

Response of Prasar Bharati to the issues raised by TRAI in its Consultation Paper on “Issues related to Digital Terrestrial Broadcasting in India”

Q.1 Do you perceive the need for introduction of Digital terrestrial transmission in multiple broadcasting distribution platforms? Please provide your comments with justification.

Developments over the past two decades have led to various technology platforms being able to provide digital television. DTH, Cable and Terrestrial are three main modes of Digital TV transmission/reception. The terrestrial platform benefits from using an established, low end-user cost technology; it allows local content to be broadcast, has proven to be broadly robust and is reliable in all weather conditions. Mobile TV Transmission is another key advantage of Digital Terrestrial Television (DTT). The DTH platform, by comparison, is the only platform that enables wide coverage in most locations, and this can be provided by a single satellite but the DTH may not enable local content to be easily broadcast and a risk of catastrophic satellite failure exists. Also, DTH lacks mobile transmission capability and may find difficulty in during heavy rains etc. The proliferation of delivery options and the fragmentation of the markets raise a number of important issues for broadcasters who wish to be present on a number of platforms. The potential of available distribution options need to be critically analysed to fulfil their requirements (e.g. coverage, capacity, reception mode, type of service).

The role of the terrestrial platform is different in different countries. These differences reflect specific market and regulatory situations, administrative as well as the related legacy issues in each country. The key prerequisites for the terrestrial platform include a favourable regulatory and political climate, sufficient amount of spectrum, market success and support by broadcasters, network operators and equipment manufacturers. The terrestrial broadcast platform will be relevant in the long term if its usage offers veritable benefits to the broadcasters, the audiences and the society as a whole. Even in countries where cable, satellite or broadband hold a significant market share, terrestrial broadcasting is usually regarded as an essential, flexible and reliable way of delivering broadcast content to a mass audience.

In order to remain viable in the long term the terrestrial platform must be digital. DTT offers following benefits:

- Near-universal coverage,
- Ability to provide for fixed, portable and mobile reception,

- Ability to efficiently provide regional and local content
- Flexibility and content format agnostic. The newer formats of TV channels such as HD TV, 3D TV, UHD TV, data and radio services etc. can thus be delivered.
- Technical and cost efficiency,
- Efficient use of spectrum as multiple program channels can be transmitted using one TV spectrum channel of 8 MHz
- Network has ruggedness and not prone to catastrophic failure and sabotage from enemies
- Terrestrial broadcasting has strategic importance along the borders
- The potential for further development.

DTT is being provided in free-to-air (FTA) mode in most of the countries. It's capability to provide local content will facilitate in providing social benefits of promoting local talent, local culture & music, generating employment, catering to local self governance information needs etc.

This powerful combination would be difficult to replicate by any single alternative technology. 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 and hence is the need for every country. DTT broadcasting has emerged as one of the popular digital television platforms in countries such as UK, USA, Japan, Germany, France and Australia as it turns out to be one of the most economical broadcast transmission systems. 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 free-to-air (FTA), where as in the OTT the received signal quality depends upon number of viewers watching it simultaneously.

By the end of 2015, DTT constituted the second highest user base worldwide among digital TV broadcast platforms next only to that of digital cable TV services. As indicated in the consultation paper, there are 247 million households in India as per the 2011 census and a large number of these households particularly in rural and remote areas depend completely on the FTA terrestrial broadcasting TV services being provided by the public broadcaster.

Thus, in order to meet consumer expectations and ensure optimum utilization of resources, a digital terrestrial TV service having suitable bouquet of TV channels and nationwide coverage is very essential. 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 Transmitters. In our view, the Digital Terrestrial Transmission could be a boon for people living in for off remote areas. If provided free as this is done now, it will continue to fulfil the Government mandate of Public Service Broadcasting.

Q.2 If yes, what should be the appropriate strategy for DTT implementation across the country? Please provide your comments with justification.

Given the vast landscape of our country, DTT is absolutely vital. It is thus crucial to ensure that in the long term the terrestrial distribution networks should be capable of:

- Delivering the current and future, advanced linear broadcast services,
- Fulfilling the ever increasing requirements for quality and choice of services, including non-linear broadcast services

The nation-wide coverage and an attractive & a bit competitive bouquet of channels are two key factors to provide a successful DTT platform. Worldwide trend is to have 4-6 DTT multiplexes to meet consumers demand. In the Indian context, it has already identified 630 locations to provide nation-wide coverage equivalent to present analogue coverage. It is envisaged to have 10kW HPTs at 230 locations and 500W LPTs at 400 locations. In addition number off gap fillers would be required to cover shadow areas. Gap fillers will increase significantly if mobile reception is to be provided. One of the criteria for DTT planning is to cover at least the above population and area. India can have a long term plan to have four multiplex at each location to meet the present and future requirement of accommodating SD/HD/mobile/UHD, linear/non-linear services besides digital Radio Services.

To optimize the time and resources, DTT can be started with two multiplexes at each location and can be enhanced to three/four in due course of time, may be after analog switch off (ASO). Nation-wide coverage plan may further be implemented in time-bound phased manner as has been done in the case of implementation of DAS cable system.

Infrastructure sharing will be essential for easy and cost-effective implementation of DTT service in India. Sharing of infrastructure would be essential so as to minimise the cost of implementation and faster roll-out. The experience of infrastructure sharing during implementation of FM expansion may be considered as an input for DTT roll-out.

Deciding a national standard for DTT service is quite essential to have a volume of scale in terms of DTT ecosystem. Doordarshan has already adopted DVB-T2 for its DTT service and it would be beneficial for the nation to adopt DVB-T2 as national standard. Besides volume of scale, it may eliminate interoperability issues. Most of the countries are following single national standard for DTT.

Q.3 Should digital terrestrial television broadcasting be opened for participation by the private players? Please provide your comments with justification.

The television viewer needs variety in programming content which may be possible when private channels are allowed on terrestrial platform. This is also required to make attractive and competitive bouquet. We however need to ensure that the consumer are not adversely impacted or charged heavily for private services. Issues regarding quality of service, grievance redressal etc. are also important. Doordarshan also needs to see that it continues to be the Public Service Provider while providing wholesome content. The faster roll-out of DTT would require support from every stakeholder (Govt/private) for creating nation-wide network.

Q.4 Which model or a combination thereof for Digital terrestrial transmission will be most suitable in Indian context? Please furnish your comments with justification.

PB already has huge infrastructure such as land, building, towers, trained manpower, networks, etc, for its terrestrial transmission. It has also initiated setting up of DTT transmitters. Doordarshan has already installed 23 DVB-T2 transmitters at 19 locations and services have been started at 16 locations. Also, it is in the process of expanding this to 63 locations. Doordarshan has gained enough experience and has very good expertise in the field of DTT implementation including coverage & frequency planning, design of DTT network, procurement, execution, measurement & testing, field surveys etc. It is therefore a better placed entity for setting up Integrated DTT Broadcasting network that includes private broadcasters as well.

In this scenario, PB may also become a content aggregator for sharing transmitter capacity with private service providers to give variety of contents while platform remains with PB.

This will have following advantages:

- Public service broadcasting can be strengthened in the country and reach of services from public broadcaster will enhance immensely
- Dissemination of social, educational programmes to masses
- No new regulatory framework required for implementation of DTT
- Existing infrastructure will be optimally utilized
- Introduction of variety of services making DTT more competitive.

Demand for infrastructure sharing may be huge in major cities, which may require creation of new CTI infrastructure, as has been done in the case of FM implementation.

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Considering the present situation in India & to optimize the time and resources, DTT can be started with two multiplexes at 630 locations and can be enhanced to three/four in due course of time, may be after analog switch off (ASO). A suggestive model for Integrated DTT Broadcasting network could be as mentioned below:

- i) DTT may be implemented at 63 locations almost immediately where Doordarshan (PB) has already started implementation of DTT and infrastructure is almost ready. Private operators may be allowed to share this infrastructure by paying a suitable fee to Doordarshan (PB) as is being done in the case of DD DTH service. [This may be called **DTT Pioneer Plan**]
- ii) Out of remaining 567 locations, wherever Doordarshan has sufficient requisite infrastructure, DVB-T2 multiplexes may be established and private broadcasters can share those exactly in the same way as detailed in i) above. [This may be called **DTT Expansion Plan-Phase1**]
- iii) A new CTI infrastructure may be established at all other places where Doordarshan infrastructure is not available. These CTIs may be established by an experienced separate entity (e.g., BECIL). However, the ownership may be with Doordarshan (or a consortium). The process for this may be started in parallel to phase-1 but may have a different

target date as establishment of new CTI will take more time. [This may be called **DTT Expansion Plan- Phase2**]

As there will be large number of stations to be established in the Phase2, this may be implemented in two parts based on population, importance etc.

Capital Funding & revenue sharing

For Pioneer Phase, Doordarshan has already got funds from Government. Additional funds for completion of this phase may be provided to Doordarshan by government. Private broadcasters may be charged a suitable fee for using this infrastructure. This has already been implemented in DD DTH service.

For DTT Expansion Plan Phase1 &2, one option could be that PB (Doordarshan) gets fund from Government and charge a fee from private broadcasters as in the case of Pioneer Plan. OR

Doordarshan (Government) & Private broadcaster can share the Capital expenditure in a suitable sharing model. Revenue may also be shared using the same model.

Q.5 What should be the approach for implementing DTT network (MFN/SFN/Hybrid)? Please furnish your comments with justification.

MFN is easy to implement but requires relatively more spectrum. SFN saves the spectrum but is complex to implement. SFN also puts restriction of broadcasting the same content from all transmitters working in the SFN. Thus, localized broadcasting may be difficult to implement in this case. So, National SFN is not feasible at all.

If we consider regional SFN, the particular region should have same content, that also limit the insertion of local content in flexible manner. Flexibility in deciding the channels would be more required if we consider allowing private channels for DTT.

Further, in case of regional SFN, frequency planning for Regions has to be done on the fundamentals of MFN. This way, there may not be enough spectrum saving besides having network complexity of SFN.

It would be appropriate to have hybrid MFN, with main transmitters in MFN and associated gap fillers in SFN with main transmitter. The gap fillers would be required to provide coverage in the shadow areas.

Q.6 What should be the criteria for arriving at optimum size of DTT multiplex at any location? Please furnish your comments with justification.

TV viewers want choice of program on any platform that should include HD/SD channels in fixed/Mobile mode having all possible genre, e.g., entertainment, news, sports, music etc. DTT will certainly require all these options so as to make it attractive and competitive. That is why most of the countries have opted for 4-6 DTT Multiplexes. India should learn from International Experiences.

There is an immediate requirement of two DVB-T2 multiplex at each of the locations to provide a reasonable bouquet of channels having mix of DD and private channels. To make it a competitive platform and to meet the future requirement of consumers and broadcasters, it would be appropriate to plan for 4 DTT multiplex in longer term. Further requirement may be re-ascertained after completion of two multiplex at each locations.

Q.7 How many digital multiplex per DTT operator should be planned for metro, major cities, urban and rural areas and why? Please furnish your comments with justification.

Total multiplex at a location should be at least 4 as detailed above in the Ans. of Q6. No. Of operators will depend upon the model adopted.

Q.8 What should be most appropriate frequency band as per National Frequency Allocation Plan 2011 for implementation of Digital terrestrial transmission including mobile TV? Give your comments with justification.

Worldwide DTT has been implemented in UHF band 470-860 MHz or part thereof. Therefore fully developed eco-system is available for DTT in UHF band. NFAP-2011 also specifies that frequency band 470-698 MHz is available for DTT service. However, it is also to mention that practically only 470-646 MHz is available for terrestrial broadcasting purpose. It is actually putting constraints in the planning of more multiplexes at each location. Therefore, the complete broadcasting band 470-698 MHz may be made available for DTT implementation.

Q.9 Should spectrum be exclusively earmarked for roll out of DTT services? If so, what should be the quantum considering the broadcasting sector requirement in totality?

It will be difficult to earmark exclusive spectrum for DTT as Doordarshan is already using the UHF band-IV for analog TV service. Besides, Doordarshan is also using Band-IV for DTT and has planned utilization of Band-IV and Band-V frequencies for already approved DVB-T2 transmitters. It has also planned DTT transmitter network at 630 locations with 2 MUXs, in Band-IV and Band-V.

For the simulcast period, additional spectrum is required for the parallel transmission of TV services in analog and digital mode. The required amount of spectrum will heavily depend on the introduction strategy adopted for DTT. ITU-R studies has concluded that 224 MHz spectrum would be required in UHF band for implementation of 4-5 DTT Multiplex at each locations. Whereas, in India, practically only 176 MHz (470-646 MHz) spectrum is available in UHF band. It would be appropriate that the entire broadcasting band 470-698 MHz, may be made available.

Q.10 What should be the roadmap for digitization of terrestrial TV network in the country? Please provide your comments with justification.

Answer to Q4 provides detailed roadmap for implementation of DTT in India. Salient points are listed below:

- i) DTT may be implemented at 63 locations almost immediately where Doordarshan (PB) has already started implementation of DTT. Private operators may be allowed to share this infrastructure by paying a suitable fee to Doordarshan (PB) as is being done in the case of DD DTH service. [This may be called **DTT Pioneer Plan**]
- ii) Out of remaining 567 locations, wherever Doordarshan has sufficient requisite infrastructure, 2 DVB-T2 multiplex may be established and private broadcasters can share those exactly in the same way as detailed in i) above. [This may be called **DTT Expansion Plan-Phase1**]
- iii) A new CTI infrastructure may be established at all other places where Doordarshan infrastructure is not available. These CTIs may be established by an experienced separate entity (e.g., BECIL). However, the ownership may be with Doordarshan (or a consortium). The process for this may be started in parallel to phase-1 but may have a different target date as establishment of new CTI will take more time. [This may be called **DTT Expansion Plan- Phase2**]

Q.11 What should be the Analog Switch off date(s) for the terrestrial TV channels in context with the suggested roadmap for DTT implementation? Please provide your comments with justification.

During transition period, most of the countries have adopted simulcasting of services in analog and digital mode, so that viewers can get time to switch to digital reception before switching off the analog transmission.

It is important to note that necessary eco system for DTT such as TV receiver, STBs and services etc are to be put in place by the stakeholders

well in advance so that consumers are not put to any inconvenience. The countries adopted following steps to boost switching to digital:

- a) Subsidy on STBs
- b) Mandatory DTT tuner in all TV receivers after certain date
- c) Awareness campaign regarding ASO
- d) Incentives to broadcasters in terms of spectrum charges for providing simulcast
- e) Dialogue and incentives to manufacturer/importer of DTT receiving equipment

India would certainly need such concerted efforts to popularize digital reception and achieve ASO. With the concerted effort, India may think of a simulcast period of at least 6-12 months before switching off analog transmitters. As the digitization is proposed to be implemented in phased manner, ASO will also happen in a phased manner. However, the situation will have to be reviewed before actually switching off the analog transmitters.

Q.12 Stakeholders may also provide their comments on any other issue relevant to the present consultation paper?

Three issues on Digital Radio, Device diversity and Regulations & Subsidies are mentioned as below:

I. DVB-T2 Radio: The DVB-T2 platform has capabilities to transmit Radio services on it. About 37 Countries have started digital Radio using DVB-T/T2 Transmitters , some of them are noted as below:

1. Copenhagen: 10 Radio services
2. Italy: 34 Radio services
3. Spain: 24 Radio services
4. U.K: 24 Radio services
5. Poland: 12 Radio services
6. Belgium: 6 Radio services
7. Norway: 5 Radio services

Capacity of various Digital Radios:

DRM Consortium and AIR carried out trial in New Delhi(as per DRM+ New Delhi Test Report May 2011), for the DRM+ a single test frequency of 100.1 MHz , which carried three program channels - Gold DRM (FM), Rainbow DRM (FM) and AIR news in Journaline. .The robustness optimized DRM

Multiplex configuration used the 4-QAM mode with PL 1, resulting in an available net capacity of 49.7 kbps. It carried 'FM Gold' with an assigned bit rate of 22.640 kbps, 'FM Rainbow' with 22.720 kbps, and Journaline and the PRBS sequence with 1.840 kbps each. The capacity optimized DRM Multiplex configuration used the 16-QAM mode with PL 2, resulting in an available net capacity of 149.0 kbps. It carried 'FM Gold' and 'FM Rainbow' with an assigned bit rate of 70.0 kbps each, Journaline with 3.840 kbps, and the PRBS sequence with 4.560 kbps.

- a. DAB+ uses HE-AAC at 64 kbit/sec incl. the 1/12 bits for the second level RS error correction. The bit-rate for the audio is then 64 kbit/sec. This enables 17 or 18 services in a DAB mux (1152 kbit/sec).
- b. T2 (Lite) transmitter can get 3.300 Mbit/sec in one PLP and may transmit 50 channels with full 64 kbit/sec HE-AAC can also be broadcast. Classical music channels can be allocated 128 kbit/sec. With DVB-T2 3.3 Mbit/s capacity (~ 50 HE AACv2 radio stations) can be achieved compared to the DAB / DAB+ 1.1 Mbit/s capacity (~ 6 mpeg1 layer II / ~ 16 HE AACv2 radio stations) with the same propagation model. DVB-T2 can provide a 2.5 to 4 times increase in capacity over the DAB/DAB+ standard under the same broadcasting conditions (2 ½ - 4 Mbit/s vs ~1MBit/s). The DVB-T2 standard offers the efficient HE-AAC audio codec, Dolby AC-3, Dolby Enhanced AC-3, AMR-WB+ and AMR-WB speech codec and H.264/AVC video codec (4:3/16:9).

Frequency Bands in Radio:

1. The DAB system: DAB, DAB+ and T-DMB for VHF band III (174-230 MHz)
2. The DRM system: DRM in OFDM Modes A-D (DRM30) below 30 MHz and DRM in OFDM Mode E (DRM+) for VHF band I (47-68 MHz),
3. FM band (87.5-108 MHz) and VHF band III (174-230 MHz)
4. DVB T2 Lite: 1.7 MHz Raster in VHF Band III(174-230 MHz) 8 MHz in UHF (470-698 MHz)

Summary comparison of various Radio Standards:

	DRM+	DAB	T2 Lite
Programme channels	Approx 2-3 programmes	Approx. 16 programmes	Approx. 36 programmes
Additional services	Simple web pages (Journaline) rich multimedia programme guides, slideshows, traffic information etc.		
Date rate	37-186 kbit/s	~ 1125 kbit/s (PL=3A)	~ 3300 Kbit/s
Audio encoding	MPEG-4 HE-AACv2		
Frequency range	VHF band II (FM band 87.5-108 MHz) & VHF Band III (174-230 MHz)	VHF Band III (174-230 MHz) UHF (470-698 MHz)	
Available transmitter network configurations	Multi Frequency Network (MFN) or Single Frequency Network (SFN)		
Modulation	Digital COFDM		
Bandwidth	96kHz 1536kHz		1.7 MHz ,

Therefore, DVB-T2 may also be used for digitalization of radio services in India.

II. Receiving devices: There are various multi standard chips available for receiving devices. Octopus 3, Parrot “O3+” takes digital and analog radio reception to the next level. The current generation is already deployed through major European, Japanese and Chinese OEMs and enables global radio reception: AM, FM, DAB, DAB+, DRM, DRM+, DVB-T2 Lite and HD Radio standards. Sony launches new mobile one chip DVB-T2 & T2 Lite digital radio & TV Tuner module with very low power consumption - under 200 mW. The SMT-EW100 series is the DVB-T2 compatible module, especially designed to be incorporated in the mobile devices and is the first module from Sony specialized for mobile usage. The tuner module supports various types of digital terrestrial digital radio & TV broadcast systems, including DVB-T, DVB-T2, DVB-T2 Lite, ISDB-T and ISDB-Tmm including the 1.7 MHz BW in VHF band III as an alternative to DAB/DAB+/ DMB.

It will be interesting to see the new DVB-T2 and T2 Lite products with the new mobile one chip solution from Parrot, Sony (SMT-EW100) and Siano (SMS4430) with low power consumption that has gone . Integrated Digital TV(iDTV)(In-built DVB-T2 Tuner) Brands like Samsung, LG, VU, Sony etc.

already available in Indian Market. Few Dongles and Wi-Fi Dongles for DVB-T2 available for mobiles and tablets. Mobiles with Embedded Chips for DVB-T2 available in France, Thailand etc. Regulations may be made in India for following:

III. Regulations and subsidies: Provision of DVB-T2 Tuner mandatory on all TV imported/manufactured in India after say 1.4.2018. Similarly Embedding of DVB-T2/T2 Lite tuner in mobile phones should also be mandated say w.e.f 1.4.2018.

Some subsidy may be provided on such receiving items to popularise the DTT Services as done by USA, France, Thailand etc. Various receiving devices are shown below:

