Subject: Counter-comments of Prasar Bharati on consultation issues raised in TRAI Consultation Paper on "Proliferation of Broadband through Public Wi-Fi Networks".

Reference: TRAI Consultation Paper No.14/2016 on "Proliferation of Broadband through Public Wi-Fi Networks" dated 13.07.2016 along with subsequent press release No. 77/2016 and the comments submitted by various stakeholders.

At the outset, Prasar Bharati welcomes TRAI's efforts for raising various national issues and formulating policy on that. However, following fundamental points are required to be considered while formulating any policy:

- Associated technical studies must be completed and proposed policy shall conform to the technical studies
- Present incumbent services must be protected and their future growth must be ensured
- Demand for the proposed new service/network shall be realistic in terms of volume, growth and sustainability
- policy for proposed new service/network shall be technology and promoter neutral

It is noticed that 57 stakeholders have submitted their comments on this consultation paper. Comments of stakeholders on Q5 of the consultation paper, really attracts Prasar Bharati's attention.

Q5. Apart from frequency bands already recommended by TRAI to DoT, are there additional bands which need to be de-licensed in order to expedite the penetration of broadband using Wi-Fi technology? Please provide international examples, if any, in support of your answer.

Some of the salient points raised by various stakeholders on Q5 are listed below:

- Many stakeholders want no additional allocation of spectrum for Wi-Fi hot-spot
- Some of the stakeholders wants re-definition of existing frequency allocations such as power limits, de-licensing of some parts etc.
- Some stakeholders want further allocation of spectrum on the lines of some international practices already identified by TRAI such as de-licensing of E-band & V-band
- **Some stakeholders want use of TV White Space (TVWS) for providing back-haul for Wi-Fi hot-spot**

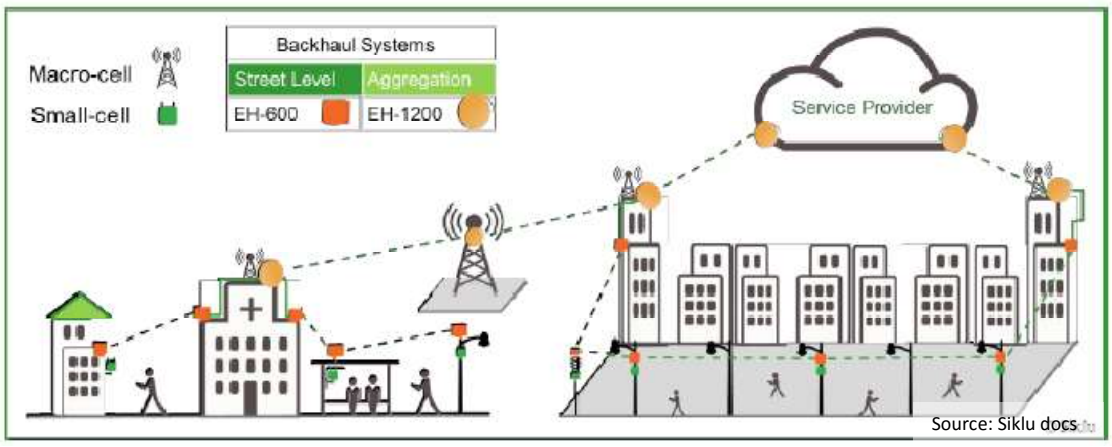
A) Prasar Bharati's views on requirement of spectrum for Wi-Fi network

i) Globally, there are on average 150 people per Wi-Fi Hot-Spot with millions of Wi-Fi hot-spots in many countries. It has been managed with the existing allocation of frequency bands mainly in 2.4 GHz & 5GHz bands. India is much behind the global average of 150 people/hot-spot and certainly can manage with present allocation of frequencies as mentioned in table 2.5 of the consultation paper.

Table 2.5: Unlicensed Spectrum bands in India

Frequency range (MHz)	Class of Transmitter	Maximum EIRP	Remarks
2400-2483.5	Low power equipment. (IND62)	4 Watt	Can be used Indoor as well as outdoor.
5150-5350	Low power equipment for indoor applications only.(IND67)	200 mW	Low power (max EIRP 200 mW). Outdoor use permitted in 5150-5250 MHz range, but it is not license-exempt. (IND68)
5725-5875	Wireless access system including RLAN indoor only.(IND67)	200 mW	Low power (max EIRP 4 W) outdoor use for Wireless Access System incl. RLAN and Dedicated Short Range Communication (DSRC) permitted in 5725-5825 MHz, but it is not license-exempt. (IND71)
5825-5875	Low power equipment. (IND 72)	4 Watt	Indoor as well as Outdoor.

ii) New set of frequencies for high capacity backhaul, namely, E-Band (71-76/81-86 GHz) and V-band (57-64 GHz), have also been identified by TRAI to meet the further growth. A typical arrangement for using 60 GHz and 70/80 GHz for high capacity backhaul is depicted below:



These bands may be explored based on estimated requirement (ref. Para 3.7 of consultation paper).

iii) Best backhaul solution is provided by fibre optic network, which has requisite capacity & reliability and provides guaranteed & long term solution.

iv) In addition, following frequency bands may also be considered for backhaul purpose:

a) **3.4-3.6 GHz band** along with 3.3-3.4 GHz has been identified for BWA subject to necessary protection to FSS service in the 3.6-4.2 GHz band. Actually, 3.3-3.4 GHz band is being used for providing wireless broadband but 3.4-3.6 GHz band is not able to be used due to high degree of co-ordination to avoid interference to FSS service in the band 3.7-4.2 GHz band. If this is used for providing Point-to-point back-haul for Wi-Fi Hot-spots, there is hardly any possibility of interference with FSS in neighbouring band. Allocating this band/or part of it, may really strengthen the data capacity.

b) **450-470 MHz band** is identified for IMT subject to co-ordination with existing users. As per the reports available so far, there is not much effort/ willingness to use this spectrum for normal IMT services. This band may be made available on National Basis for rural broadband back-haul. Co-ordination with incumbent services becomes much easier if used for point-to-point back-haul.

c) **368- 380 MHz band** is allocated for rural communication in the NFAP (IND30). This band may be explored for providing rural wireless broadband back-haul.

d) **Cellular 3G/4G network** can also be used as back-haul for Wi-Fi network.

B) Prasar Bharati's views on use of TVWS for Wi-Fi Back-haul

TVWS means the spectrum, which could not be used at a location due to technical consideration of interference free TV reception, can be used for opportunistic secondary usage for TVWS application, at '**whatever is available & whenever is available'** basis under strict co-ordination/monitoring mechanism. Availability of white space frequencies vary region to region. The size of the frequency gaps, and their precise frequency, varies too. In other words, there is no single white space frequency that can be used around the country.

Such spectrum can be made available for other radio communication services at a given time in a given geographical area on a non-interfering / non-protected basis with regard to the Primary services with a higher priority on a national basis.

TVWS spectrum is suitable for strategic/emergency usages by Indian security agencies like police, paramilitary forces, anti terrorist squads etc. and can enhance their communication systems. Defence is already using some portion of it for their applications.

The issue has been further deliberated in the following sections.

1. Doordarshan's requirement for terrestrial TV service:

Doordarshan, India's Public Service Broadcaster, serves the entire nation through implementation of mandate of the Govt. of India to educate, inform and entertain its masses across the country in general and in remote, under-developed, border, rural and inaccessible areas in particular.

i) Importance of Doordarshan's terrestrial TV service

- In the presence of huge number of DTH and Cable TV Channels, a strong Terrestrial platform is critical to healthy competition in the TV and Radio market
- All weather reliable platforms for distribution of Radio and TV Signals. Terrestrial TV signal do not suffer from rain attenuation, it is easy to receive with indoor or outdoor antenna.
- The Digital Terrestrial Television (DTT) has high potential in distribution of multiple Video and Audio signals especially using local content for the realization of a wide range of social and cultural benefits.
- Satellites broadcasting may face catastrophic failure or frequency jamming, which may cause complete breakdown. Satellite jamming is possible from across the border and hence terrestrial TV broadcasting is strategically important as well.
- Digital terrestrial Television secures greater plurality in Platform ownership, ensuring that no single platform owner is so powerful that they can exert undue influence on public opinion or political agendas.
- Every platform has its strength and weakness and as such all platform are essential for Audio-Visual distribution & they co-exist worldwide to supplement each other.
- No country in world has disbanded Terrestrial TV, albeit Analogue Transmitters have been replaced with Digital Transmitters.

A detailed Note on importance of Terrestrial TV transmission is given at Annexure-I.

ii) Doordarshan's spectrum requirement

a. Doordarshan is presently operating analog transmitters and will be digitalizing its network targeting 4-6 multiplex at each location. While putting digital transmitters, gap fillers and repeaters will be required to cover the shadow areas. As per the present progress, the digitalization plan may go much beyond targeted date of 2017. Much more spectrum would be required during transition phase. Worldwide studies have established that 224 MHz (470-694 MHz) would be required for a proper DTT network. However, in India only 176 MHz (470-646 MHz) is available for TV. DD has planned to establish all its DTT transmitters within this band.

   A brief on World DTT scenario is given at Annexure-II.

b. TV Broadcasting Technologies are ever evolving creating new products and services all over the world such as HDTV, 3D-TV, Ultra-HDTV, 4K TV, 8K TV etc. India (Doordarshan) would also like to do some experiment and implementation using these technologies needing more spectrum.

c. Terrestrial TV broadcasting may be opened to Private broadcasters as well (as already recommended by TRAI), which would further require spectrum.

d. Doordarshan has already carried out frequency planning for 2x630 DTT transmitters. During the planning exercise for two DTT MUX at 630 locations, in presence of existing analog transmitters, it has been observed that there is hardly any possibility of accommodating more TV transmitters. 3rd and 4th multiplex can be accommodated only after ASO (Except some cases).

   Utilization of spectrum by Doordarshan with existing analog transmitters and 2 digital MUXs is represented at Annexure-III.

2. TV White Space & Issues for terrestrial broadcasting

Co-existence of Terrestrial Broadcasting with other Mobile services has been studied by ITU-R during the process of WRC-15 and it was concluded that sharing of Broadcasting (terrestrial) & IMT (Mobile service) is not possible in the UHF band 470-698 MHz band. India tried to identify this band for IMT services, however, the same was not agreed to by WRC-15. Use of UHF TV spectrum by TVWS will put undue constraint to the development of TV broadcasting in addition to the high interference potential to the existing services. Any kind of TVWS application need an extensive practical study on interference from TVWS devices to terrestrial TV receivers, which has not been even initiated in India so far.

Some of the major issues are listed below:

i) Interference from TVWS

a) Co-channel interference from White space devices to analog and digital transmissions

b) adjacent channel interference from white space devices to analog and digital transmissions

c) Receiver front-end overloading: the situation arises due to saturation of TV receivers in close proximity of white space device

ii) Efficient Use of Spectrum:

Availability of continuous spectrum (no other services allowed in between) for TV broadcasting makes utilization of spectrum more efficient. As a result it is possible to provide maximum number of TV channels. Utilization of TV white space for other services will limit the efficient use of broadcasting spectrum for TV broadcasting.

iii) Restriction on DD expansion:

a) Future expansion of TV transmitters will be adversely affected : large number of white space devices will put a lot of constraints on future planning and expansion of TV transmitters due to interference probability to and from white space devices

b) Restrictions on putting gap-fillers in the shadow coverage areas especially for providing mobile reception

3. TV White Space & Issues for Wi-Fi broadband

Spectrum requirement for Wi-Fi Hot-spot or its back-haul should have dedicated and guaranteed capacity. The use of TVWS will not be suitable for this purpose as TVWS application is Opportunistic-Secondary usage of technically unutilized TV broadcasting spectrum. As digitalization of terrestrial transmission of Doordarshan are still underway there will be a lot of changes in available spectrum for which TVWS devices need to adjust very frequently.

There are a lot of unresolved issues for interference between TV services and TVWS applications, for which dedicated studies are required. At this point of time, status of studies in India is not adequate:

a) Experiments were conducted by some organisations in liaison with Microsoft to demonstrate the WS technology's working for providing broadband service
b) Experiments for interference studies between TVWS application to TV receivers has not been even initiated which is very important

Sharing of same spectrum for two different services is being considered, probably, for the first time in India. Therefore, this will require establishment of a strong regulatory framework to tackle Registration-Monitoring-Regulatory-Mitigation issues. Monitoring of TVWS operation such as use of specified and certified equipment, operating on specified parameters, no-interference to TV receivers etc. will be very critical.

Above requirements make TVWS spectrum un-suitable for Wi-Fi hot-spot back-haul.

It is also to mention that Min. of I&B vide their letter no. 2/70/2014-BP&L dated 03.06.2016 has supported the views expressed by Prasar Bharati regarding use of TVWS for other applications.

Conclusion: In view of the above mentioned points, Prasar Bharati recommends that broadcasting band UHF 470-646 MHz shall be available exclusively for Terrestrial Television Broadcasting.

Why Terrestrial TV?

Even in the presence of huge number of DTH and Cable TV Channels, ***a strong Terrestrial platform is critical to healthy competition in the TV and Radio market and to the realisation of a wide range of social and cultural benefits*** and most essentially an ***all weather reliable platforms*** for distribution of Radio and TV Signals. The **Digital Terrestrial Television (DTT)** has high potential in distribution of Video and Audio signals and that is why '**no country in world has disbanded Terrestrial TV'** albeit Analogue Transmitters have been replaced with Digital Tx.

The immense reasons of selecting the Digital Terrestrial Television are briefed as below:-

I. Digital television offers new possibilities to the viewers and broadcasters with improved technical quality of picture and sound, additional programs and additional reception modes (portable and mobile). **About 14 SDTV or 6 HDTV or a combination thereof** can be relayed with single Transmitter.

II. More robust reception for portable and mobile receivers , DVB-***T2 provides flexibility to meet the needs of different television markets like Smartphone, PC and moving vehicles .***The biggest coming trends are Portability and Mobility – watching TV anytime anywhere!!!

III. In the DTT broadcasting process everybody watches the same content at the same time and it **guarantees everybody the same high level of service**, since they are all bathed in the same signal and that too FTA , where as in the OTT the received signal quality depends upon number of viewers watching it simultaneously

IV. DVB-T2 Lite is not only suitable for mobile TV but it is also highly suitable as the future standard of digital radio instead of DAB, DRM etc. A single DVB T2 Transmitter can relay about 36 Radio channels i.e. a single Digital Terrestrial TV Transmitter can relay Radio channels equal to capacity of 36 FM Transmitters***. About 37 countries are broadcasting Radio services on DVB-T/T2 Transmitters along with TV channels.***

V. ***Local content*** has been a common requirement in DTT Networks, being most economic mode. Up to 50% of services in Europe are typically local/regional channels. Community TV /Municipality /Health, Education and Agriculture are some areas where DTT can provide unmatched services.

VI. ***Satellites broadcasting may face catastrophic failure*** or frequency jamming, which may cause complete breakdown. This fact is of paramount importance during wartime or other disasters.

VII. ***DTT secures greater plurality in Platform ownership***, ensuring that no single platform owner is so powerful that they can exert undue influence on public opinion or political agendas. Spare capacity may be leased out to Pvt. Broadcasters.

VIII. The ***terrestrial Transmitter continues innovations like LTE A+ Tower overlay on DVB T2 Transmitter***. Interactive services, Billboard, Text transmission and emergency information's are other features in DTT.

Every platform has its strength and weakness and, as such, all platforms co-exist. DTH has larger coverage and can exercise monitoring and control over contents, but it faces disruption in services during rain and storms and Catastrophic failure can disrupt all services. Cable TV has highest data capacity and large no. of Programme channels can be transmitted but it faces non availability in remote Areas and small localities, at many places there is no competition and there is annoying monopolies and no monitoring and control on contents. LTE/4G offers

services for high speed data and services for Smartphone's and tablets but as the number of subscribers increases in a given cell, the bit rate of programme content is lowered, adversely affecting the video quality besides introduction of interferences in receiving equipments of Cable TV and DTT.

Thus all platforms are essential for Audio-Visual distribution and co-exist worldwide to supplement each other. The following Table gives portrait of above statement:-

Country	**No. of Terrestrial TV Transmitters**	**DTH**	**Cable TV/LTE**
Japan	2194	SKY PerfecTV	Nippon BS Broadcasting Corp
U.K	1556	Sky Freesat iSat LTD	Virgin Media (known as Virgin TV)
Italy	24000	Sky Italia	Telecom Italia , FASTWEB
Australia	420 and many repeaters	Viewer Access Satellite Television (VAST) , Austar, Foxtel, SelecTV, UBI World TV, Australia TV PLUS	SKY Network Television Ltd (SKT)
South Africa	556 and 144 repeaters	MultiChoice	M-Net South Africa
Russia	7,306	Kosmos TV, NTV Plus, Orion Express, RIKOR TV, Russian TV Time, Tricolor TV Sibir, NTV Plus Vostok, Tricolor TV	ER-Telecom, Golden Telecom, Beeline CenterTelecom, Uralsvyazinform, VolgaTelecom
USA	2,218	Pittsburgh International Telecommunications DirecTV, DISH Network, Glorystar, Spiritcast, Sky Angel, GlobeCast ,World TV, Home2US	Time Warner Cable Inc., Cablevision Systems Corp (CVC), Charter Communications Inc (CHTR), Comcast Corp(CMCSA), Here Media Inc(HRDI)

Sweden	252	Canal Digital, Viasat	Com Hem, Tele2Vision, Canal Digital
Spain	224 plus 2,105 repeaters	Digital+	Ono, Canal plus, Movistar TV
Sri Lanka	14	Dialog TVWireless Peo TVcable TV	Dialog TV, LBN Cable TV
Vietnam	61	Audio Visual Company JSC (AVG)	Vietnam Cable TV , SCTV
South Korea	57 plus repeaters	Skylife	KBS cable channel operator KBS N (149 operators)
France	584 & plus 9,676 repeaters	ABSat, CanalSat, TPS	Lyonnaise, FT Câble
China	3,240	Phoenix Satellite Television	Hubei Broadcasting & Television Information Network Co Ltd
India	1412 (Analogue) DTT: 67 DTTs (approved as on date) . The DTT rollout plan is 2 Mux at 630 cities and many gap filler transmitters.	Airtel Digital TV, Bharat Business Channel (Videocon D2H), DD FreeDish, Dish TV, Reliance Digital TV, Sun Direct, Tata Sky	Hathway Cable & Datacom Ltd (HATH), Hinduja Ventures Ltd (HVL), Ortel Communications Ltd (ORTEL) and many more

Annexure-II

DTT world Scenario:

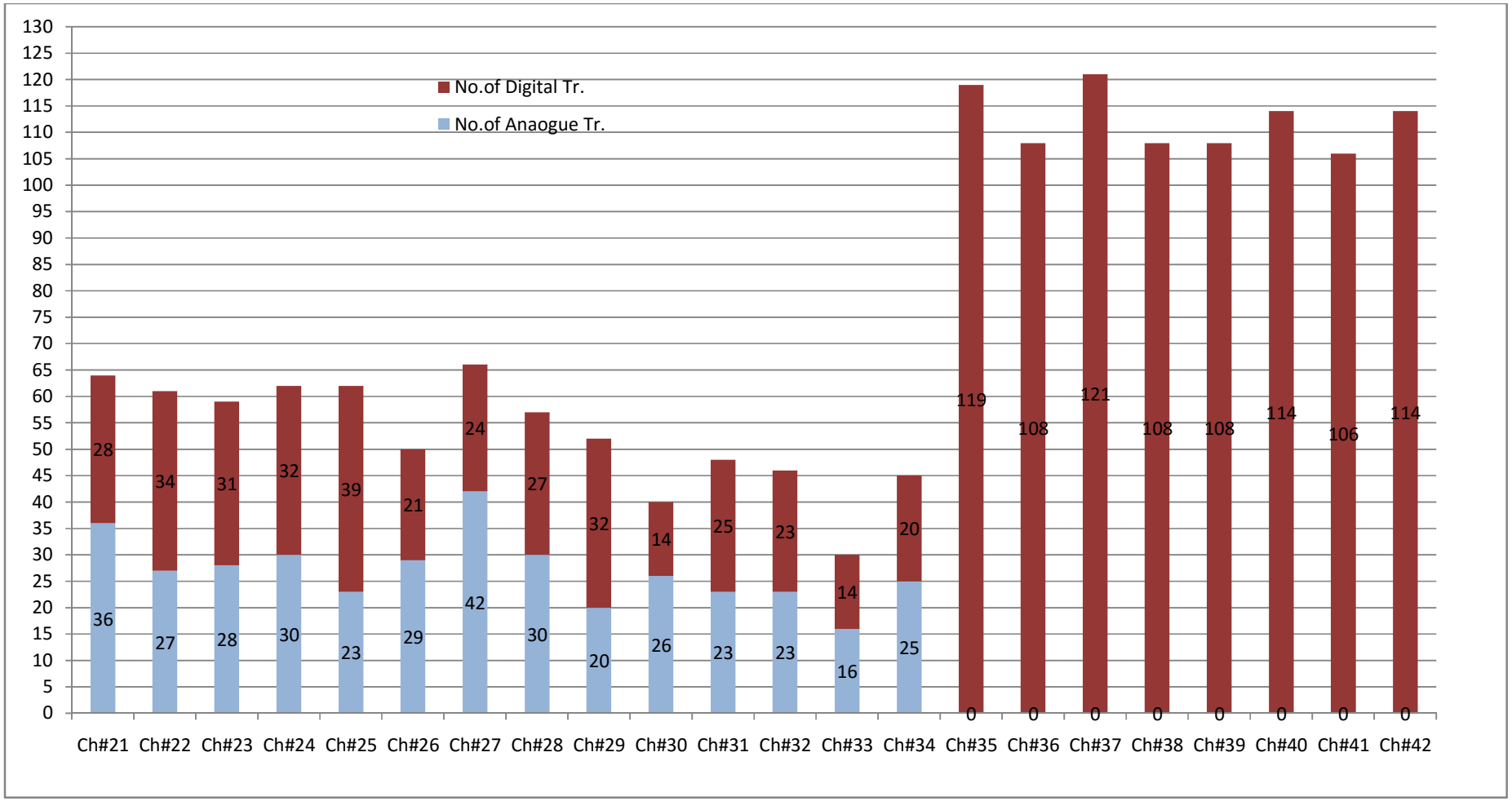
Terrestrial digital TV broadcasting is a new format of broadcasting that enables the viewer to receive higher quality video and audio signals than conventional analog TV, with no ghost images and no noise. This migration from analog to digital of the television provides multiple options for fixed, mobile and portable devices. Digital Terrestrial Television (DTT) is a spectacular success worldwide. With its low cost and easy access, it has become the most popular delivery platform for television content in Europe.

Normally 5 Muxes (One Transmitter carrying multiple Channels) with MFN are deployed worldwide. In U.K, there are 6 Muxes for SDTV and another 2 Muxes for HDTV. Other examples are: Italy (6 Mux), Germany (6 Mux), Sweden (5 Mux), Ukraine (4 Mux), Thailand (5 Mux). Everywhere, many gap-filler transmitters are deployed in SFN. Few Nations, like Australia, have adopted SFN. The DTTs worldwide have been shared by PSB and other Private Broadcasters. So far, only Doordarshan has license to install and operate DTT Transmitters in India and private Broadcasters do not have permission to install their TV Transmitters.

A few cases of DTT world over as below:-

i. Digital Terrestrial Television is the most popular television delivery in Europe. A total of 40% of European households use the DTT platform followed by satellite, used in 23% of homes, and cable, used in 19% of homes. If the analogue households are included, the terrestrial television covers 46% of all households
ii. Japan has already switched-off analogue transmitters and has migrated to DTT with about 2194 Transmitters. The services offered are FTA and there is no paid DTT platform.
iii. Finland's DNA DTT network covers 85% of Finnish households. YLE HD channel, available FTA on the DNA network offered HD for Euro football, the European Athletics Championships Helsinki, and as the climax for the summer, the London Olympics. Very popular along with cable TV both in Hybrid mode – PTV & FTA.
iv. According to the report of Industry body Free TV Australia , 14.3 million people in Australia watch free-to-air DTT television every day, a figure Free TV says is a seven-year high.
v. Italy - Over 2 million DTT subscribers.
vi. 80% of South African population is already covered by DVB-T2
vii. France - DTT is used in nearly 60% of homes
viii. Hungary - 850,000 DTT viewers
ix. Turkey: 6000 DTTs will be installed to cover 90% of the population . Most of the area is comprised of mountains terrain.

x. Vietnam: With digital terrestrial TV will serve up to 60% of Population by 2015. ASO by 2020.
xi. DVB T2 has been established in big way in South Africa and Russia. Russia has set out a plan to complete the switchover of the analogue terrestrial signal to digital by 2018.
xii. Thailand has auctioned it's all Muxes, operating on DVB T2.



Doordarshan Channel sharing in Band – IV & V

Note: *1. Above planning is for two MUX at each location.*
2. In addition, there will be need for deployment of many gap-fillers (per service) at each location to cover the shadow areas.