest albeit with some modifications.
- The entry fee for the unified license should be brought down to Rs. 5 crores (as against Rs. 100 crores recommended earlier) and further to Rs. 30 lakh after five years (as recommended earlier) as indicated in Table 1 at page 25.
- There should be flexibility in spectrum allocation to take full advantage of new services and new technologies for existing services that may evolve with time. Clubbing of services and the flexibility should be specified before bidding/assignment and not after these processes are over.
- Spectrum allocation should also be technology and service neutral to the extent possible so as to avail the full benefits of a converged licensing regime.
- Issues covered in the report of the Committee

(a) Rationalisation of Differential Custom Duty Regime

The cable industry and the telecom industry are vastly different in terms of their size, entry fees and technology. However wherever they are performing similar services both should be treated as far as practicable identically. Accordingly the Authority recommends that the changes in customs duties should be made to promote effective competition amongst telecom and cable operators. At present there are several items which perform the same function, but are classified under one head for the cable industry and under another head for the telecom industry and accordingly are charged different duties. Therefore for all equipment where the same function is performed, either by a cable system or by a telecom system, the duty structure should be the same.

(b) Restriction on use of Protocols

The Authority recommends that call termination should be permitted on Customer Premise Equipments (CPEs) using any protocol recommended by ITU/IETF. The Security Agencies should accordingly be advised to gear up for tracing and monitoring calls using any protocol recommended by ITU/ IETF.

(c) Institutional funding

The Authority recommends that the Government may suitably address the banks and financial institutions of the importance of these projects in building up the

country's communication infrastructure and to provide funds to the cable industry wherever this found commercially feasible.

(d) FDI Limits

The Authority has already taken a view on this issue in several of its recommendations and would again urge the Government to undertake a complete review of the FDI policy for the various sub sectors in telecommunications and broadcasting so that there is consistency in policy and a level playing field between competing technologies.

(e) Right of Way

The Authority recommends that Ministry of I&B may write letters to State Governments and Ministry of Surface Transport for providing Right of Way to Cable operators providing digital services pending amendment in the Cable Act which has already been proposed.

Annexure-III

Extracts from Report of the Sub Group IV of the Working group for the I&B

Ministry constituted by the Planning Commission

The fast growing economy of India, with faster growing media and telecom industry, is pushing for technological applications to provide variety in the hands of the user. The user wants everything from larger resolution High Definition TV to effective, on the move, Mobile Television. This is the right time to evaluate options and allow commercial launch of Mobile TV keeping an eye on not only addressing the needs of Indian users but also to take a lead in the sub-continent.

A very large percentage of the Indian population resides in rural areas and providing them connectivity through the new medium could be a specific objective. The policy on Mobile TV should have an approach to cover far-flung areas. The rural market is smaller in size and potential but at the same time the average income of rural India is rising phenomenally.

In India, sharing of infrastructure of existing digital transmitters and planning for broadcasting to handled devices while organizing roll-out of digital terrestrial transmitter can reduce the cost of the project considerably. This, in turn, will provide faster roll-out and a cheaper solution to both broadcaster and consumer. Sharing of infrastructure should, therefore, be resorted to wherever possible. The overlapping activity areas of Broadcasters and Telecom operators need to be addressed to avoid the grey areas which may cause commercial conflict. Use of existing Prasar Bharti infrastructure both in urban and rural areas by private players for providing mobile TV to handheld devices is an appropriate solution of the present situation. This may require allocation of frequency bands for private players as well as the evolution of regulatory mechanisms and a content monitoring set up.

Except for the DVB-H transmission to be set up by DD in Delhi by December 2006, to provision of mobile media solutions on handheld devices is more likely to be a private sector activity.

In order to accomplish the mission of implementing the scheme of Mobile Media Solution for audio, video and data in the country, the first step would be to form a committee to examine the issues concerning definition of service, definition of quality, number of licences to be provided in each city, number of channels to be included in a bouquet and the spectrum requirements. In respect of the spectrum, it will be in the interest of service to examine the possibility of earmarking bands, as follows:

- UHF band IV to national broadcaster
- UHF band V to private terrestrial broadcasts for DTH/Mobile TV

As far as technology is concerned, the Government should remain technology neutral and will not bind licensees on the issue of technology to be adopted by them. The Government should only specify the minimum technical standards that are required to be met by the licensees.

Extracts from relevant recommendations of the Authority wherein a review of FDI policy has been recommended

A. In its recommendations on “2nd Phase of Private FM Radio Broadcasting” dated 11th August, 2004, the Authority had pointed out “... The rules regarding FDI vary from segment to segment in the media sector. ... This leads to anomalies in media policy – whereas foreign news channels can be seen even for news, FDI is not permitted even for pure entertainment FM radio.” The Authority had recommended “...It is therefore necessary for the Government to review the policy in a holistic manner and bring about a greater degree of consistency in the rules for various segments.”

B. Thereafter, in its recommendations on “Issues relating to Broadcasting and Distribution of TV Channels” dated 1st October, 2004 the Authority recommended “...The Foreign Direct Investment limit in Cable TV as well as related sectors like DTH should be reviewed and a consistent policy adopted.”

C. The issue was again covered in the recommendations on “Issues Relating to Private Terrestrial TV Broadcast Service” dated 29th August, 2005 by the Authority. Regarding FDI for private terrestrial television, the Authority recommended “...In the case of terrestrial TV, a decision would have to be taken on this issue as there has been no such service in the past. This could be kept at 20% to be on par with FM radio since both involve terrestrial broadcasting and have wide reach. However it may be better to take a consolidated view of all media related sectors – in addition note would have to be taken of the likely convergence in this sector with the telecom services also.

Thus as has been recommended earlier by the Authority in the context of Private FM Radio, the rules regarding foreign investment need to be reviewed to bring about a greater consistency in the rules of various segments of the media sector. Given the

interest of the telecom sector in this area, this review would also need to take note of the likely convergence in future between telecommunications and broadcasting.”

D. The recommendations on Digitalization of Cable Television dated 14th September 2005 reiterated the earlier recommendations on the issue by stating “...The Authority has already stated in its recommendation on “Issues relating to Broadcasting and Distribution of TV channels” that there should be consistency in policy and level playing field between competing technologies and therefore had recommended that there is need for a complete review of the FDI policy so that it is consistent across all sectors. This would ensure that policies are not a stumbling block where there is a natural convergence of technologies. This recommendation is reiterated in the context of digitalisation also.”

E. The recommendations on “Issues Relating to Convergence and Competition in Broadcasting and Telecommunications” dated 20th March 2006 referred to earlier recommendations on the issue and stated “...The Authority has already taken a view on this issue in several of its recommendations and would again urge the Government to undertake a complete review of the FDI policy for the various sub sectors in telecommunications and broadcasting so that there is consistency in policy and a level playing field between competing technologies.”

ANNEXURE-V

Statement regarding Bank Guarantees to be given by Unified Access Service Licensee

(Amount in Rs. Crores)

S.No	Service Area	Cate - gory	Entry fee	FBG Requir ed	PBG require d	Networth	Paid up equity capital of Applica nt Compa ny
1	West Bengal	B	1.0000	25.00	10.00	50	5
2	Andhra Pradesh	A	103.0100	50.00	20.00	100	10
3	Assam	C	5.0000	5.00	2.00	30	3
4	Bihar	C	10.0000	5.00	2.00	30	3
5	Gujarat	A	109.0100	50.00	20.00	100	10
6	Haryana	B	21.4600	25.00	10.00	50	5
7	Himachal Pradesh	C	1.1000	5.00	2.00	30	3
8	Jammu & Kashmir	C	2.0000	5.00	2.00	30	3
9	Karnataka	A	206.8300	50.00	20.00	100	10
10	Kerala	B	40.5400	25.00	10.00	50	5
11	Madhya Pradesh	B	17.4501	25.00	10.00	50	5
12	Maharastra	A	189.0000	50.00	20.00	100	10
13	North East	C	2.0000	5.00	2.00	30	3
14	Orissa	C	5.0000	5.00	2.00	30	3
15	Punjab	B	151.7500	25.00	10.00	50	5
16	Rajasthan	B	32.2500	25.00	10.00	50	5
17	Tamilnadu	A	233.0000	50.00	20.00	100	10
18	Uttar Pradesh (West)	B	30.5500	25.00	10.00	50	5
19	Uttar Pradesh (East)	B	45.2500	25.00	10.00	50	5
20	Delhi	A	170.7000	50.00	20.00	100	10
21	Kolkata	A	78.0100	50.00	20.00	100	10
22	Mumbai	A	203.6600	50.00	20.00	100	10