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DELAYED CONTRIBUTION

Question 8/1: Examination of strategies and methods of migration from analogue to digital terrestrial broadcasting and implementation of new services

SOURCE: Thailand

TITLE: Thailand Case Study: Transition to Digital Terrestrial Television Broadcasting

Action required: Participants are to consider this contribution.

Keywords: *Transition to Digital Broadcasting, Digital Terrestrial Television, Thailand*

Abstract:

This document provides an overview of Thailand's activities related to transition from analogue to digital broadcasting.

The Thailand's Act on Organisation to Assign Radio Frequency and to Regulate the Broadcasting and Telecommunications Services (2010) stipulates that the National Broadcasting and Telecommunications Commission (NBTC) shall have mandates to put in place a master plan for spectrum management and a master plan for broadcasting in Thailand.

Pursuant to the First Thailand Broadcasting Master Plan (2012-2016), transition from analogue to digital (terrestrial) broadcasting is one of seven strategies of the NBTC. In this regard, the NBTC has developed a roadmap for transition to digital terrestrial TV broadcasting in Thailand. The roadmap defines 39 service areas nationwide and each has 12 channels for Community Services. The total number of DTTB channel is 48 channels, 24 channels are allocated for national Business broadcasting services and 12 channels are allocated for national Public broadcasting services. 5 DTTB networks have been deployed, all operators agreed to share common infrastructure and facilities, network roll out plan target to reach 95% of household coverage within 4 years (2017).

This report consist of background of transition to digital broadcasting, television broadcasting in Thailand, network planning and deployment, service licensing and spectrum auction, receiver and subsidy program, DSO communication, ASO planning and implementation, and lesson learned.

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1. Introduction

The Thailand's Act on Organisation to Assign Radio Frequency and to Regulate the Broadcasting and Telecommunications Services (2010) aka "Organisation Act" stipulates that the National Broadcasting and Telecommunications Commission (NBTC) shall have mandates to put in place a master plan for spectrum management and a master plan for broadcasting in Thailand.

The Act (Section 49) mandates the NBTC to allocate at least 20% of frequencies allocated in each licensing area for public interest and community services i.e. non-commercial purposes. Section 85 of the Act also states that an allocation of frequency to the civil sector for the purpose of television broadcasting service shall not apply until the digital transmission system is prescribed by the NBTC.

With these connections, apparently transition to digital terrestrial broadcasting plays a vital role in shaping up a new market structure of broadcasting industry in Thailand not only from technological point of view but also for efficient use of spectrum resource and optimal public benefits especially civil societies and communities.

Pursuant to the First Thailand Broadcasting Master Plan (2012-2016), transition from analogue to digital (terrestrial) broadcasting is one of seven strategies of the NBTC. More importantly, the Master Plan sets out indicators, among others, i.e.:

- Establishment of transition policies and plans for the switch to digital television broadcasting transmission within one year, and for the switch to digital audio broadcasting transmission within two years;
- Establishment of criteria and procedures for permission to use radio frequencies for digital television broadcasting services within two years, and for permission to use radio frequencies for digital audio broadcasting services within three years;
- Commencement of digital audio broadcasting and television broadcasting transmission within four years.

In this regard, the NBTC has developed a roadmap for transition from analogue to digital terrestrial TV broadcasting in Thailand. The roadmap defines 39 service areas nationwide and each has 12 channels for Community Services.

As regards the State's obligation to international community, the Thai Government announced a transition to digital (terrestrial) broadcasting policy to the Parliament on 23 August 2011 that the government would efficiently use national radio frequency spectrum at the optimum level, promote public use of sound and television broadcasting as well as transition from analogue to digital (terrestrial) broadcasting taking into account optimal public benefits.

In addition, the government also adopted a policy aimed at promoting international cooperation especially among ASEAN Member Countries in order to ensure readiness of all stakeholders and help achieve target of the ASEAN Community to be effective by 2015, and to foster international cooperation with other countries in the region. Thailand also actively participated in the ASEAN Ministers Responsible for Information, AMRI which is a forum for discussions on transition from analogue to digital broadcasting in ASEAN Member Countries. At the 9th AMRI held in Indonesia, the meeting agreed to use Digital Video Broadcasting-Terrestrial (DVB-T) as a common standard for digital broadcasting in ASEAN. Later at the 10th AMRI hosted by Laos DPR, the meeting adopted timeline for Analogue Switch-Off for ASEAN which is between 2015 and 2020, and also agreed to jointly determine a standard(s) for Set-top Box with an aim to make the price of Set-top Box affordable. The 11th AMRI held in Malaysia on 1 March 2012 considered that Digital Video Broadcasting- Terrestrial 2nd-generation (DVB-T2) is superior to DVB-T and hence agreed to adopt DVB-T2 as a common standard for ASEAN.

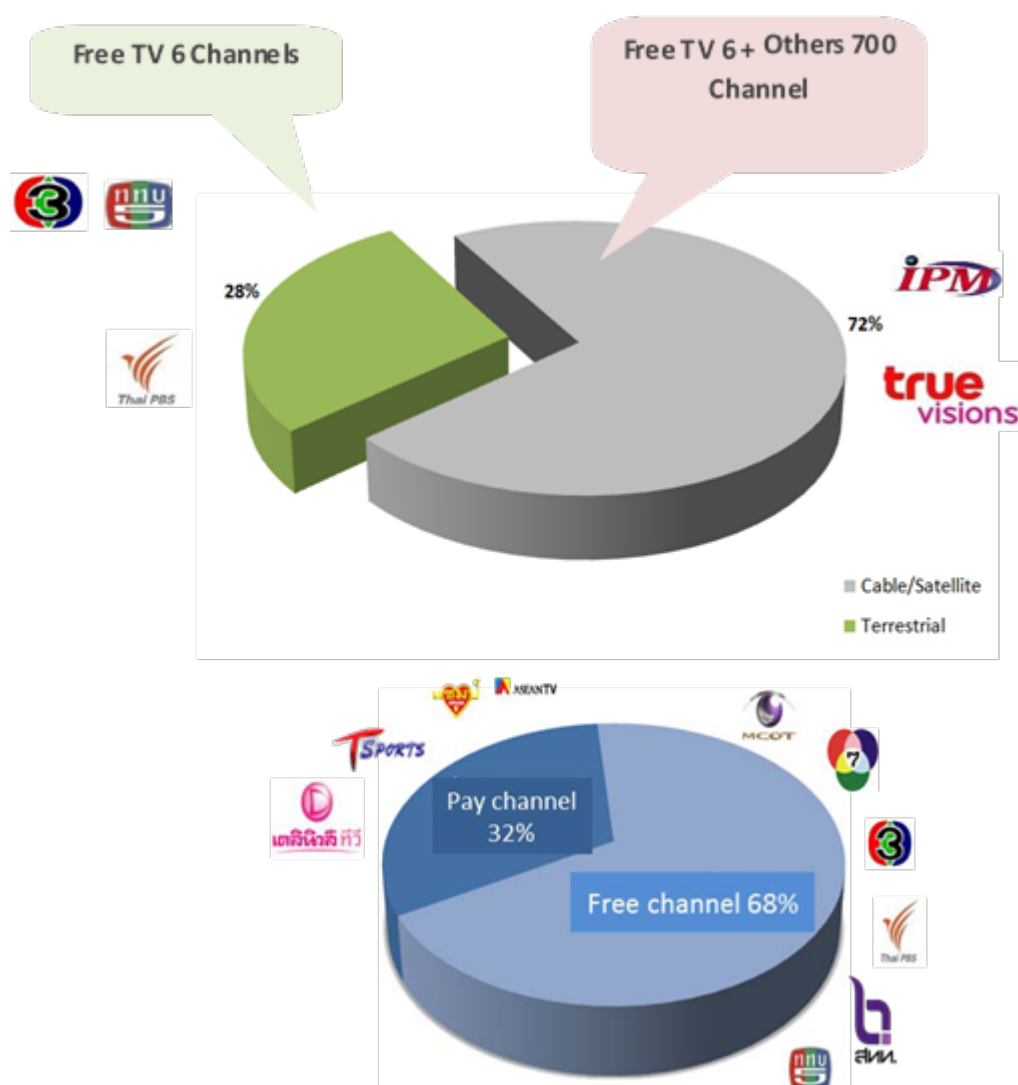
2. Television Broadcasting in Thailand

2.1. Broadcasting Landscape and Market Share

Broadcasting business plays an important role in social and economic development in Thailand especially terrestrial television or free TV which is universally accessible by the Thai citizens. Hence terrestrial TV has been significantly influential to perceptions and behaviors of Thais from both social and economic aspects and has had impact to quality of life. Businesses related to public communication can be categorized into four groups:

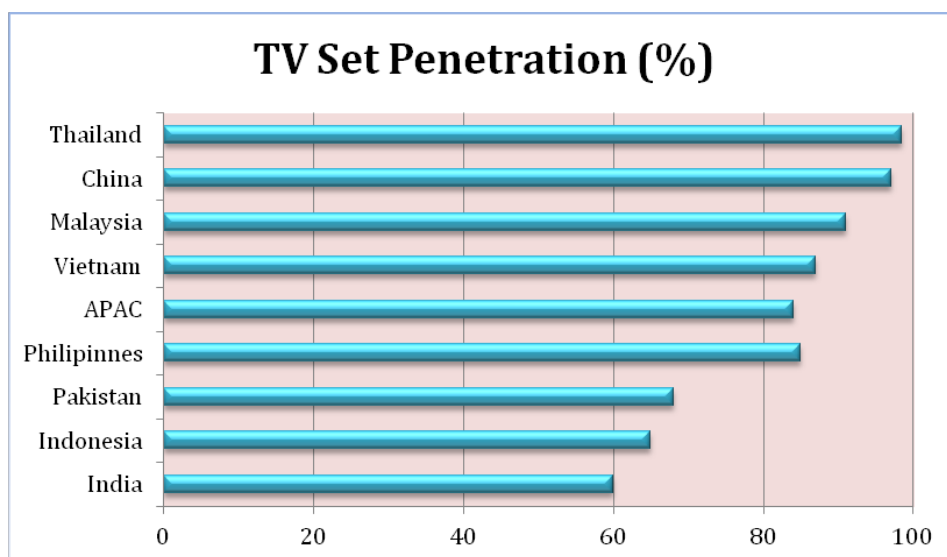
- 1) Television businesses
- 2) Sound businesses
- 3) Publication (print media) businesses
- 4) New media (i.e. Internet)

Of the four groups, television businesses have the most influence to people in that approximate 63 million Thai people or about 98% of the Thai population can access television. Prior to the transition to digital broadcasting, Thai people watched (analogue) TV about 250 minutes per day by average.



Before Digital Switch-Over (DSO), there were 6 FTV channels and about 700 cable and satellite channels. Cable and Satellite are major platforms for TV broadcasting in Thailand. Only 28% or 6 million households watch TV via terrestrial platform; while 68% watching Free TV channels via

Cable or Satellite platform which also broadcast programmes offered by terrestrial platform with no extra cost.



Source: Credit Suisse

Figure: TV set penetration (%)

Television broadcasting started in Thailand 60 years ago. Transition from black-and-white TV to colour-TV took about 12 years; while transition from analog to digital has taken 46 years. In Thailand, about 22 million households have televisions which accounts for about 98% TV Households (TVHH) penetration which is higher than the average of the Asia and the Pacific Country.

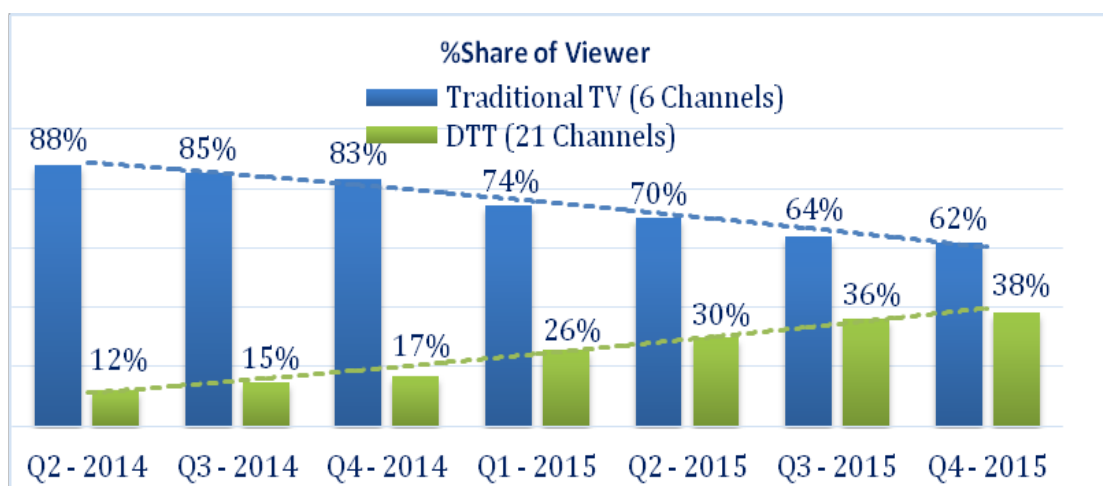
ADEX Share 2015

Thailand Media adv.	Million Baht	%Share
TV	57,525.77	47.03%
Cable TV	6,054.73	4.95%
Digital TV	20,930.25	17.11%
Radio	5,675.43	4.64%
Newspapers	12,331.76	10.08%
Magazines	4,226.52	3.46%
Cinema	5,133.58	4.20%
Outdoor	4,264.53	3.49%
Transit	4,477.89	3.66%
In-Store	639.06	0.52%
Internet	1,058.28	0.87%
Grand Total	122,317.78	100.00%

Source: Nielsen

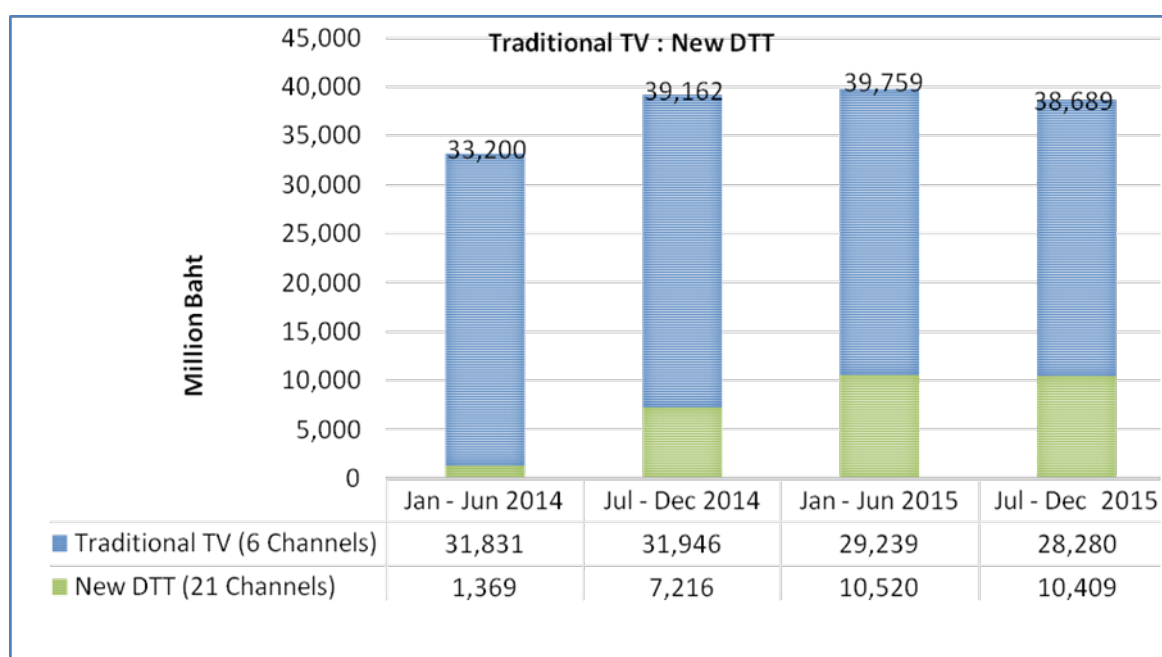
Figure: ADEX share 2015

In 2015, about 70% or 2.4 billion US dollars were spent for TV advertisement. After Digital Switch Over, trend of TV viewing on Digital Terrestrial TV platform has continuously increased while advertisement revenues also moved from analog to digital terrestrial channels.



Source: Nielsen

Figure: % share of viewers



Source: AGB Nielsen

Figure: Traditional TV: New DTT

2.2. Thailand’s Digital Switch Over (DSO) policy

Transition to digital broadcasting has national impact and hence requiring a clear policy from the government or an authority in order to ensure smooth transition. In Thailand, the National Broadcasting and Telecommunications Commission, an independent authority regulating Broadcasting and Telecommunications businesses, is mandated to develop a Master Plan for Thailand Broadcasting and issued a Notification on Transition to Digital Broadcasting which has four policy aspects.

2.2.1. Technology policy

In view of consumer protection, it is important to determine national standards for Digital Terrestrial Television Broadcasting (DTTB). It is also essential for smooth transition to digital Terrestrial TV broadcasting at effective costs and investments. Thailand has applied the following standards.

- 1) Transmission: DVB-T2 was selected as the national standard for transmission of DTTB in Thailand. It was proposed by NBTC and approved by the Cabinet on 20 May 2012. In this

regard, NBTC determined technical specifications and published detail in its relevant Notifications.

- 2) TV Presentation Format: Thailand through relevant NBTC Notifications requires that both SD (Standard Definition) and HD (High Definition) must be available in digital broadcasting.
- 3) Video Compression: The selected standard for video compression in Thailand is MPEG-4 AVC/H.264. NBTC published technical specifications in its relevant technical Notification in this regard.
- 4) Audio Compression: For audio compression, the minimum standard selected for Thailand is MPEG-4 HE AAC V2 and alternative standards are any technologies which support 5.1 channel surround sound. Relevant technical specifications were published by NBTC.
- 5) Conditional Access (CA): As DTTB in Thailand is free TV, hence no standard is specified for conditional access.
- 6) Middleware or Application Programming Interface (API): No standard is specified for middleware/API in Thailand. However, any broadcaster wishing to install middleware/API, they need to submit a proposal with detail of chosen standard and technical specifications to NBTC for approval. The selected standard must be compliant with open standard and certified by an international standardization body.

As far as Emergency Warning System (EWS) is concerned, Thailand implements a measure and process ensuring emergency warnings in coverage areas of DTTB in that broadcasters are obliged to provide such emergency service as part of license conditions.

2.2.2. Spectrum policy

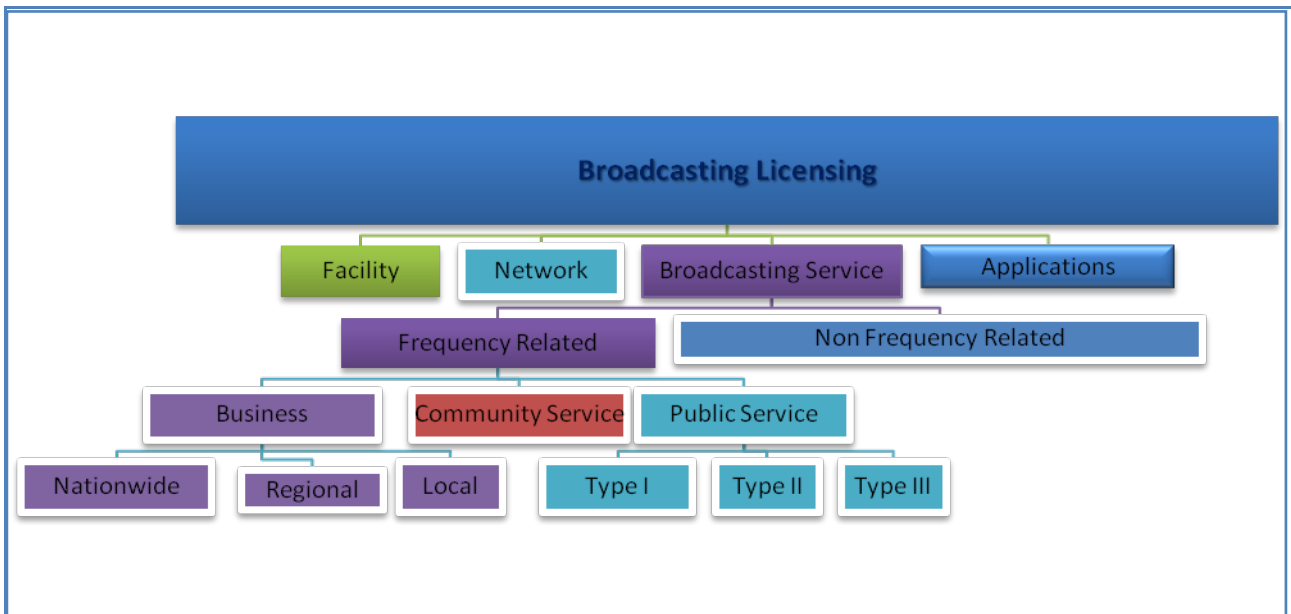
Thailand spectrum policy for DTTB covers the follows:

- 1) UHF band is used for DTTB and in compliant with the National Spectrum Management Master Plan.
- 2) Frequency planning take into considerations both Single Frequency Network (SFN) and Multi-Frequency Network (MFN) with an emphasis on interference protection and efficient use of spectrum as a priority.
- 3) Maximizing existing infrastructure and facilities and encouraging infrastructure (including network facilities) sharing.
- 4) Frequency harmonization with neighbouring countries.
- 5) DTTB must cover national, regional, and local services whose coverages are divided into zones according to technical characteristics of transmission and frequency plan. In this regard, sufficient frequencies must be ensure during simulcast period (analogue and digital broadcasting co-exist).

2.2.3. Licensing policy

Main objective of the policy is to ensure fair and free competition by applying structure separation concept resulting in the following license categories:

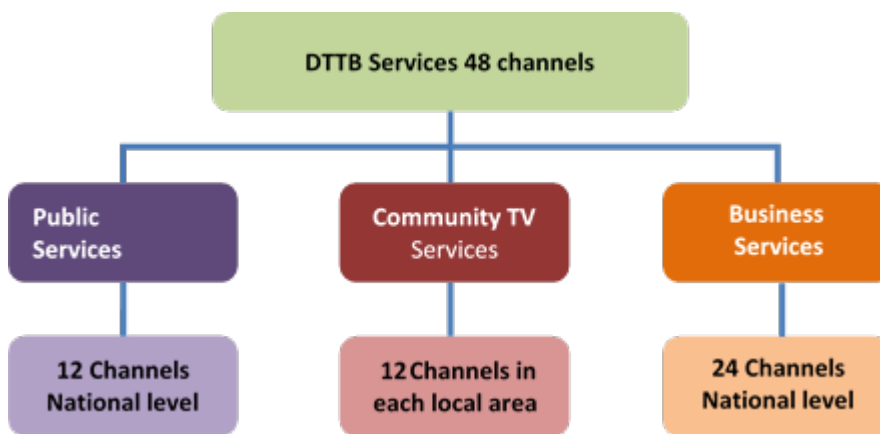
- 1) Network provider license
- 2) Facility provider license
- 3) Broadcasting service provider (broadcaster) license
- 4) Application provider license



Source: NBTC

Figure: Thailand Broadcasting Licensing Structure

According to the above licensing structure, spectrum right, broadcast right, and operating right depend on license type. A holder of spectrum right however must operate broadcasting by himself, but may lease time up to 40% to another and must follow criteria and conditions on time leasing specified by NBTC. The total number of DTTB programmes (TV channels) in Thailand is 48 programmes.



Source: NBTC

Figure: DTTB Services in Thailand

2.2.4. Measure for promoting free and fair competition

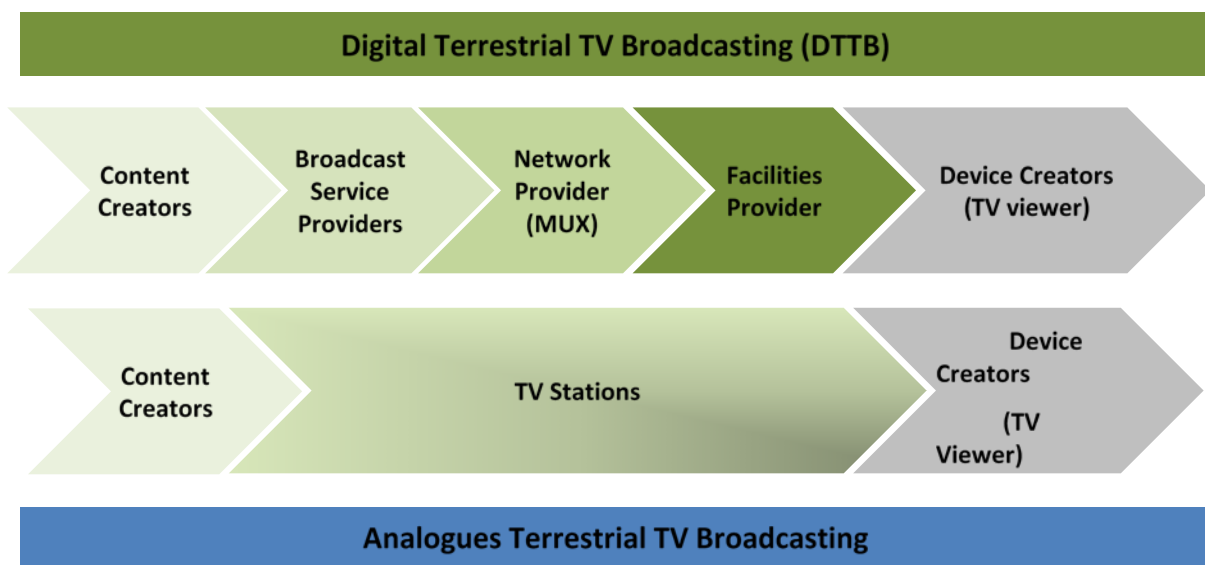
Transition to digital broadcasting not only increase efficiency of spectrum utilization in that more programmes (channels) can be offered with the same amount of spectrum required; improve quality of signal (picture and sound), it also reform the market structure i.e. structure separation which favours competition. In the old regime, broadcasters did everything and in all processes by themselves. The new structure, though, allows participation of specialized stakeholders in particular processes. This mechanism enables competition and regulation at any point of broadcasting value chain and moves from the old monopoly market. Content creators have more choices to reach audience and better targeted. From consumer point of view, more quality programmes and variety of content are offered. Specific content to particular groups of people are also possible. DTTB also reduces investment costs particularly in network infrastructure and facilitate new comers to the broadcasting industry. Compared to analogue television broadcasting,

the digital television broadcasting value chain has an extra function: the Multiplex operator or Network provider.



Source: NBTC/ITU collaboration project

*Service Provider is applied for Pay TV



Source: NBTC

Figure: The Value Chain for Television Broadcasting

2.2.5. Analogue switch off policy

NBTC started developing a plan for Analogue Switch Off (ASO) in 2015. The plan also addresses unused frequencies when switching off analogue broadcasting which is known as ‘digital dividend’. Broadcasting businesses in analogue system still have spectrum right and broadcast right pursuant to the Act on Organisation to Assign Radio Frequency and to Regulate the Broadcasting and Telecommunications Services (2010), however according to timeline as specified in the NBTC Spectrum Management Master Plan (2012) and the NBTC Broadcasting Master Plan (2012-2016).

It is also important that the ASO plan needs to ensure readiness of all stakeholders including public, businesses, and the country in overall, as well as timelines of other member countries of ASEAN. The period of ASO also needs to take into account simulcast period.

3. DTTB Network Planning and Deployment

3.1. DTTB Network Planning

3.1.1. Terrestrial television networks in Thailand

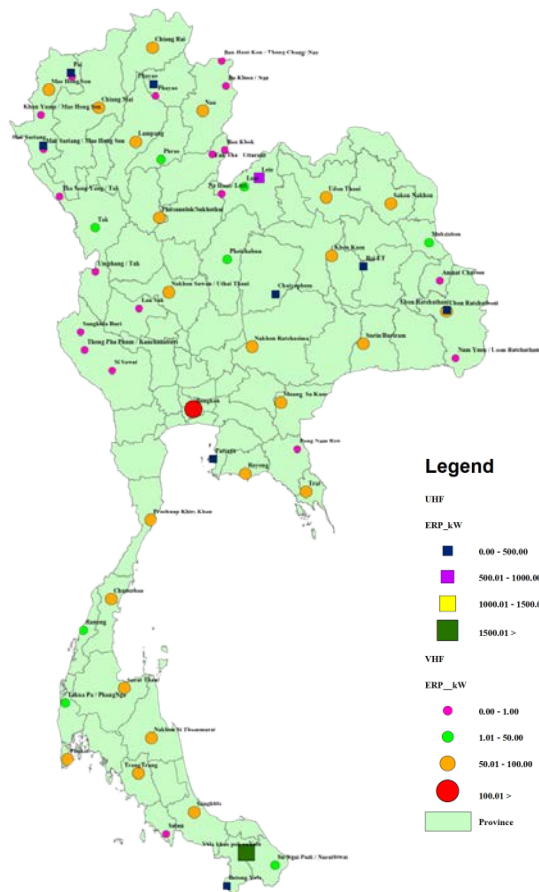
Currently analogue and digital terrestrial networks are in operations in Thailand, the six incumbent broadcasters operate their own analogue television (ATV) network with number of transmitter sites per ATV network show as below table.

ATV Broadcaster	Ch 3	Ch 5	Ch 7	Ch 9	Ch 11	TPBS
VHF transmitters	34	53	48	50	51	0
UHF transmitters	6	10	7	3	18	52
Total	40	63	55	53	69	52

Source: NBTC/ITU collaboration project

Figure: ATV Transmitter Sites of ATV broadcasters

Thai Public Broadcasting Service (TPBS) deployed its network after the other broadcasters and operates a full UHF network. For the other broadcasters use both UHF transmitters and VHF transmitters to increase its coverage. As UHF transmitters were added later to improve service coverage so UHF sites is relative small in each ATV networks.



Source: NBTC/ITU collaboration project

Figure: VHF and UHF Transmitter Sites of ATV Network

- **Phase 1:** Apr'13 - Jun'14: Complete 11 main stations which will cover 50% of total household (about 11 million HHs)
- **Phase 2:** Jul'14 – Jun'15: Complete 39 main stations which will cover 80% of total household (about 17.6 million HHs)
- **Phase 3 & 4:** Jul'15-Jun'17: Complete 95% of total household with additional site and gap fillers in municipal/city areas to improve portable indoor receptions

As of Feb2016, 39 main sites and 24 additional sites have been implemented cover 86% HHs. And finally 95% HHs coverage will be reached by Jun 2017. The MUX6th is reserved for providing Community TV services which is available after TPBS switch off ATV.

3.2.2. Mux Loading

Multiplex loading as of March 2016.

Channel No.	TV Channel	Mux1 PRD	Mux1 RTA1	Mux3 MCOT	Mux4 TPBS	Mux1 RTA2
Public Broadcasting Services						
1	RTA Radio and Television		✓			
2	NBT	✓				
3	TPBS				✓	
10	Thai Parliament TV			✓		
Business Broadcasting Services						
13	BEC Multimedia				✓	
14	MCOT			✓		
15	Thai TV	Revoked License				
16	Thai News Network (TNN)		✓			
17	Thai TV	Revoked License				
18	DN Broadcast					✓
19	Spring News Television			✓		
20	Bright TV					✓
21	Voice TV			✓		
22	NBC Next Vision					✓
23	Thai Broadcasting		✓			
24	True DTT		✓			
25	GMM Big TV					✓
26	Bangkok Business Broadcasting					✓
27	RS Television				✓	
28	BEC Multimedia				✓	
29	Mono Broadcast					✓
30	MCOT			✓		
31	GMM One TV		✓			
32	Triple V Broadcast			✓		
33	BEC Multimedia				✓	
34	Amarin TV					✓
35	BBTV		✓			
36	Bangkok Multimedia and Broadcasting					✓

Channel No.	Mux1 PRD	Mux1 RTA1	Mux3 MCOT	Mux4 TPBS	Mux1 RTA2
Combination HD+SD	2HD+6SD	3HD+3HD	2HD+6SD	2HD+6SD	2HD+6SD
HD Channels	1	3	2	2	2
SD Channels	0	3	4	3	6
Vacant Channels	1HD+6 SD	0	2 SD	3 SD	0

Source: NBTC

Figure: Multiplex loading as of March 2016.

3.3. DTTB Network Quality Monitoring

According to the Notification of NBTC on Licensing Criteria and Procedures for Radio or Television Broadcasting Network Services 2012, the network licensee is obliged to maintain TV network's quality at all time during the licensing period following the given license conditions.

Office of NBTC provides an annex document of conditions required for each licensee to provide continuous TV network's service availability not lower than 99.98 % of total service time per year per transmitting station or to be defined by National Broadcasting Commission (NBC) separately.

Formula of Service Availability (SA)

Service Availability = (A-BA) x 100 (%) / (A-BA) x 100%

Whereby A = total broadcasting minutes in the specified period

B = total broadcasting down time in the specified period

As a part of Network Quality Monitoring process, Office of NBTC requests the licensee to report its network quality to NBTC in monthly basis. The report should contain Service Availability (SA) and any related problems found. In any case found that SA is lower than 99.98%, Office of NBTC shall request the licensee to report cause of the problem and proposal of the solution to relieve the problem.

If it is found that the Licensee failed to provide network service quality with NBTC's conditions stipulated in the annex. Office of NBTC may escalate the case to NBC Committee for domination measure afterwards. So far, Office of NBTC has executed domination measure to Network Operators e.g. MCOT, Royal Thai Military and TPBS. If any of such operators failed to rectify the problem within the time specified in the network license condition, they will subject to penalty fee according to domination measure.

After 2nd phase deployment which DTTB coverage reaches 80% of households in Thailand, NBTC has conducted technical field test to verify network coverage and also check the quality of reception quality by using commercial DVB-T2 set-top-box to check user reception experiences. And also cooperate with DTTB network operators and broadcasters for regular auditing as monthly basis.

4. Service Licensing and Spectrum Auction

4.1. Service Licensing

4.1.1. Business Service Licensing

Regarding the "Act on Organization to Assign Radio Frequency and to regulate the Broadcasting and Telecommunications Services 2010", the NBTC roadmap defines 24 business broadcasting services nationwide. NBTC published its notifications in 2013 and 2014 about the criteria, means, conditions for spectrum bidding and permission to use the spectrum for Digital Television broadcasting-National Business Service Type-which is key important mechanism to make selection process successfully.

4.1.2. Public Service Licensing

As regards the Notification of NBTC on Licensing Criteria and Procedures for Radio or Television Broadcasting Services 2012, license to operate Public Broadcasting Services are divided into the following three types:

- 1) **Public Broadcasting Service Type one:** the licenses is issued to public broadcasting services with objective for the promotion of knowledge, education, religions, arts, and culture, science,

technology and environment, agriculture and other occupational extension, health, sanitation, sports or enhancement of quality of life of the people.

- 2) **Public Broadcasting Service Type Two:** Type two public broadcasting services for national security or public safety
- 3) **Public Broadcasting Service Type three:** public broadcasting services for dissemination of news and information to promote better understanding between the government and general public, Parliament and the people, dissemination of news and information which may promote distribution and provision of education to the people in democratic regime of government with the King as Head of the state, provision of news and information services beneficial for the disabled, underprivileged persons or interested groups who conduct non-for-profit activities or provision of news and information for other public benefits.

Currently Thai Parliament Television (TPTV) received license for Public broadcasting Service with 4 year term, broadcasting on channel 10 with its main objective to broadcast news and information to promote better understanding from the government and the Parliament to public/people.

In additional, there are 3 simulcast channels, Royal Thai Army (RTA), National Broadcasting Services of Thailand (NBT), and Thai Public Broadcasting Service (TPBS) broadcast public service programs on DTTB Platform channel 1 to 3. These broadcasters complied with stated law to provide public broadcasting services and would apply for public broadcasting services license in the future, and the DTTB public service broadcasters have to comply with the criteria of public service program proportion. The Simulcast broadcasting with Analogue TV will be ended when their switch ATV services (ASO) in 2018.

4.1.3. Community Service Licensing

Regarding the NBTC Organization Act and Thailand Broadcasting Master Plan (2012-2016), not less than 20% of frequencies allocated in each area reserved for non-commercial public/citizen usage of which will be implemented after the Digital Switch Over. DTTB network defines 39 service areas nationwide and each has 12 channels for Community Services. It is envisaged that community service will promote not only social development but also strengthen the community identity and promote local culture and knowledge thereby enabling people in expressing their rights and increase their participation in the society as a whole. NBTC, ITU together with UNESCO are now running collaboration project on “Development of Framework for Introducing Community TV Broadcasting Services in Thailand” which aims to put in place a suitable policy and regulatory framework for community TV Service in Thailand including guideline to producing high quality local content.

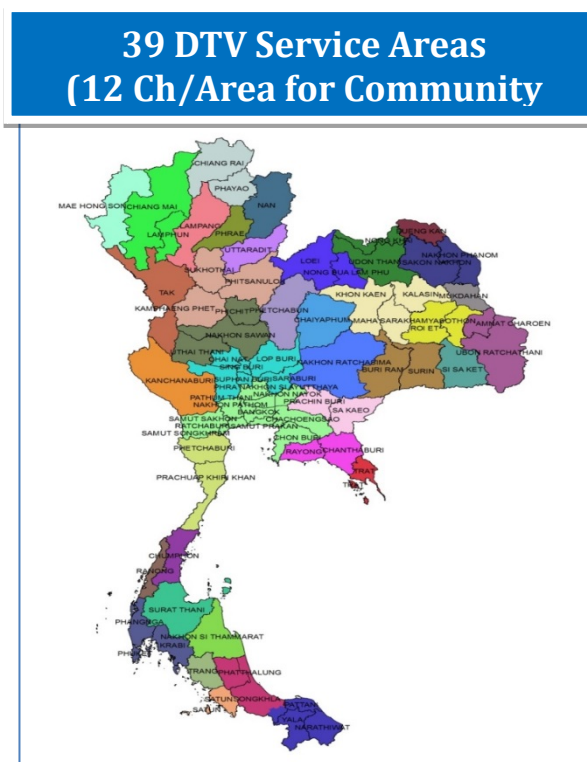


Figure: DTV Service Areas

4.2. Auction Design and Implementation

4.2.1. The licensed spectrum

The auctioned spectrum of 510 to 790 MHz (UHF Band IV and V, Channels 26 to 60) is allocated for digital television broadcasting services of National Business Service Type as defined in the National Frequency Plan (NFP). The licensee has the right to use the spectrum by sharing with other licensees.

Regarding the license to use spectrum for business broadcasting services, NBTC has significant measures to promote variety of television contents, allowing people to enjoy more choices of contents that meet their needs. As well as promote the better service, the high quality of picture (high definition). It enables consumers to benefit directly from television programs that suit each interested group; and does not focus only on entertainment. NBTC set television program into four categories, allowing a total of 24 licenses (programs) as follows.

1) Category 1: Kids and families, total 3 licenses

"Categories Kids and Families" means a television service that offers TV contents to promote learning and education in various fields. Kids and Families Program Consist of content that is useful to improve the quality of life of children and youth; or to promote good relations among family members. The content and its broadcasting time must be safe and appropriate for children and youth. And it must not contain illegal content, immoral or violence or using profane language. Also takes equality and opportunities of every children and youth groups in the society into account. Contents and its program schedule must be compliant with NBC's prescribed regulation and must not violate the relevant laws.

2) Category 2: News and Information, total 7 licenses

"Category of News and Information" means the TV broadcasting service that focus on delivering news or information including fact, analysis articles, and opinions which have impact to social,

economic or quality of life. The broadcasting news must base on equality and opportunities for all people, all groups in society with precision, covers every angle aspects, independence and neutrality. Licensee must broadcast valuable news for the public in the proportion of not less than fifty percent. Broadcasting contents and its program must be compliant with NBC's prescribed regulation and must not violate the related laws. The news must be broadcasted in the appropriate time. Especially at the time when most viewers can access (prime time) of not less than fifty percent or according to NBC has prescribed.

3) Category 3: SD General, total 7 licenses

"Category of SD General" means the TV service which broadcast contents with proportion according to the law and NBC's regulation regarding the program and content for TV services. SD General or SD Variety program broadcasts in standard definition resolution according to NBC's regulation prescribed.

4) Category 4: HD General, total 7 licenses

"Category of HD General" means the TV service which broadcast contents with proportion according to the law and NBC's regulation regarding the program and content for TV services. HD General or HD Variety program broadcasts in high definition resolution according to NBC's regulation prescribed.

Total Business Licenses	Category			
	Kids Youth and Family	News and Information	General Standard Definition (SD)	General High Definition (HD)
24 Licenses (17 SD + HD)	3 Licenses (SD)	7 Licenses (SD)	7 Licenses (SD)	7 Licenses (HD)
Minimum / Reserve Price	140 Million Bath	220 Million Bath	380 Million Bath	1,510 Million Bath
Bidding Increment Step Price	2 Million Bath	2 Million Bath	5 Million Bath	10 Million Bath
Bidding Warrantee	14 Million Bath	22 Million Bath	38 Million Bath	15 Million Bath
Channel Number	13-15	16-22	23-29	30-36

License term of National business digital television broadcasting service is 15 years starting from the granted date of the license with conditions and scope as following:

- 1) Permission to use spectrum frequency to provide National digital television broadcasting service-business type and free TV broadcasting service according to "the Notification of NBTC on the Criteria for Free Television Broadcasting"
- 2) The winning bidders in each category can select its preferred channel number ranked by winning bidding price. If the bidding price is equal, such bidders have to do random draw to get the final winner.
- 3) To select DTTB network, the bidder in each category can select its preferred network by order of winning bidding price ranking. If the bidding price is equal, such bidders have to do random draw.

4.2.2. Principles for Auction Design

The principle for spectrum auction design are describe below:

- 1) The auction participants have their business plan before the auction to determine the highest budget at the bidding on the condition that the business can be carried out normally. NBTC

does not focus on the highest bidding price, but the right price because the operators will still have burden of long-term production for quality content under the character of the channels and relevant laws.

- 2) Winning Bidders in the same category should win with insignificant price different to each others to avoid Winner Curse.
- 3) The interested bidders can participate bidding only one license in each category, and if bidder select to participate in category "News and Information" such bidder cannot participate in "General HD" and vice versa. The bidders were able to aggregate up to 3 licenses which News and Information could not be combined with HD General License.

4.2.3. Auction procedures and conditions

- 1) The auction is conducted separately by the defined categories.
- 2) Auction time set 60 minutes round in each category.
- 3) During the auction, participants are entitled to bid as many times they wish.
- 4) The first bid in the auction must be higher than the starting price. The bidding price offered each time from each bidder must be higher than the price they had offered earlier. The bidding price will be increased by step given in each category.
- 5) When auction in each category started, the auction participants must offer first bidding price within the first five minutes. Otherwise, it will be disqualified from the auction and the auction collateral will be forfeited.
- 6) During the auction, the auction participants will know the bidding status and bidders' ranking by their bidding price throughout the auction, including the lowest price of the bidder who supposed to win the bidding.
- 7) At the end of the auction, if there are provisioning winning bidder at same price, as well as causing number of winning bidders exceed the number of licenses in each category, then the auction is set to extend for a further period of five minutes each round. In extended period, if there is no offer bid, the winning bidder who offer at same price have to do random draw.
- 8) The bidders who have the right to be the winning bidders have to formally endorse the final price they offered.
- 9) Broadcasting Commission will announce the certified results of the auction within fifteen days after the auction finished in each category provided that the winners in that category have endorsed the final price they offered.

After NBC announced the certified results of the auction, the bidding is considered as completed.

4.3. Auction Implementation

Before execute the spectrum auction for National Digital Television Broadcasting Services Business Type, NBTC had conducted a series of pre-test the auction procedures, software and relevant facilities to ensure it works smoothly as well as Pre-Mock auction for participant bidders and press.

4.3.1. Pre-mock Auction

The office of NBTC arranged the Pre-Mock Auction to demonstrate the process for the DSO subcommittee to test and get feedback from meeting on 28 May 2013 and the Pre-Mock Auction had been arranged later 4 rounds of full system testing with whole auction process and procedures in order to improve the (draft) NBTC notification which relates to Business Digital Television Broadcasting Services- National level, and also show process of Pre-Mock Auction to Press.

4.3.2. Selling the bidding documents and submit the proposals for auction

On 10-12 September 2013, the office of NBTC began selling 49 bidding documents to totally 33 bidding companies. After that, Office of NBTC had 3 meetings to clarify the auction process & detail to every companies who bought the bidding documents. Also have set up the Advisory Clinic to serve each bidders during 9-11 and 18 October 2013. As an outcome, 29 companies with a total of 41 applications submitted qualified applications to participate the auctions.

4.3.3. Demonstrate and Pre-Mock Auction

Pre-Mock on spectrum auction were set up many rounds at the auction place, CAT Tower, Pre-Mock were organized into 3 groups as follows:

- For applicants on 12-13 December 2013
- For press on 18 December 2013
- For qualified bidders on 19-20 December 2013

4.3.4. Spectrum Auction Event

Office of NBTC organized two-day auction on 26-27 December 2013 for 24 Business National Digital TV Broadcasting Service licenses which were divided into four categories. The first day auction was arranged for 7 High Definition (HD) General channels and Standard (SD) General channels and the second day was arranged for 7 SD News and Information channels and 3 SD Kids and Family channels.

All qualified bidders attended the auction and followed all auction rules and notification as following;

- 1) All qualified bidders registered at 9:30 a.m. and randomly draw its bidding room's number. After that they received username and password to log in to the auction system.
- 2) Qualified bidders came to the room and log in to system for bidding. Auction process of all categories was non-stop until completion of the bidding.
- 3) When bidding in every categories are over, all bidders offer higher price than starting price as minimum price of that categories. No bidding time extended at bidding of every categories.
- 4) After completed in each categories, all bidders gave bidding documents back and sign guarantee on the final bidding price.



4.4. Auction Result

4.4.1. Auction results

Total Winning Bidding Price of 4 categories 24 licenses are summarized as following.

Category	No. Licenses	Min. Reserve d Prices	Min./ Reserved Prices (Million THB/Million \$)	Total Winning Bidding Price (Million THB)
General –HD	7	1,510	10,570	23,700

General –SD	7	380	2,660	15,950
News and Information	7	220	1,540	9,238
Kids Youth and Family	3	140	420	1,1974
Total	24		15,190 (\$ 474 million)	50,862 (\$ 1,589 million)
The value above the reserve price level 35,672,000,000 THB \$ 1=32 THB				















Source: NBTC

Figure: Total Winning Bidding Price of 4 categories 24 licenses















The auction showed competitive bidding in each category as the number of bidders is higher than number of licenses and the total bid value exceeded the reserved price by 235% (Over reserve price approximately THB 35.67 billion).

The winners in each category as well as their rank in terms of final bid price show as following:















1) General-High Definition 7 licenses:

Winning Bidders		Ranking	Auction Result (Million Baht)	Channel No.	DTTB Network
BEC-Multimedia Co.,Ltd.		1	3,530	33	
Bangkok Media & Broadcasting Co.,Ltd.		2	3,460	36	
Bangkok Broadcasting & TV. Co.,Ltd.		3	3,370	35	
Triple V Broadcast Co.,Ltd.		4	3,360	32	
MCOT Public Company Limited.		5	3,340	30	
Amarin Television Co.,Ltd.		6 Co-Rank	3,320	34	
GMM HD Digital Co.,Ltd.		6 Co-Rank	3,320	31	







3) General-Standard Definition 7 licenses

Winning Bidders		Ranking	Auction Result (Million Baht)	Channel No.	DTTB Network
Thai Broadcasting Co.,Ltd.		1	2,355	23	
True DTT Co.,Ltd.		2	2,315	24	
GMM SD Digital Co.,Ltd.		3	2,290	25	
BEC-Multimedia Co.,Ltd.		4	2,275	28	
R.S. Television Co.,Ltd.		5	2,265	27	
Mono Broadcast Co.,Ltd.		6	2,250	29	
Bangkok Business Broadcasting Co.,Ltd.		7	2,200	26	

4) News and Information 7 licenses

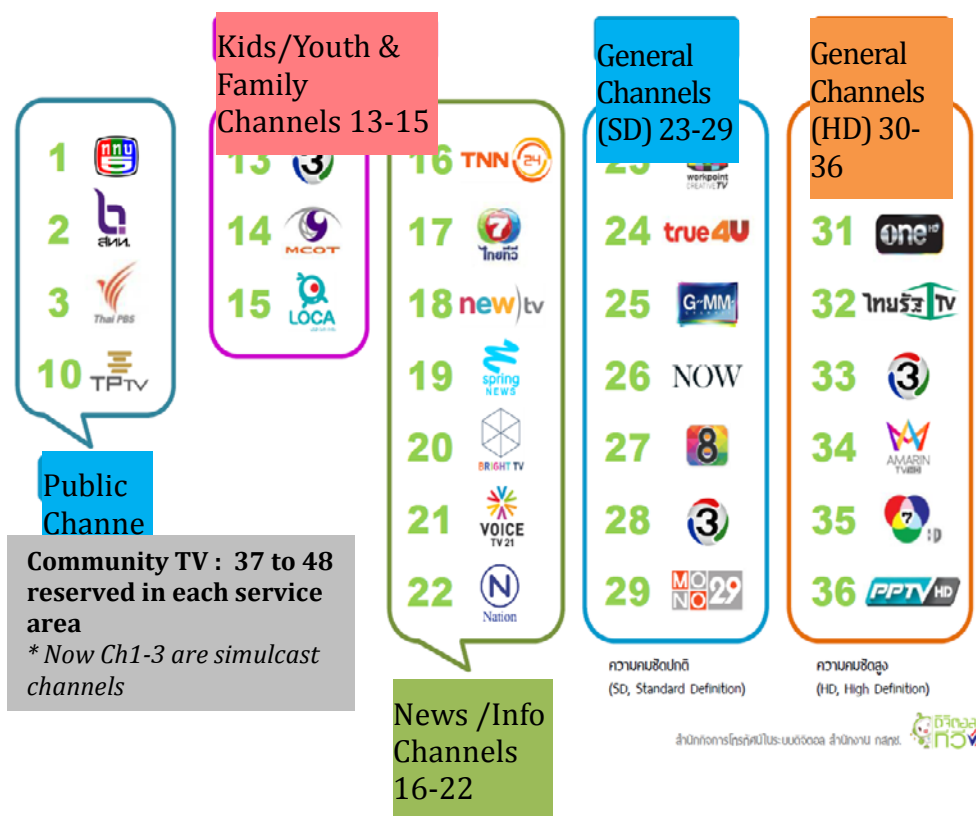
Winning Bidders		Ranking	Auction Result (Million Baht)	Channel No.	DTTB Network
NBC Next Vision Co.,Ltd.		1	1,338	22	
Voice TV Co.,Ltd.		2	1,330	21	
Thai TV Co.,Ltd.		3	1,328	17	
Spring News Television Co.,Ltd.		4	1,318	19	
Thai News Network (TNN) Co., Ltd.		5	1,316	16	
DN Broadcast Co.,Ltd.		6	1,310	18	
3A Marketing Co, Ltd.		7	1,298	20	

5) Kids Youth and Family 3 licenses

Winning Bidders		Ranking	Auction Result (Million Baht)	Channel No.	DTTB Network
BEC-Multimedia Co.,Ltd.		1	666	13	
MCOT Public Company Limited.		2	660	14	
Thai TV Co.,Ltd.		3	648	15	

4.5. DTTB Service Channeling

As regard the licensing policy, there are 48 DTTB Service Channels, channel 1 to 12 are reserved for national public broadcasting services channel and channel 13-36 are reserved for national business broadcasting while channel 37 to 48 are reserved for community TV in each local service area as defined as picture below:

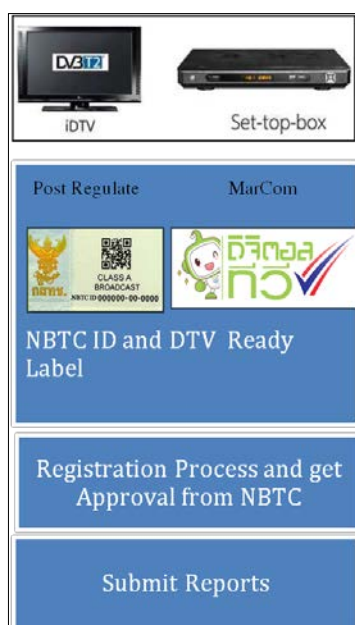


Source: NBTC

5. Receiver and Subsidy Program

The discussion of Digital Broadcasting Switch Over in ASEAN in the 9th Conference of AMRI held in Indonesia was agreed for DVB-T to be a standard for ASEAN digital terrestrial television broadcasting. Then in the 10th Conference of AMRI held in Laos PDR, the meeting agreed that ASEAN 's Analogue Switch-Off should take place between 2015 and 2020. In the 11th Conference of AMRI hosted by Malaysia on 1st March 2012, the meeting agreed that DVB-T2 is a more advanced technology compared to DVB-T so all members should adapt DVB-T2 as sole standard. All members will be co-developing common specifications for DVB-T2 receiver's economies of scale production.

The Office of NBTC announced technical notification that identifies minimum technical specification of Set-Top-Box for DVB-T2 receiver and of integrated Digital Television (iDTV) since Q4-2012, and the DVB-T2 receiver can receive Standard Definition (SD) and High Definition (HD). Self-conformance approval process are applied, the manufacturers submit their test reports to Office of NBTC. Any receivers qualified with the specification will have NBTC's certified stickers with NBTC logo (Garuda emblem) or "DooDee" label, a mascot of DTV Thailand, at each receiver box.



Source: NBTC

Figure: NBTC receiver approval process and Sticker label

According to the NBTC's report, there are 619 DVB-T2 receiver models approved and totally 20 Million NBTC's certifying sticker labels distributed of which divided to 3 categories i.e. (1) STB (DVB-T2) 15.5 million (2) iDTV 4.4 million and (3) Portable receiver 2.7 million.

Year	STB (DVB-T2)	DTV	Portable	Total (Models)
2014	147	238	45	430
2015	10	159	20	189

Figure: Digital TT Receiver Type Approval

Year	STB (DVB-T2)	iDTV	Portable	Total (units)
2014	13,221,429	1,632,592	2,577,189	17,431,210
2015	2,316,960	2,758,263	165,045	5,240,268

Figure: Total DTT Receiver sticker

Month	STB (DVB-T2)	iDTV	Portable	Total (THB)
2014	66,107,145	8,162,960	12,885,945	87,156,050
2015	11,584,800	13,791,315	825,225	26,201,340

Figure: Revenue from DTT Receiver sticker label

Source: NBTC

Revenue from issued sticker labels is divided to 3 categories: STB (DVB-T2) 77,691,945 Baht iDTV 21,954,275 Baht and Portable receiver 13,711,170 Baht



Source: NBTC

Figure: Portable: Tablet, WIFI Hotspot and Smart Phone with built-in DVB-T2 tuner

The Office of NBTC implemented supporting measure to audience by distributing subsidy Digital-TV coupons worth 690 baht to support transition to Digital terrestrial television broadcasting. The coupon showed message indicating “Coupon to support people on transition to DTTB services” and “Return Happiness to the people”. The coupon can be used as discount to buy Set-Top-Box or TV from retailers who registered with Office of NBTC. This subsidy budget comes from revenue of Spectrum auction for DTTB Service in 2014. The coupons were delivered by Thai Post Company to Eligible Households in countrywide. The instruction to assist people on the DTTB receiver installation and how to redeem coupon also included in the registered letter together with the coupon.





Terms and Conditions for using Digital-TV coupons

Digital-TV coupons can be used either to buy or to discount receiver from retailers who has registered with the Office of NBTC as following

- i. To redeem the DVB-T2 Set-Top-Box worth 690 baht or
- ii. To discount Set-Top-Box which price higher than 690 baht or
- iii. To discount iDTV

Eligible Households for subsidy Digital-TV coupons must have householder registered (Refer to database from Department of Provincial Administration as of September 2014). To use Digital-TV coupons, there 2 steps as following

Step 1: Prepare document

In case a householder apply the right by themselves, the following documents are required:

- National Identification card and its copy
- Household registration and its copy

In case of authorizing another person to redeem the coupon, the following documents are required:

- National Identification card of the house holder and its copy
- Household registration of house holder and its copy
- National Identification card of delegated person and its copy
- Fill information in back of Digital-TV coupons with householder’s signature

Step 2: Digital-TV Coupon Redemption

- Bring Digital-TV coupons and documents as listed above to a retailer who has registered with the Office of NBTC. The registered retailer can be verified from NBTC Website www.nbt.go.th or <http://digital.nbt.go.th/people.php> or Call Center 1200

There are 61 retailer companies that have registered and approved by the Office of NBTC.

- Present Digital-TV coupons and the necessary documents to a registered retailer whose Digital-TV signage presented.

The coupon can also be used at popular chained stores and outlets e.g. Lotus, Big C, Makro, Home Pro, Power Buy, IT City, 7-11, Family Mart and electronic store in any provinces.

In October 2014, the first lot of Digital-TV coupons was distributed in 21 provinces of Thailand where DTTB network coverage is more than 80% and the five more lots were distributed in districts where DTTB network coverage is more than 80%. By the end of January 2016, about 13.5 million Digital-TV coupons were distributed in provinces of which 64% of distributed coupons was redeemed accounting for about 8.7 million coupons as shown in the table below.

Lot	Distribution Date	Distribution Area			Redemption Rate	Expired Date
		Coupon	Province	District		
1	10 Oct 2014	4,645,495	21	Alls	63%	31 Jul 2015
2	28 Nov 2014	1,777,495	20	100	67%	31 Jul 2015
3	24 Dec 2014	623,401	4	41	73%	31 Aug 2015
4	28 Jan 2015	633,825	5	38	68%	30 Sep 2015
5	10 Feb 2015	517,463	7	36	72%	31 Oct 2015
6	6 Mar 2015	124,763	4	8	67%	30 Nov 2015
7	21 May 2015	5,248,854	56	476	62%	31 Jan 2016
All		13,571,296			64%	

Source: NBTC

Figure: Distribution of Digital-TV coupons

The 2nd subsidy Project

On 16 February 2016, NCPO / Prime Minister approved a proposal from the Office of NBTC to subsidize Digital TV receiver by coupons for 4 groups of households as the follows:

- 1) Eligible householders of the first lot which did not receive coupons and those coupons were returned to the Office of NBTC by Thailand Post Company.
- 2) Any Household having house registration document and householder after 16 September 2014
- 3) Any household with a house but doesn't has a householder
- 4) Any household with temporary house registration document

The subsidy budget for 22.9 million households comes from revenue of Spectrum auction for DTTB Services to support Digital TV Switch-over.

6. DSO Communication and Information Support to Customer

6.1. DSO Planning

NBTC has a strategic framework for its public relations and communication to ensure proper awareness and transition from analog to digital switch over (DSO Communication Framework)



Figure: Strategic framework for its public relations and communication

From this strategic framework, NBTC has organized a communication campaign and activities to promote mass awareness and nation-wide understanding on DSO. Main information and messages targeted to general public.

6.2. DSO Communication and Tools

6.2.1. DSO Communication

NBTC also organized a campaign to promote general understanding for Digital Switch Over by following strategic framework with channels/activities such as

- **DTV Mascot**

NBTC launched DTV Mascot called “Doo Dee”, Doo Dee mean good watching in Thai, Doo Dee mascot is widely used by broadcasters, network operators, manufacturers and other relevant stakeholders to create awareness on DSO and Digital TV.

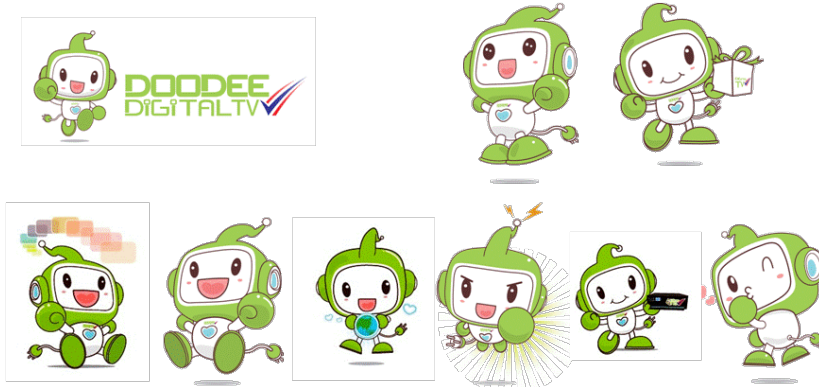


Figure: Doo Dee mascot

- **DTV Song**

Digital TV” Song was produced for promoting transition to digital TV, and NBTC has asked cooperation from TV and Radio Broadcasters, Network Operator to promote DTV song as well as mascot.

- **DTV Communication Channels**

- DSO Event/ Exhibition: organize event/exhibition with cooperation with broadcasters and DTTB network operators
- DTV Broadcaster and DTV Receiver Engagement : request support for special events from Digital TV broadcasters and set-top box providers i.e. National Communication Day, participate in Red Cross event and help to promote set-top box upgrade, or support with movie stars and artists from those channels to help promote Digital TV awareness campaign
- Journalist and Blogger Engagement: organize workshop and DTV station site visit for journalists and blogger to promote understanding on Digital TV transition
- Property Engagement: Seeking collaboration from leading property developers to support Digital TV with proper installation of antenna and in-building cable for all the high rise resident buildings.
- -National and local seminar: Organized seminar and training in particular areas to relevant organizations, government staff, student, local community leaders to create awareness and proper understanding the DSO policy and accept to adopt DTTB services
- A field operation in provincial area to promote awareness and understanding with general public by handing out Digital TV set-top box subsidy coupon before redemption date
- A Digital TV Seminar for academic faculty and students of vocational schools within Ministry of Education in each province with a live training broadcast to other 77 vocational schools nationwide
- Meeting with the Governor and head of Government Agency to communicate those key important rationale of the terrestrial Switch over from Analog to Digital TV

- Site visit in ASO area by area to promote public awareness and knowledge about the Analog TV Switch off / Digital TV Switch and Set-top box subsidy program since ASO has started.
- Creating a public campaign: “A Terrestrial Switch over and proper transition plan for dormitory and apartment buildings” this campaign was supported by various associations such as the Child Development and Protection Agency, Child Social Benefits Protection Agency, and Children, Youth, Disable and Elderly Protection Agency from The Ministry of Social and Human Capital Development and those academic representatives with dormitory and student apartment network with an objective to support this terrestrial transition and migration within this student dormitory high rise building segment around Bangkok and other major provinces.

Print Media: DTV Handbooks/Brochures



Mass media on Television Broadcasting: Television Media “DigitalTV – “Best Viewing on Every Channel”



ดิจิทัลทีวี ทุกช่อง



ดิจิทัลทีวี ทุกช่อง

- SMS alert for general public on the Digital TV subsidy coupon expiration date
- Establishment of collaborative network for the promotion of public awareness, knowledge, and understanding for the general public
 - NBTC and Office of Vocational School Committee signed memorandum of understanding to collaborate on creating general public awareness on the terrestrial DigitalTV campaign with an objective to accelerate awareness and understanding for citizen of all the districts and villages around the area within those provinces that already received the DigitalTV subsidy coupon via the collaborate with the office of vocational school committee, Ministry of Education, where the technical vocational school around the country support by using their technical students to general public for the installation of these new DigitalTV set-top boxes
 - NBTC and the Royal Thai Army TV Station signed an MOU to collaborate on the topic “The Collaboration to promote the general public awareness and understanding on the terrestrial Digital TV” with an objective to install DigitalTV set-top box as prototype within

Government Agencies such as Provincial Administration Agency (Aor Bor Tor) and public hospitals which are the main Government agency contact point with most frequent visits.

6.2.2. Communication Tools

Application “DTV Service Area” NBTC has created a smart phone application for users to check digitalTV ready footprint area and other features below. Such smart phone application supports on Andriod, iOS and computer platform via the website.

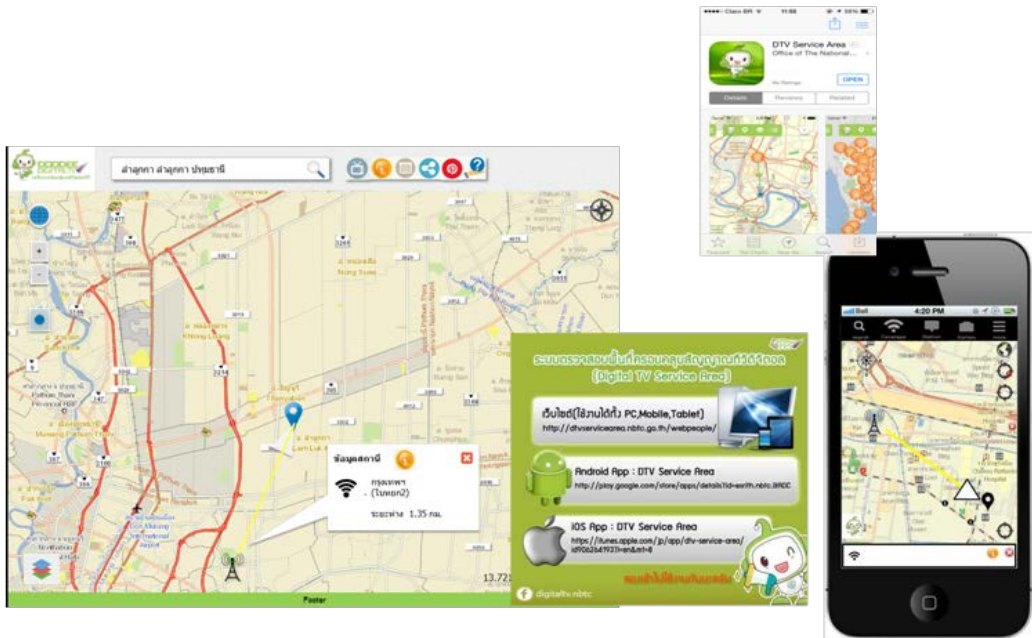


Figure: Smart phone application

- i. Check for digital TV coverage within your area
- ii. An adjustment of the Digital TV antenna direction
- iii. An audit inspection of Digital TV transmitter in each provinces
- iv. Find a proper distance from Mobile Tower (on an Andriod location accuracy will be better than location base application on normal mobile handset)
- v. Monthly Signal Transmission Plan
- vi. An Audit Inspection of Information and channel for each towers
- vii. List of channels that broadcast from various networks
- viii. User can send feedback and recommendation to inform whether your current location is able to view Digita ITV properly or not with an objective to enhance the quality.
- ix. Able to operator both on android and iOS platform including computer via website or application download

Download application sites as follows:

- i. For website please visit <http://dtvservicearea.nbtc.go.th/webpeople/>
- ii. Android OS (Play Store)
<https://play.google.com/store/apps/details?id=esrith.nbtc.BRDC&hl=en>
- iii. Iphone iOS (App Store)
- iv. <https://itunes.apple.com/jp/app/dtv-service-area/id906264193?!=en&mt=8>

6.2 Social Media Communications

1) Website

Website : <http://digital.nbtc.go.th/dood-land/index.html>



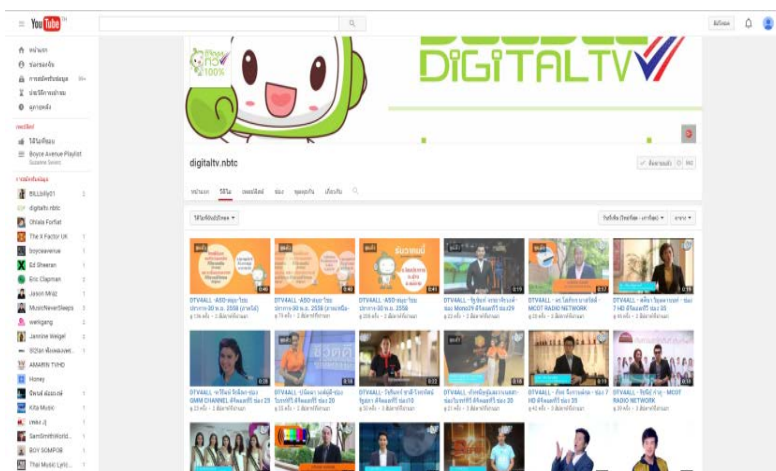
2) Facebook

Facebook : <https://www.facebook.com/digitaltv.nbtc>



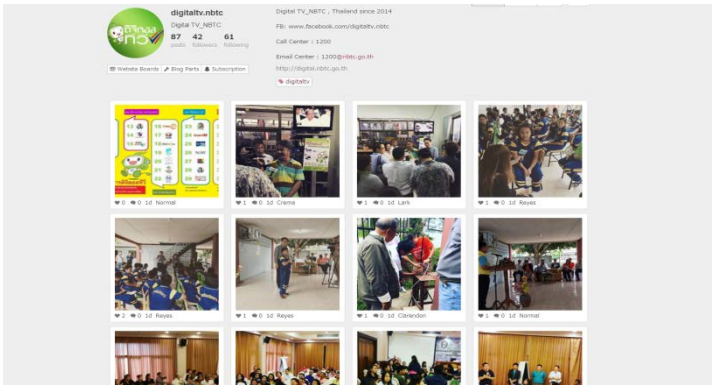
3) Youtube

Youtube : <https://www.youtube.com/channel/UCJDpO4v27bTYVwDzg-aRXJA>

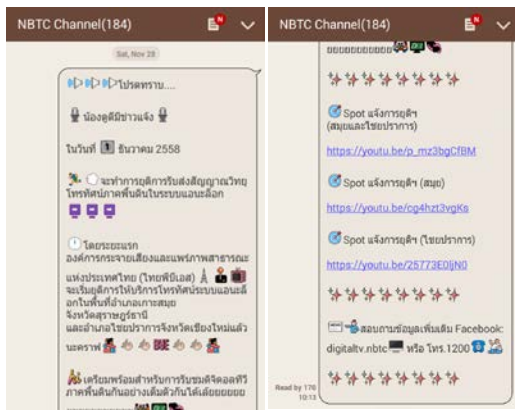


4) Instagram

Instagram: digitaltv.nbtc



5) Line



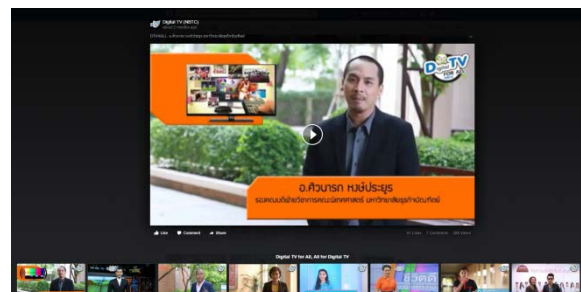
6) DTV 4 All, All 4 DTV Campaign

“DTV 4 All, All 4DTV Campaign” was a viral prototype campaign using social media. This campaign was fully supported by many movie stars, label artists, well known singers, famous speakers and experts from various fields which aim was an invitate and illustrate Digital TV as an readily available and suitable alternative platform. We also promoted the handout and installation of the new digital TV set-top box campaign as a pilot and an effective reaching out to those target audiences which included:

Poster with additional descriptions and explanation



Movie clips with additional descriptions and explanation



6.3 Information Support to Customers

NBTC established a feedback channel to answer general questions and public queries by calling 1200 free of charge and Set up Consumer Protection Subcommittee and Consumer Protection Bureau for customer complaint handling and promote media literacy. For Customer complaints, SLA is set up to control compliant handling process, and officers have to update/feedback the status to the customer.

NBTC provide information support customer via Call Center on DTV coupon approximately 513,000 calls between 10 October 2014 to 5 February 2016. Most calls are information inquiry with only 66 calls is as complaints.



6.4 DSO Monitoring

Office of NBTC has executed project DTTB User Survey to monitor the development of DTTB project and to get feedback of the Digital TV experience in order to improve Digital TV transition program and services. The objectives are to study how information can be received and process executed more effectively, to listen to general feedback and views about terrestrial DigitalTV and to study social impacts from our public relations and awareness campaign of the terrestrial switch over from analog to digital TV including concerns and obstacles in transmitting and receiving of this terrestrial digital TV platform ,and running Broadcasting Accessibility and User Behavior Survey to monitor DTTB services take up rate during DSO and to ensure an effective implementation before Analog Switch off date.

7. ASO Planning and Implementation

The NBTC Notification on Roadmap for transition from Analogue to Digital Television states its policy on Analogue Switch-Off (ASO) and Digital Dividend with an aim to gain the returned spectrum frequencies in 2015. Analogue TV operators are still eligible to use the spectrum frequency according to NBTC Organization Act 2010 of which conditions following the Spectrum Master plan (2012) and the first Sound and Television Broadcasting Master plan (2012-2016)

ASO plan will be decided base on readiness of audience, operators and macro level conditions including timeframe between 2015 - 2020 commonly announced in the 10th meeting of AMRI (ASEAN Minister Responsible for Information) held in Laos. Such ASO plan shall relies on limited burden for television during simulcast period.

There are 6 analogue terrestrial television broadcasters in Thailand e.g. (1) Thai Royal Army (2) Public Relation Department (3) TPBS (4) MCOT (5) Bangkok Entertainment (6) Bangkok TV & Radio. The Office of NBTC has co-operated with broadcasters (1) – (4) in transition from Analogue to

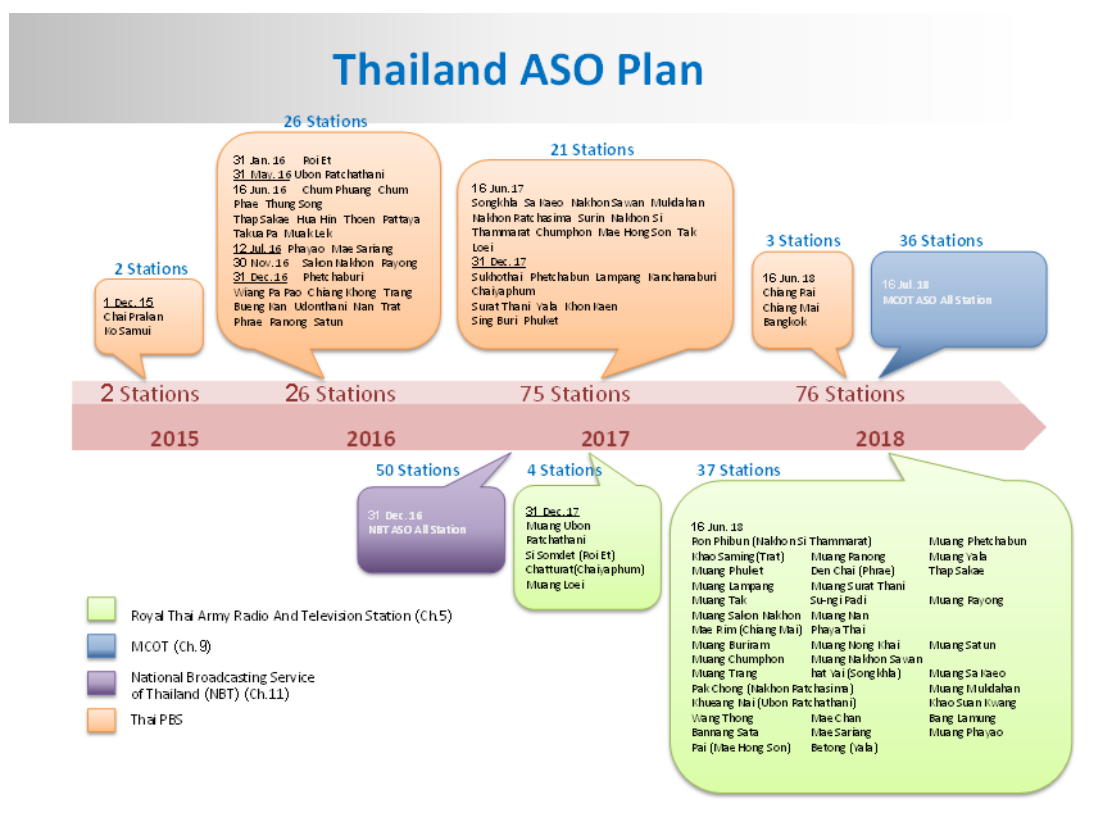
Digital Television Broadcasting within 5 years after such 4 ATV broadcasters were granted DTTB Network license(s) in 2013, hence 4 broadcasters agreed to switch off their ATV by 2018.

In consideration of ASO plan of the 4 ATV broadcasters which also are the DTTB Network Operators, NBC assigned the DTTB Network Implementation working group to propose ASO plan for the DTTB Network Operators to NBC. Their proposals are summarized in below,

- 1) Declaring a date of ASO and effectively communicate the ASO to public and all relevant stakeholders.
- 2) Making use of the given frequency spectrum according to NBTC’s announcement on frequency spectrum for digital terrestrial TV.
- 3) Readiness of audience in the areas where analogue TV to be switch-off
- 4) Readiness of Digital Terrestrial TV to replace switched-off Analogue TV
- 5) Readiness of TV Channel players.

The 4 DTTB Network Operators have submitted ASO plan to NBTC. So far TPBS has shut-down its analogue system in Samui Island as the first trial of ASO process commonly conducted by the Office of NBTC and TPBS. Activities include field study of ASO impact, creating awareness and understanding of DSO as well as Digital Television Technology and preparation for receiving digital TV services properly.

For Bangkok Entertainment (Channel3) and Bangkok TV & Radio (Channel 7) who provide TV broadcasting channels under concession with MCOT and Thai Royal Army respectively, they have planned to remain their analogue TV services until the end of concession according to the Broadcasting Business Act, 2008 Section 81.



Source: NBTC

Figure: Thailand ASO plan

8. Lesson Learned and Recommendations

1) Digital Communication

- Mass communication to public in transition from traditional Analogue TV to Digital TV broadcasting is considered as critical activity to allow successful transition process.
- The published PR message has to cover key transaction activities, impact & benefits to audience including key project's time line. Each message need to be simplified enough for mass audience in various ages from youth to senior citizen.
- Getting engagement from government agencies in state and local level, public agencies and relevant local parties are also key factors to drive a success of on mass communication Digital TV transition
- On-Line Communication such facebook, youtube, twitter, line are the fastest and most effective channels to communicate directly to the people.

2) Digital TV Subsidy Program

- Collaboration between the agencies who distribute the set-top-box coupons and other federal agencies who have regular contact with consumers helped to outreach campaign.
- Redemption DTV Coupon should be distributed to areas whereas DTTB signal covered.
- If there is enough budget, DTV coupon should be distributed thoroughly to every households and cover all groups of audiences.
- DTV coupon value should be enough to cover a qualified set top box with necessary accessories to receive signal well e.g. antenna and cable. Proper training for the STB installers prior to distribution of coupon and STB is a success factor for local to accept and support the transition from analogue to Digital TV service.

3) Receivers

- Develop common spec in ASEAN to achieve economy of scale production cost.
- STB-specification concerned on disability people such as Audio Description(AD), Closed Caption(CC) etc.
- Collaboration with Vocational school and network operators to help people on STB Receiver Installation.
- Develop application or tool to help the people to equip and tilt the antenna correctly like 'DTV Service Area' (Distance to the station, antenna direction, antenna type)
- Having variety of receiver types like portable DTV Receivers e.g. smartphone, tablet, or portable. Selecting proper antennas type and model for Set-Top-Box is important to receive signal well.
- Set up advisory group either by dedicated group or volunteer group to support installation.

4) DTTB Network Rollout

- Sharing infrastructure and facilities can dramatically reduce network cost.
- Ensuring that network rollout, network coverage an network quality of every MUXs are ready to provide broadcasting service the same period for fair competition.
- Regular network quality auditing to ensure that DTTB network quality is acceptable and satisfy people.
- Setting proper Service Availability, faster recovery, redundancy system/location should be well planned in network design in the first place.
- In order to make fastest rollout of TV network, NBTC decided to utilize existing antenna system and site facilities of existing network operators for other new digital network operators to

share such systems. This allow all operators to build 80% of Thailand's house hold coverage within 2 years by using only single direction receiving antenna at each house hold.

- NBTC enforced the rule of 'must carry' for the commercial and public program broadcasters to commence broadcasting their content from day one on other broadcasting platforms e.g. satellite and cable TV which already cover more than 70% audiences in Thailand to increase DTV eye balls.

5) Collaboration

- Collaboration with industry : ATV and DTV broadcasters, DTTB network operators, manufacturers, retailers is a key factor for successful transition as well as Real Estate-High rise building for fast network rollout.
- Collaboration with government agencies and public agencies in national and local level are also key factors to drive a success of digital transition.

6) Set up trial

Trial on the DTT system at the early transition before fully commercial launch was important to test the whole system and trial broadcasting markets.

7) Licensing

Strategy on licensing should be contemplated carefully including proper research to design proper number of channel and licensing phases. Advertising Expense (ADEX) which is main revenue stream to broadcasters, relevant expense on broadcasting, readiness of new broadcasters/players and quality of content production should be taken into account.

8) Rating of Television Broadcasting

Rating survey should be conducted to cover all broadcasting platforms including digital platform (i.e. internet) to have real broadcasting rating and user behavior.

9) Call Center and Information to Support Customer

Cooperation with DTTB network operators to help people on installation the DTTB receivers, and also build confidence on DTTB network quality.

10) Supporting Fund

During transition, DSO programme project should get enough supporting fund for successful promoting and supporting DSO throughout the process as well as supporting broadcasting industry. In Thailand, Broadcasting and Telecommunications Research and Development Fund for the Public Interest (BTFP) was established by funding from annual fee with certain revenue shared by each business broadcasters.
