SRI LANKA

Roadmap for the Transition from ANALOGUE TO DIGITAL TERRESTRIAL TELEVISION BROADCASTING IN SRI LANKA

Report

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Telecommunication Development Sector

Roadmap for the Transition from Analogue to Digital Terrestrial Television Broadcasting in Sri Lanka

Report

February 2012

The roadmap for the transition from analogue to digital terrestrial television broadcasting in Sri Lanka has been prepared in the framework of the ITU digital broadcasting project in collaboration with the Korea Communications Commission (KCC), Republic of Korea. The project's objective is to assist countries in setting out a roadmap and to shift smoothly from analogue to digital terrestrial television broadcasting, and to introduce mobile television (MTV).

This report was prepared by ITU expert Mr Peter Chu with the support from the National Roadmap Team (NRT) of Sri Lanka and the ITU Regional Office for Asia and the Pacific.

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Foreword

The process of transition from analogue to digital terrestrial television broadcasting offers advantages in terms of spectrum efficiency, higher video and audio quality and new business opportunities. It also offers the opportunity to allocate part of the broadcasting band to International Mobile Telecommunication (IMT) services and other applications.

In all ITU regions this has started. In a number of countries (e.g. the USA and many countries in the European Union) analogue switch-off has been completed. Most developing countries are also considering digital switch-over or have started the process. To support developing Member States to overcome the challenges and transit smoothly from analogue to digital broadcasting ITU developed a programme to help countries to reap the full benefits of spectrum efficiency, and covers terrestrial TV, mobile TV and sound broadcasting.

In May 2010, the ITU published a comprehensive set of guidelines for the transition from analogue to digital terrestrial television broadcasting under this programme. These guidelines were developed for the Africa region but most of this version can be used worldwide. A version which contains the specific information for the Asia-Pacific region and the conversion of the analogue archives to digital will be published soon. In a further effort to help countries to switch over to digital broadcasting, ITU has been helping countries to draft a roadmap, and Sri Lanka is one of the countries receiving further assistance.

From August to October 2011, the roadmap for transition from analogue to digital terrestrial television in Sri Lanka was jointly developed by a team of ITU experts and the National Roadmap Team (NRT) of the Sri Lanka Government.

I would like to commend Mr Peter Chu the ITU expert who has developed the roadmap through his excellent expertise and experience, as well as to give special thanks to the Sri Lanka National Roadmap Team.

Also, I very much appreciate the active support of the Telecommunications Regulatory Commission of Sri Lanka (TRCSL) and the Ministry of Mass Media and Information (MMMI), Sri Lanka, with the support of the Korea Communications Commission (KCC) and ITU Regional Office for Asia and the Pacific in facilitating the work of the ITU experts.

I am confident that this report will help the Sri Lanka Government in reaching their digital switch-over objectives.

Brahima Sanou
Director
Telecommunication Development Bureau
International Telecommunication Union

Executive Summary

The roadmap for transition from analogue to digital terrestrial television broadcasting in Sri Lanka was prepared by ITU expert Mr Peter Chu with the support from the National Roadmap Team (NRT) from August to October 2011.

The main observations and conclusion of the roadmap are summarized below.

Scope of the roadmap

The roadmap for transition from analogue to digital terrestrial television broadcasting in Sri Lanka covers the short term digital switch-over (DSO) and long term DSO objectives and the activities managed by the NRT. However, this report does not include:

- The introduction of Mobile TV, because frequency channel in UHF band is exhausted by current TV broadcasting services. Nevertheless, mobile TV remains a long term DSO objective.
- The introduction of digital radio. In this case, digital radio remains a long term DSO objective and will be reviewed once the analogue switch-off (ASO) has been completed.

The Sri Lanka television market is characterized by a great number of national and commercial TV services and a wide choice of TV platforms (analogue and digital cable, satellite TV, IPTV). The TV market in Sri Lanka is mainly a free-to-air terrestrial TV market with a total of 23 TV licence holders. Sixteen broadcasters are currently in operation.

The aim of the roadmap is reflected in the DSO objectives. In the deliberation process of the first NRT meeting, the NRT considered the DSO short term and long term objectives as summarized in Table 1(see also section 2.3.1).

Table 1: Summary of DSO objectives

No	Objective	Short term (1 year after analogue switch-off)	Long term (5-10 years after analogue switch-off)
1	Smooth transition from analogue to digital by means of using strategy driven and regional service approach. DTTB service before mid-2012 is planned to be available in Western Province and Northern Province.	All analogue services converted to digital with same island-wide coverage areas for all current analogue TV programmes.	NRT will follow the direction from Ministry of Mass Media and Information (MMMI); Telecommunications Regulatory Commission of Sri Lanka (TRCSL) will conduct the planning for digital dividend.
2	Issue system licence to the Digital Broadcast Network Operator (DBNO)[1]	Second DBNO licence will be issued if frequency spectrum is available after ASO. Assignment of frequencies for free-to-air DBNOs take	NIL

[1] Subsequent to a cabinet decision on introducing digital television transmission in Sri Lanka, a subcommittee was appointed by the secretary to the Ministry of Mass Media and Information to propose a suitable policy framework for the digitalization of terrestrial television broadcasting in Sri Lanka, through deliberations. A report named, A Policy Framework for the Digitalization of Terrestrial Television Broadcasting in Sri Lanka, drafted by the subcommittee on 20 August 2011. The report recommends a new category of network operator to provide the service of delivering the content of the broadcasters to the viewers. The new category is termed Digital Broadcast Network Operators (DBNO).

No	Objective	Short term (1 year after analogue switch-off)	Long term (5-10 years after analogue switch-off)
		precedence over subscription based DBNOs.	
3	The DBNO should set up the free-to-air DVB-T2 digital terrestrial television transmission network.	NIL	NIL
4	The broadcasters should make use of the services of a DBNO for the delivery of their television programmes to the viewer. All existing broadcasters should be instructed to make all channels available as a mandatory requirement in the digital platform constructed by the respective DBNOs from the very beginning.	NIL	NIL
5	Solution to issues arising out of practical difficulties in implementing the policy. The regulator shall take responsibilities on the concerned solutions.	NIL	NIL
6	Tax policy	From 2012 to 2015, tax concessions will be provided to promote current broadcasters.	From 2012 to 2018, tax concessions will be provided for the CPE.
7	Frequency planning before ASO in supporting framework of transition from analogue to DTTB	The outcome of frequency planning will be used for the second DBNO system licence and other possible digital broadcasting services.	Can accommodate more DBNO licences.
8	Better picture quality	HDTV quality up to the market if more island-wide multiplexes are available after ASO	3D TV up to the market
9	More digital broadcasting services	NIL	MTV and/or digital radio
10	Digital dividend	Draft to be discussed	Restacking UHF spectrum

Source: Production based on discussion with NRT of Sri Lanka

The duration of the transition process from analogue to digital terrestrial television broadcasting has been determined by the NRT. The following milestones are based on the timelines originally stated in the subcommittee draft report[2] submitted to the Ministry of Mass Media and Information (MMMI):

- end-2011 to mid-2012: Deployment of DTTB pilot transmission services in Northern Province and Western Province;
- mid-2014: Deployment of DTTB services from eight DTTB principal stations;
- end-2015: Analogue shut off in Western Province;

[2] *A Policy Framework for the Digitalization of Terrestrial Television Broadcasting in Sri Lanka*

- end-2017: Complete analogue switch-off.

It is estimated that it will take around five to six years for consumers to convert.

The scope of activities outlined in the roadmap depends on the licensing model that will be adopted. In the digital value chain, the proposed digital broadcast network operator (DBNO) needs to be established with a licence encompassing the role of multiplex operator, content distributor and service provider. The multiplex operator combines the programme stream from all current free-to-air terrestrial TV broadcasters into transport streams to be distributed to the DTTB transmitters. The tasks of the multiplex operator together with the task of the transmitter network operator and service providers (licensing model B). In the latter case the roadmap includes more activities.

The input and output documents of the phases of the roadmap related to licensing model B (common multiplex and network operator) are summarized in Table 2. Before a licence can be issued to the first DBNO, the NRT and regulator have to conduct initial network planning as shown in phase 3 (Licensing policy regulation). The detailed network planning will be the responsibility of the DBNO once the system licence has been issued.

Table 2: Input and output documents of the phases of the roadmap for licensing model B

Roadmap phase for NRT and regulator	Input document	Output document
Phase 1: DTTB policy development for NRT and regulator	• International agreements • Existing national telecom broadcast and media laws • Existing policy document and objectives	• Digital terrestrial television broadcasting policy •Initial frequency plan
Phase 2: ASO for NRT and regulator	• Digital terrestrial television broadcasting policy	• Analogue switch-off plan
Phase 3: Licensing policy and regulation for NRT and regulator	• Analogue switch-off plan • Digital terrestrial television broadcasting policy	• National coordinated frequency plan • Internationally coordinated frequency plan • Licence terms and conditions • Licence procedure and planning
Phase 4: Licensing administration for NRT and regulator	• Licensing procedure and planning • Notification to regulator from contents distributor	• Station N TRCSL approved • Station N record in MFIR
Roadmap phase for operator (DBNO)	**Input document**	**Output document**
Phase 1: Preparation for the operator (DBNO)	Licence procedure	Licence application Service proposition, business plan and network plan
Phase 2: Planning for the operator (DBNO)	• Licence procedure • Service proposition, business plan and network plan	• DTTB Network implementation plan

Roadmap phase for operator (DBNO)	Input document	Output document
Phase 3: Implementation for the operator (DBNO)	• DTTB network implementation plan	• End-consumer support and communication plan • Coverage presentation • Notification to regulator • Order to put DTTB site in operation
Phase 4: ASO for operator (DBNO)	• Analogue switch-off plan • DTTB network implementation plan	• Notification to the regulator • Order to put revised DTTB site in operation

Source: Production based on discussion with NRT of Sri Lanka

The decisions taken, partly taken and not yet taken on the key topics and choices regarding phases 1 to 4 of the roadmap by the NRT, the regulator and the operator (DBNO) and the activities required to prepare the decisions are indicated in annexes 1 to 6.

Recommendations

1. The NRT is recommended to carry out the following steps for a smooth transition to digital terrestrial television broadcasting and the analogue services switch off:

   a. Seek the roadmap report approval by the Ministry of Mass Media and Information and Telecommunications Regulatory Commission of Sri Lanka (TRCSL).

   b. After approval, acquire a mandate to plan and manage the ASO process in accordance with the phases of the roadmaps for NRT and the regulator and work out the output documents in phases 1, 2 and 3 in order to prepare and issue a system licence to the first DBNO by mid-2012.

   c. Form a project management office and NRT under the proposed broadcasting authority and start drafting an initial detailed ASO planning and determine the progress reporting procedures and structures.

2. Apart from these next steps for the NRT to take, additional recommendations are given below to meet the situation of Sri Lanka:

   a. The frequency channels in categories of reserved, proposed, expired and cancelled should be reviewed with high priority. It is recommended to limit the scale of frequency channel assignment furthermore for current and new broadcasters in order to release frequency channels in island wide to the DBNOs (see Table 13). The TRCSL is recommended to complete an initial DTTB frequency plan in supporting the output document of the DTTB policy in the phase 1 of the roadmap for NRT and the regulator.

   b. As the milestone to issue a system licence for the first DBNO is scheduled in mid-2012, initial network DTTB network planning is the key issue to prepare the output document, national coordinated frequency plan and licence and terms and conditions in phase 3 of the roadmap for NRT and regulator.

   c. The initial feasibility study for the site infrastructure sharing with current TV broadcasters at the proposed eight DTTB sites and the design of Single Frequency Network (SFN) transmission network and coverage planning based on DVB-T2 as proposed by the NRT are key issues. The NRT and project management office under the broadcasting authority are recommended to start the feasibility studies earlier before the awarded DBNO to undertake detailed DVB-T2 transmission network design.

1. Introduction

ITU has published guidelines for the transition from analogue to digital broadcasting (hereinafter referred to as ITU Guidelines)[3]. The ITU Guidelines provide assistance to ITU Member States to migrate smoothly from analogue to digital broadcasting. In a further effort to help countries to switch over to digital broadcasting ITU has selected beneficiary countries to help draft a national roadmap for the digital switch-over (DSO) process. Sri Lanka is one of the five beneficiary countries in Asia and the Pacific receiving further assistance.

The roadmap for transition from analogue to digital terrestrial television broadcasting in Sri Lanka has been jointly developed by ITU expert Peter Chu and the Sri Lanka National Roadmap Team (NRT). The NRT is chaired by Mr Helasiri Ranatunga, Deputy Director, Spectrum Management, Telecommunications Regulatory Commission of Sri Lanka (TRCSL). The NRT consists of representatives from the following organisations:

- Telecommunications Regulatory Commission of Sri Lanka;
- Ministry of Defence;
- University of Moratuwa;
- Sri Lanka Rupavahini (TV) Corporation (National Television Network);
- Independent Television Network Ltd. (National Television Network);
- EAP Networks (Pvt) Ltd. (commercial broadcaster);
- MTV Channel (Pvt) Ltd. (commercial broadcaster);
- Dialog Television (Pvt) Ltd. (commercial broadcaster).

The Sri Lanka TV market, with an estimated 3.5 million TV households, is mainly a terrestrial TV free-to-air (FTA) market with a very high number of analogue terrestrial TV programme services (23). There is a wide choice of TV delivery platforms; in addition to analogue terrestrial TV, there is also digital TV satellite, analogue and digital cable TV, IPTV.

The Sir Lanka Gross Domestic Product (GDP) per capita was an estimated USD 2 240[4] in 2010, and continues to grow rapidly. This relatively low GDP figure and the very competitive TV market mark is one of the great challenges for the DSO process. Digital switch-over can only succeed if the costs for the government, the broadcasters and the viewers are kept low. On the other hand, transition to digital television will offer great advantages. The viewer will have more services and better picture quality, the broadcasters can offer new services and network costs can be reduced. The government can achieve more efficient use of the frequency spectrum and may allocate part of the broadcasting band to other communication services.

The ITU assistance to Sri Lanka consisted of four key activities:

1. preparation and first country visit to collect information;
2. drafting of the roadmap report;
3. missions to present and discuss the draft roadmap report; and
4. drafting of the final roadmap report.

The ITU experts who prepared the guidelines for the transition to digital broadcasting visited Sri Lanka from 15 to 26 August 2011 and from 26 September to 4 October 2011. During the first visit the experts together with the NRT prepared:

- an analysis of the TV market and regulatory situation;

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[3] The ITU Guidelines for transition from analogue to digital broadcasting can be found at www.itu.int/publ/D-HDB-GUIDELINES.01-2010/en.

[4] The World Bank: http://data.worldbank.org/country/sri-lanka

- an overview of short term and long term digital switch-over objectives; and
- an inventory of decisions (partly) taken regarding key objectives and choices with respect to the functional building blocks of the ITU Guidelines.

Section 2 of this report addresses the current situation and digital switch-over (DSO) objectives. Section 3 shows the draft national roadmap for achieving the DSO objectives. Section 4 considers the top-ten key topics and choices.

Annexes 1 to 6 show in detail the decisions taken, partly taken and not yet taken on the key topic and choices regarding the DSO process in Sri Lanka. Activities required to prepare the decisions that are still pending are also indicated. Annex 7 provides examples of digital terrestrial television broadcasting (DTTB) single frequency network (SFN) coverage based on the proposed eight DTTB sites.

2. Current Broadcasting Situation in Sri Lanka

2.1 Market structure

In 2001, the population in Sri Lanka had reached 18.8 million[5] and it is estimated to reach 20.68 million in 2011[6]. There are 4 054 385 households in 3 969 211 occupied housing units in 18 districts. The average household size is 4.2 persons. Households with television in 2002 had reached 31.64 per cent[7]. The total number of households with a television was estimated at about 1.28 million in 2002 increasing to about 3.5 million[8] in 2011.

The first television network in Sri Lanka was launched on 14 April 1979. The ITN channel, owned by the Independent Television Network Ltd. (ITN) became the first terrestrial television channel in Sri Lanka. On 5 June 1979 ITN was the subject of a government takeover and was later brought under the Sri Lanka Rupavahini Act 6 of 1982 along with the newly created Sri Lanka Rupavahini Corporation (SLRC).

Significant changes occurred in 1992 as the government permitted the establishment of private television networks. Subsequently, the Maharaja Television Network was launched in collaboration with Singapore Telecommunications Limited (SingTel).

Since then many new television networks have come into existence within Sri Lanka. There are also a number of satellite networks and pay per view television networks in Sri Lanka. The national telecommunications provider Sri Lanka Telecom also launched an IPTV service in 2008[9].

Table 3 lists the registered broadcasting licences[10]. Two new broadcasters, Carlton Sports Network (Pvt.) Ltd. and Ritz Asia (Pvt.) Ltd obtained a licence in the first quarter of 2011. In March 2011, there was a total of 23 TV broadcasters issued with a TV licence since 1992.

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5 Final result CPH 2001, Brief Analysis of Population and Housing Characteristics, Department of Census and Statistics, Sri Lanka.

6 Central Bank of Sri Lanka www.cbsl.gov.lk/

7 NationalMaster.com www.nationmaster.com/country/ce-sri-lanka/med-media

8 The total TV households is just above 3.5 million and total viewers are around 14 million i.e. one TV has four viewers average) in accordance to the research organization, LMRB www.lmrbint.com

9 Television in Sri Lanka, source: Wikipedia, http://en.wikipedia.org/wiki/Television_in_Sri_Lanka#Pay_Television_Networks_.28Sri_Lankan_Owned.29

10 Registered institutions for radio and TV licenses record in Ministry of Mass Media and Information, www.media.gov.lk/licenses.html

Table 3: Registered TV licences

No.	Broadcaster Name	Programme Name	% Pop Coverage	Million viewers per week (note 1)
1	Sri Lanka Rupavahini Corporation	RUPAVAHINI (Ch 1)	95	1.92 m
		CHANNEL EYE/NETHRA (Ch 2)	95	1.56 m
		NTV	95	0.014 m
2	Independent Television Network. (Pvt.) Ltd.	ITN	93	2.54 m
		Vasantham	93	0.056 m
		Prime TV	NA	NA
3	EAP Network (Pvt) Ltd.	SWARNAVAHINI (SWAR)	87	2.30 m
		ETV	10	0.056 m
4	MTV Channel (Pvt) Ltd (Maharaja Group)	SIRASA TV	85	2.25 m
		Shakthi TV	85	1.36 m
		CHANNEL 1 MTV	85	0.028 m
5	Telshan Network (Pvt) Ltd.	TNL	70	0.36 m
6	IWS Holding (Pvt) Ltd.	Art TV	12	0.042 m
7	Asia Broadcasting Corporation (Pvt.) Ltd.	NA	NA	NA
8	Television and Radio Network	TV Lanka	50	0.014 m
9	Power House Ltd.	DERANA TV	75	1.16 m
10	MGMR Network Pvt Ltd.	MaxTV	10	0.028 m
11	Dumee Intenational (Pvt) Ltd.	NA	NA	NA
12	Voice of Asia Netwok (Pvt) Ltd.	SIYATHA	70	0.24 m
		Vetri TV	70	0.056 m
13	People`s Media Network (Pvt) Ltd.	Buddlist TV	10	0.014 m
14	Rangiri Sri Lanka Media Network (Pvt) Ltd.	NA	NA	NA
15	Lak View Broadcasting (Pvt.) Ltd.	NA	NA	NA
16	Sat Net (Pvt.) Ltd.	NA	NA	NA
17	Yellow Win Media (Pvt) ltd.	NA	NA	NA
18	Future Sat Com Holdings (Pvt) Ltd.	NA	NA	NA
19	VIS Broadcasting Network (Pvt) Ltd.	CCTV	12	note 3
20	Sri Globaal Television Company (Pvt) Ltd.	NA	NA	NA
21	Ask Media (Pvt,) Ltd	NA	NA	NA
22	Carlton Sports Network (Pvt,) Ltd	PRIME/CSN	75	0.028 m
23	Ritz Asia (Pvt) ltd.	NA	NA	NA

Note:

1 Million viewers per week is based on audience share in one week from 31 July 2011 to 6 August 2011

2 NA: means the broadcaster is not operational

3 No audience share data

Source: Production based on information provided by NRT of Sri Lanka

In addition to free-to-air terrestrial TV licences, there are also Radio, Cable TV, IPTV and Mobile TV[11] licences. (See Table 4).

[11] Mobitel currently operates a 3.5G network with HSDPA/HSUPA support and downlink speeds of up to 3.6 Mbit/s and uplink speed up to 1.00Mbit/s. According to speedtest.net Mobitel is the operator to issue the fastest internet connections in Sri Lanka via HSPA, while they have also fully tested out 42Mbit/s downlink HSPA MIMO technology in Colombo. It is also serving customers with over 1500 GSM and 400 3.5G base stations island wide. Source: http://en.wikipedia.org/wiki/Mobitel_(Sri_Lanka)

Table 4: Registered Cable TV, DTH (TV), IPTV and Mobile TV licences

No.	License type	Broadcaster name	issued date
1	Cable TV	Television and Radio Network	30.05.1996
2		Grant Communication (Pvt). Ltd.	15.07.1996
3		The Southern Development Authority (Pvt.) Ltd.	15.07.1996
4		Dialog Television Pvt. Ltd.	09.02.2004
5		Voice of Asia Netwok (Pvt) Ltd.	16.02.2006
6		Sky TV & Radio Network (Pvt.) Ltd.	23.02.2007
7		Lanka Broadband Network (Pvt.) Ltd.	29.03.2007
8		City Cable Links (Pvt) Ltd.	19.01.2009
9		Lanka Cable & Satellite Network	24.02.2011
1	DTH (TV)	Messers Dynavision (Pvt.) Ltd	31.10.1997
2		Dialog Television Pvt. Ltd.	09.02.2004
3		Voice of Asia Netwok (Pvt) Ltd.	14.05.2007
4		Sky TV & Radio Network (Pvt.) Ltd.	23.02.2007
5		The Buddhist Broadcasting Servic	22.6.2007
1	IPTV	Sri Lanka Telecom (Pvt.) Ltd	09.04.2007
1	Mobile TV	Mobitel (Pvt) Ltd.	09.04.2007

Source: Production based on information provided by NRT of Sri Lanka

The Sri Lanka television market structure is shown in Figure 1.

The TV market in Sri Lanka is mainly a free-to-air terrestrial TV market with 23 TV licence holders and 16 broadcasters currently in operation. The audience share rating survey is currently undertaken by a research organization, LMRB[12]. Table 3 provides a sample of audience measurement (viewers per week) for key broadcasters.

In the draft subcommittee report on a policy framework for the digitalization of terrestrial television broadcasting in Sri Lanka, it is recommended to the Ministry of Mass Media and Information in 2010, to stop issuing new media licences for analogue television broadcasting. The expansion or new assignments for current analogue transmission infrastructure in the Western Province should be terminated with immediate effect.

In addition to terrestrial analogue TV broadcasting services, the current commercial broadcasting services market include nine Cable TV licensees, five DTH TV licences and one IPTV licence and Mobile TV licence. The current operating Cable TV Distribution Network operator is Lanka Broadband Network (Pvt.) Ltd. (LBN)[13] and City Cable Links (Pvt) Ltd. LBN provides connection fees and monthly subscriptions rates in four packages. For example, the basic package monthly rental is LKR 699 with an additional telecommunication levy of 20 per cent. It provides 36 channels and VHS quality pictures, mono sound system on selected channels. While the digital premium package, the monthly rental is LKR 1599 with an additional telecommunication levy of 20 per cent. It provides more than 100 channels, DVD quality pictures, and stereo sound. The number of cable TV subscribers is estimated to be 50 000.

The current licence to operate direct-to-home satellite broadcasting service is held by Dialog TV (Pvt) Ltd.[14] and Future Satcom Holding (Pvt.) Ltd. Dialog TV provides four standard packages. The pearl package

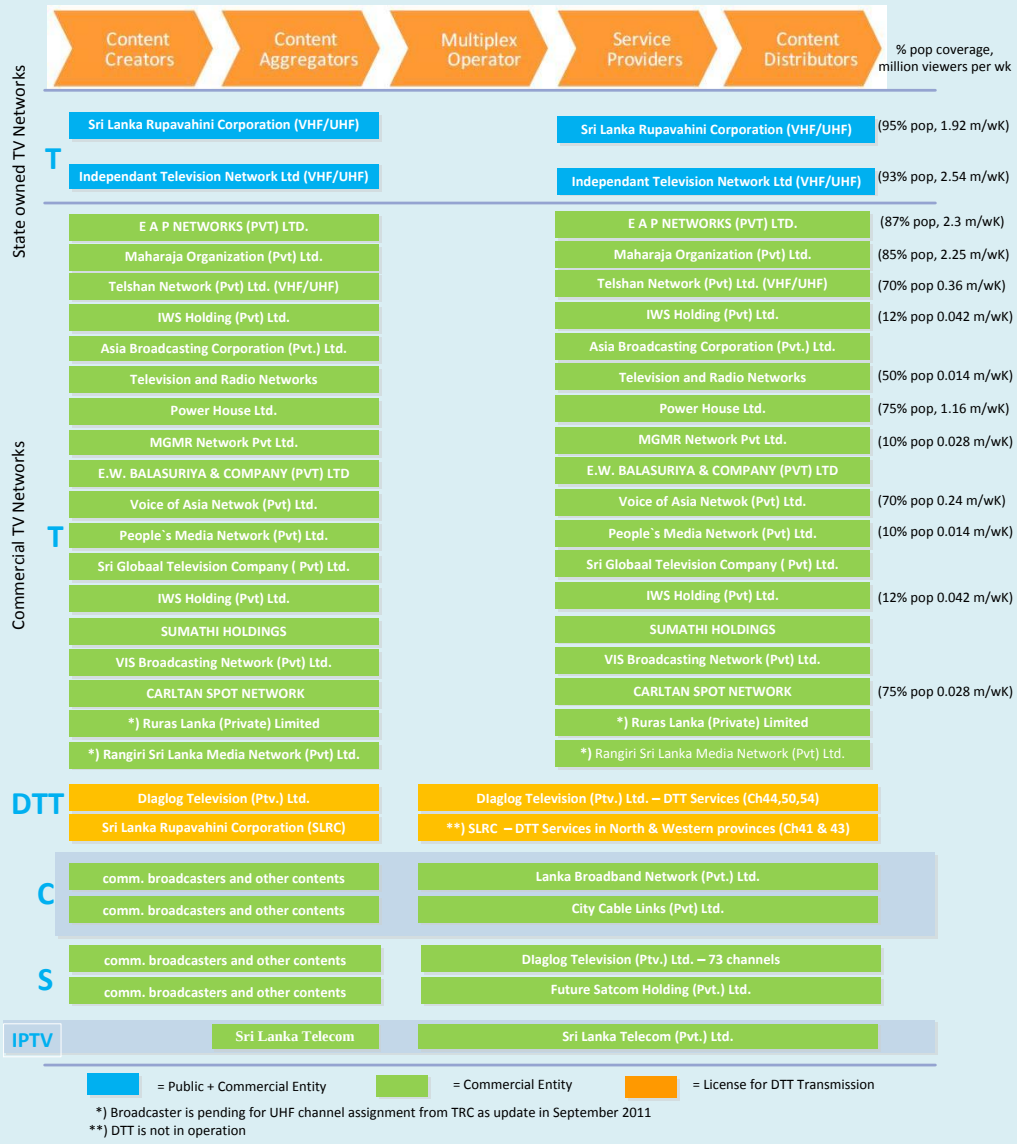
[12] The most accepted Market Research Company for media audience measurement is Lanka Market Research Bureau Limited (LMRB), www.lmrbint.com/ in Sri Lanka. The survey of TV progammes from all broadcasters uses the people meter method for audience measurement.

[13] LBN, www.lbn.lk/ provided as many as 15 foreign language channels including Maldivian, French, Chinese, German, Russian. The list of channels include different programme contents, such as Movies, Sports, Entertainment, Life Style, Educational, Children, Music and Fashion, News, Religious, Tamil, Hindi, Local TV Channels, Other. LBN also reaches people in the Mattakuliya, Negombo, Raddolugama and Nivasiepura areas.

[14] Dialog TV (Pvt) Ltd. www.dialog.lk

provides 41 channels with monthly package rental LKR 699 and the gold package provides 73 channels with a monthly package rental of LKR 1 949. All packages provide local TV channels. The connection fee is LKR 9 990. Direct-to-home Satellite broadcasting services delivered services to about 183 000 subscriber by mid-2011.

Figure 1: Sri Lanka TV market structure



Source: Production based on information provided by NRT of Sri Lanka

In accordance with TRCSL records as of September 2011, the frequency channel assignment for the FTA TV broadcasters in operation is shown in Table 5, 6 and 7. Channels 41 and 43 will be island wide frequency channels, planned for the digital broadcasting service. Five UHF channels: 38, 45, 57, 59 and 61 are possible clean channels under the frequency channel assignment.

In addition to the operational UHF channels, some UHF channels are reserved and proposed for current broadcasters as shown in Table 8 and Table 9.

Table 5: Overview of TV frequency usage in UHF Band IV and V (1 of 3)

UHF Television Channel Assignment in operational as at 28 September 2011 by TRCSL

No	ID	Name of the Broadcaster	Location	Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
			Channel utilisation ------>		4	3	4	3	4	4	1	3	4	4	3	5	1	1	3	1	3	0	4	5	5	2	1	4	0	2	1	3	2	4	5	4	3	1	1	3	0	2	0	1	0	1
1	19	Carlton Sports Network (Private) Limited	Colombo	22		O																																								
2	19	Carlton Sports Network (Private) Limited	Colombo	26						O																																			
3	19	Carlton Sports Network (Private) Limited	Gongala	28								O																																	
4	19	Carlton Sports Network (Private) Limited	Kokavil	29									O																																
5	19	Carlton Sports Network (Private) Limited	Hunnasgiriya	30										O																															
6	19	Carlton Sports Network (Private) Limited	Nayabedda	30										O																															
7	19	Carlton Sports Network (Private) Limited	Gammaduwa	32												O																												
8	19	Carlton Sports Network (Private) Limited	Kokavil	32												O																												
9	19	Carlton Sports Network (Private) Limited	Vauniya	40																				O																					
10	19	Carlton Sports Network (Private) Limited	Kandy	41																					O																				
11	19	Carlton Sports Network (Private) Limited	Ratnapura	41																					O																				
12	19	Carlton Sports Network (Private) Limited	Jaffna	42																						O																			
13	19	Carlton Sports Network (Private) Limited	Gammaduwa	44																								O																	
14	19	Carlton Sports Network (Private) Limited	Gongala	44																								O																	
15	19	Carlton Sports Network (Private) Limited	Hunnasgiriya	44																								O																	
16	19	Carlton Sports Network (Private) Limited	Kandy	46																										O															
17	19	Carlton Sports Network (Private) Limited	Nuwara Eliya	47																											O														
18	19	Carlton Sports Network (Private) Limited	Jaffna	49																													O												
19	19	Carlton Sports Network (Private) Limited	Vauniya	50																														O											
20	19	Carlton Sports Network (Private) Limited	Nayabedda	51																															O										
21	19	Carlton Sports Network (Private) Limited	Nuwara Eliya	55																																		O							
22	19	Carlton Sports Network (Private) Limited	Ratnapura	56																																			O						
1	2	Dialog Television (Pvt) Ltd	Colombo	44																								O																	
2	2	Dialog Television (Pvt) Ltd	Colombo	50																														O											
3	2	Dialog Television (Pvt) Ltd	Gongala	50																														O											
4	2	Dialog Television (Pvt) Ltd	Magalkanda	50																														O											
5	2	Dialog Television (Pvt) Ltd	Madolsima	54																																			O						
1	3	E.A.P.Networks (Pvt) Ltd	Kandy	22		O																																							
2	3	E.A.P.Networks (Pvt) Ltd	Ratnapura	22		O																																							
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11	3	E.A.P.Networks (Pvt) Ltd	Magalkanda	40																				O																					
12	3	E.A.P.Networks (Pvt) Ltd	Nayabedda	40																				O																					
1	4	E.W.Balasuriya & Company Ltd	Colombo	60																																								O		
1	5	Independant Television Network Ltd	Colombo	24				O																																					
2	5	Independant Television Network Ltd	Hunnasgiriya	24				O																																					
3	5	Independant Television Network Ltd	Suriyakanda	24				O																																					
4	5	Independant Television Network Ltd	Jaffna	25					O																																					

Table 6: Overview of TV frequency usage in UHF Band IV and V (2 of 3)

UHF Television Channel Assignment in operational as at 28 September 2011 by TRCSL

No	ID	Name of the Broadcaster	Location	Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
				Channel utilisation ------>	4	3	4	3	4	4	1	3	4	4	3	5	1	1	3	1	3	0	4	5	5	2	1	4	0	2	1	3	2	4	5	4	3	1	1	3	0	2	0	1	0	1
1	4	E.W.Balasuriya & Company Ltd	Colombo	60																																								O		
1	5	Independant Television Network Ltd	Colombo	24				O																																					
2	5	Independant Television Network Ltd	Hunnasgiriya	24				O																																					
3	5	Independant Television Network Ltd	Suriyakanda	24				O																																					
4	5	Independant Television Network Ltd	Jaffna	25					O																																				
1	6	IWS Holdings (Pvt) Ltd	Colombo	28								O																																	
2	6	IWS Holdings (Pvt) Ltd	Kandy	52																															O										
1	7	MGM Network (Pvt) Ltd	Colombo	30										O																															
2	7	MGM Network (Pvt) Ltd	Kandy	56																																				O						
1	8	MTV Channel (Pvt) Ltd	Colombo	23			O																																						
2	8	MTV Channel (Pvt) Ltd	Gammaduwa	23			O																																						
3	8	MTV Channel (Pvt) Ltd	Colombo	25					O																																				
4	8	MTV Channel (Pvt) Ltd	Gammaduwa	25					O																																				
5	8	MTV Channel (Pvt) Ltd	Gongala	25					O																																				
6	8	MTV Channel (Pvt) Ltd	Nuwara Eliya	27							O																																		
7	8	MTV Channel (Pvt) Ltd	Gongala	29									O																																
8	8	MTV Channel (Pvt) Ltd	Kandy	29									O																																
9	8	MTV Channel (Pvt) Ltd	Nuwara Eliya	34														O																											
10	8	MTV Channel (Pvt) Ltd	Hunnasgiriya	51																															O										
11	8	MTV Channel (Pvt) Ltd	Kandy	51																															O										
12	8	MTV Channel (Pvt) Ltd	Colombo	58																																						O			
13	8	MTV Channel (Pvt) Ltd	Hunnasgiriya	58																																						O			
1	9	People's Media Network (Private) Limited	Karagahatenna	41																					O																				
2	9	People's Media Network (Private) Limited	Colombo	53																																	O								
1	10	Power House Ltd	Gammaduwa	28								O																																	
2	10	Power House Ltd	Gongala	31											O																														
3	10	Power House Ltd	Kandy	32												O																													
4	10	Power House Ltd	Nayabedda	32												O																													
5	10	Power House Ltd	Nuwara Eliya	36																O																									
6	10	Power House Ltd	Colombo	37																	O																								
7	10	Power House Ltd	Kalutara	56																																				O						
1	12	Sri Lanka Rupavahini Corporation	Jaffna	21	O																																								
2	12	Sri Lanka Rupavahini Corporation	Jaffna	23			O																																						
3	12	Sri Lanka Rupavahini Corporation	Madukanda	30										O																															
4	12	Sri Lanka Rupavahini Corporation	Colombo	39																			O																						
5	12	Sri Lanka Rupavahini Corporation	Deniyaya	39																			O																						
6	12	Sri Lanka Rupavahini Corporation	Kandy(Hantana)	39																			O																						
7	12	Sri Lanka Rupavahini Corporation	Kandy(Primrose)	39																			O																						
8	12	Sri Lanka Rupavahini Corporation	Colombo	41																					O																				

Table 7: Overview of TV frequency usage in UHF Band IV and V (3 of 3)

UHF Television Channel Assignment in operational as at 28 September 2011 by TRCSL

No	ID	Name of the Broadcaster	Location	Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
				Channel utilisation ------>	4	3	4	3	4	4	1	3	4	4	3	5	1	1	3	1	3	0	4	5	5	2	1	4	0	2	1	3	2	4	5	4	3	1	1	3	0	2	0	1	0	1
9	12	Sri Lanka Rupavahini Corporation	Deniyaya	41																					O																					
10	12	Sri Lanka Rupavahini Corporation	Yatiyantota	43																							O																			
11	12	Sri Lanka Rupavahini Corporation	Kalutara-Hingulak	51																															O											
12	12	Sri Lanka Rupavahini Corporation	Colombo	52																																O										
13	12	Sri Lanka Rupavahini Corporation	Kalutara-Padhaga	52																																O										
14	12	Sri Lanka Rupavahini Corporation	Namunukula	52																																O										
1	13	Sumathi Holdings	Colombo	62																																										O
1	14	Television and Radio Network	Colombo	48																												O													
2	14	Television and Radio Network	Gongala	48																												O													
3	14	Television and Radio Network	Laggala	48																												O													
4	14	Television and Radio Network	Colombo	51																															O										
5	14	Television and Radio Network	Hunnasgiriya	53																																	O									
6	14	Television and Radio Network	Nayabedda	53																																	O									
1	15	Telshan Network (Pvt) Ltd	Badulla	21	O																																								
2	15	Telshan Network (Pvt) Ltd	Colombo	21	O																																								
3	15	Telshan Network (Pvt) Ltd	Gongala	26						O																																			
4	15	Telshan Network (Pvt) Ltd	Kandy	26						O																																			
5	15	Telshan Network (Pvt) Ltd	Ratnapura	26						O																																			
1	16	VIS Broadcasting (Pvt) Ltd	Colombo	29									O																																
1	17	Voice of Asia Network (Private) Limited	Gammaduwa	21	O																																							
2	17	Voice of Asia Network (Private) Limited	Gongala	23			O																																					
3	17	Voice of Asia Network (Private) Limited	Gammaduwa	31											O																														
4	17	Voice of Asia Network (Private) Limited	Colombo	32												O																													
5	17	Voice of Asia Network (Private) Limited	Kandy	35															O																										
6	17	Voice of Asia Network (Private) Limited	Nuwara Eliya	42																						O																			
7	17	Voice of Asia Network (Private) Limited	Colombo	46																										O														
8	17	Voice of Asia Network (Private) Limited	Nuwara Eliya	49																													O												

Table 8: Overview of TV frequency usage in UHF Band IV and V (reserved)

UHF Television Channel Assignment under reservation
as at 28 September 2011 by TRCSL

No	ID	Name of the Broadcaster	Location	Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
				Channel utilisation --->	2	2	2	0	0	1	0	0	0	0	1	0	0	1	0	0	0	2	0	0	0	0	0	1	3	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0
1	1	Asia Broadcasting Corporation	Kandy	21	R																																								
2	1	Asia Broadcasting Corporation	Ratnapura	21	R																																								
3	1	Asia Broadcasting Corporation	Kurunegala	22		R																																							
4	1	Asia Broadcasting Corporation	Nayabedda	22		R																																							
5	1	Asia Broadcasting Corporation	Badulla	23			R																																						
6	1	Asia Broadcasting Corporation	Hunnasgiriya	23			R																																						
7	1	Asia Broadcasting Corporation	Gammaduwa	26						R																																			
8	1	Asia Broadcasting Corporation	Jaffna	38																		R																							
9	1	Asia Broadcasting Corporation	Nuwara Eliya	38																		R																							
10	1	Asia Broadcasting Corporation	Gongala	45																									R																
11	1	Asia Broadcasting Corporation	Kokavil	45																									R																
12	1	Asia Broadcasting Corporation	Magalkanda	45																									R																
13	1	Asia Broadcasting Corporation	Colombo	56																																					R					
1	2	Dialog Television (Pvt) Ltd	Rajagiriya	44																							R																		
1	6	IWS Holdings (Pvt) Ltd	Jaffna	36																																									
1	8	MTV Channel (Pvt) Ltd	Jaffna	46																										R															
1	10	Power House Ltd	Jaffna	31											R																															
2	10	Power House Ltd	Kokavil	34														R																													
1	16	VIS Broadcasting (Pvt) Ltd	Colombo	47																											R															

Table 9: Overview of TV frequency usage in UHF Band IV and V (proposed)

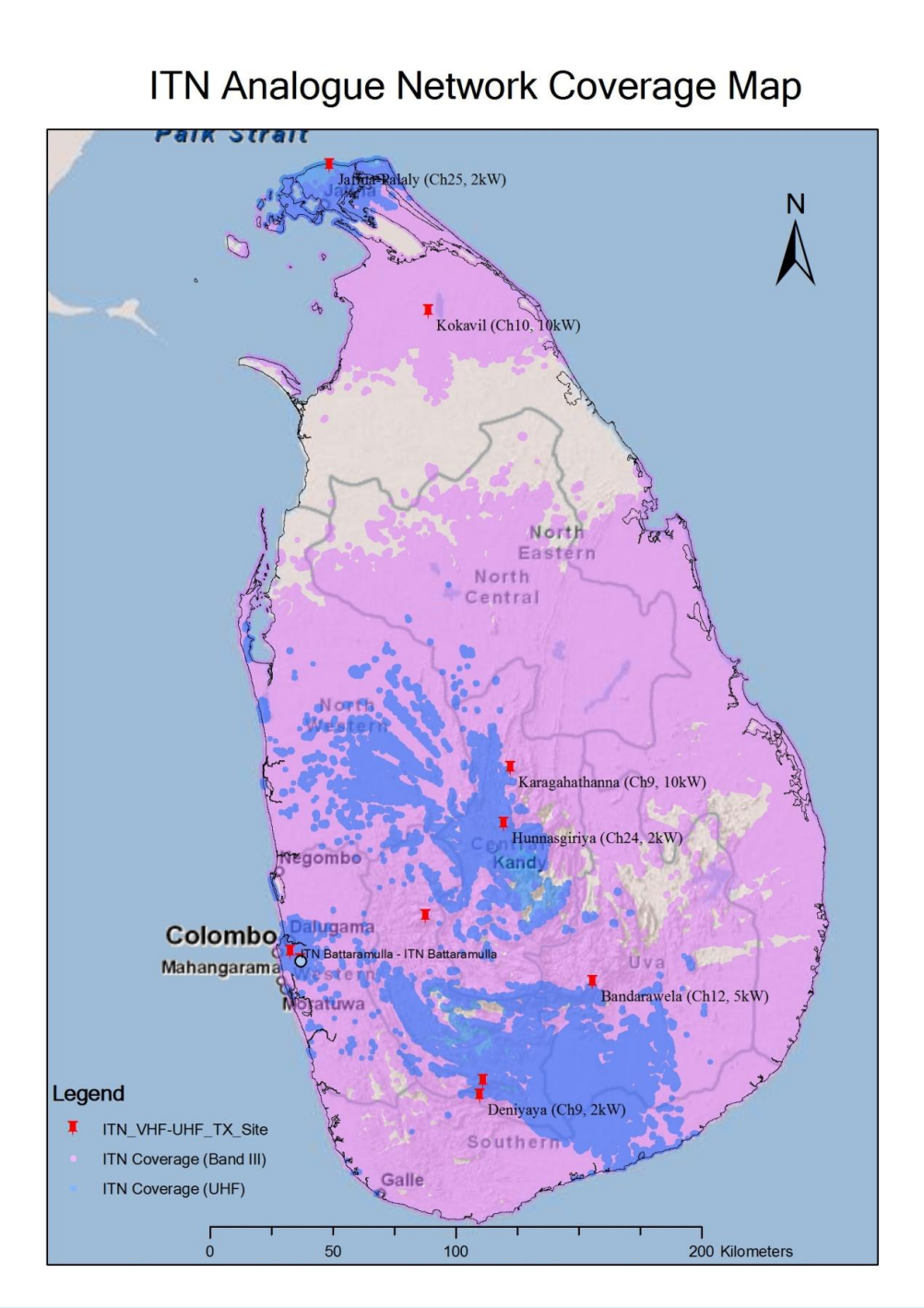
UHF Television Channel Assignment under proposal
as at 28 September 2011 by TRCSL

ID	Location	Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
			1	1	3	3	1	1	1	1	1	2	2	0	1	1	1	1	1	1	1	0	1	1	2	0	0	0	1	0	1	0	2	1	0	0	4	0	2	2	2	1	1	1
12	Padavi-Parakramapura	21	P																																									
3	Matugama	22		P																																								
8	Gongala	23			P																																							
12	Padavi-Parakramapura	23			P																																							
12	Palaly	23			P																																							
12	Jaffna	24				P																																						
8	Madukanda	24				P																																						
5	Nuwara Eliya	24				P																																						
8	Jaffna	25					P																																					
20	Colombo	26						P																																				
5	Jaffna	27							P																																			
20	Jaffna	28								P																																		
8	Nuwara Eliya	29									P																																	
7	Gongala	30										P																																
8	Kandy	30										P																																
20	Jaffna	31											P																															
21	Laggala	31											P																															
5	Jaffna	33													P																													
20	Jaffna	34														P																												
3	Madolsima	35															P																											
6	Jaffna	36																P																										
20	Jaffna	37																	P																									
20	Jaffna	38																		P																								
12	Jaffna	39																			P																							
5	Jaffna	41																					P																					
21	Nuwara Eliya	42																						P																				
12	Kokavil	43																							P																			
5	Nayabedda	43																							P																			
20	Colombo	47																											P														
7	Nuwara Eliya	49																													P												
12	Kokavil	51																															P										
8	Namunukula	51																															P										
3	Jaffna	52																																P									
21	Gongala	55																																			P							
21	Kandy	55																																			P							
12	Kokavil	55																																			P							
5	Yatiyantota	55																																			P							
12	Colombo	57																																					P					
12	Kokavil	57																																					P					
8	Kandy	58																																						P				
8	Namunukula	58																																						P				
12	Colombo	59																																							P				
12	Kokavil	59																																							P				
5	Deniyaya	60																																								P			
9	Nuwara Eliya	61																																									P		
5	Karagahatenna	62																																										P

The broadcasters, Sri Lanka Rupavahini Corporation (SLRC) and Independent Television Network Ltd. (ITN) provide more than 95 per cent of the population coverage. Both broadcasters are assigned with frequency channels in Band III and Band IV/V. Telshan Network (Pvt) Ltd. was assigned with frequency channels in Band I/III and Band IV. Other broadcasters are assigned with frequency channels in Band IV/V only.

Taking ITN as an example, Figure 2 illustrates location of the ITN transmitter site location and combined coverage map formed by six Band III stations and four UHF transmitter stations.

Figure 2: ITN combined coverage map formed by Band III and Band IV/V transmitter stations



Source: Author

2.2 Regulatory framework

The regulatory framework with regard to television broadcasting is shown in Table 10.

Table 10: Regulatory framework

Relevant legislation	Arrange/Covers	Regulatory body	Assigned rights
National Media Policy	Policy applies to the media and broadcasting	MMMI	Media/Content/Broadcast right
Sri Lanka Telecommunications Act No. 25 of 1991 amended by Act No. 27 of 1996	Legislation applies to the establishment and operation of radio frequency transmitters and broadcasting.	TRCSL	Spectrum right
Sri Lanka Rupavahini Corporation Act 6 of 1982 Sri Lanka Broadcasting Corporation Act	Laws and regulations are currently to regulate broadcasting content	MMMI	Contents/Broadcast right; Sri Lanka Rupavahini Corporation Act no. 6 of 1982 to be amended to incorporate Digital TV broadcasting services.
Issue of licences for DBNOs under the Telecommunication Act	Specify transmission and technical parameters with regard to technical quality Access and tariff of DBNO services A regulatory authority for broadcasting to resolve issues arising in implementing	TRCSL and MMMI	

Source: Production based on information provided by NRT of Sri Lanka

The main regulatory bodies are the Ministry of Mass Media and Information (MMMI) and the Telecommunications Regulatory Commission (TRCSL). With regard to the transition to digital television the following observations can be made:

1. Subsequent to a Cabinet decision on introducing digital television transmission in Sri Lanka, a subcommittee was appointed by the Secretary to the Ministry of Mass Media and Information to propose a suitable policy framework for the digitization of terrestrial television broadcasting in Sri Lanka. After the detailed study and deliberations the subcommittee submitted a report on drafting the policy framework to the Secretary to the Ministry of Mass Media and Information in August 2010. The report provides policy directives.
2. One of the policy directives introduces a new category of network operator to provide the service of delivering the content of the broadcasters to the viewers. The new category is termed Digital Broadcast Network Operators (DBNO).
3. The DBNO needs to set up the free-to-air (FTA) digital terrestrial television transmission network to accommodate all of current analogue TV licensees with the minimum number of DBNOs implying that the programme channels per DBNO would be the maximum possible. The subcommittee recommends using DVB-T2 because it can provide the highest data rate capacity.
4. The Ministry of Mass Media and Information (MMMI) and the Telecommunications Regulatory Commission of Sri Lanka (TRCSL) need to form the DBNO and regulation of access and tariff of DBNO services. TRCSL needs to issue licences for DBNOs under the Telecommunication Act and take care to specify transmission and technical parameters with regard to technical quality.

5. In the TRCSL UHF spectrum utilisation record of September 2011, a great number of analogue TV channels are operational and many UHF channels are reserved and proposed for the current TV broadcasters and any new TV licence holder. The great number of reserved and proposed channels will make the frequency planning difficult for DTTB and render the digital switch-over process more complex.

2.3 Digital switch-over objective

2.3.1 DTTB short and long term objectives

After discussion with NRT members, the digital switch-over (DSO) objectives for digital terrestrial television broadcasting are set out in Table 11.

Table 11: DTTB DSO objectives

No	Objective	Short term (1 year after analogue switch-off)	Long term (5-10 years after analogue switch-off)
1	Smooth transition from analogue to digital by means of using strategy driven and regional service approach. Target timeline of ASO End 2011 Provide DTTB transmission service in Northern Province; Mid-2012 Provide DTTB transmission service in Western Province; Mid-2014 DTTB service from all locations End-2015 Analogue shut off in Western Province End-2017 Complete analogue shut off	All analogue services converted to digital with same island wide coverage areas for all current analogue TV programme.	NRT will follow the direction from Ministry of Mass Media and Information; TRCSL will conduct the planning for digital dividend.
2	Issue system licence for content distribution by the network operator Summary of the DBNO Introduce Digital Broadcast Network Operator (DBNO) to provide service in delivering current broadcasters' content to the viewers. Assign two frequencies in UHF Ch41 and Ch43 to form two multiplexes to carry 28 programmes initially for the first DBNO. Additional frequencies should be assigned to the DBNO for island wide coverage. No additional DBNO licence should be issued before completion of island wide coverage for reason of no sufficient frequency before analogue switch-off.	Second DBNO licence will be issued in condition of frequency spectrum available after ASO. Assignment of frequencies for FTA DBNOs take precedence over subscription based DBNOs.	NIL
3	The DBNO should set up the free-to-air DVB-T2 digital terrestrial television transmission network.	NIL	NIL

No	Objective	Short term (1 year after analogue switch-off)	Long term (5-10 years after analogue switch-off)
4	Issuance of TV licences to the broadcasters based on condition relating to the content, the broadcasters should make use of the services of a DBNO for the delivery of their television programme to the viewer. All existing broadcasters should be instructed that all channels should be made available as a mandatory requirement in the digital platform constructed by the respective DBNOs from the very inception.	NIL	NIL
5	Solution to issues arising out of practical difficulties in implementing the policy. The regulator/Authority shall take responsibilities on, DBNOs maintain specified availability levels in disaster recovery facilities. The analogue services for satellite and cable television transmission to fall in line with the digitalization plan must be addressed. It is recommended to stop issuing of new media licence for analogue television broadcasting. The expansion for current analogue transmission infrastructure should be terminated with immediate effect.	NIL	NIL
6	Tax policy To provide import tax concessions for broadcast quality digital production, transmission and customer premises equipment (CPE) for a specific period of time. CPE, such as digital TV receiver and set top boxes needs some subsidizing.	From 2012 to 2015, the tax concessions will be revised to promote current broadcasters.	From 2012 to 2018, the tax concessions will be revised for the CPE.
7	Frequency planning before ASO Before ASO, conduct full scale frequency planning in order to sort out possible island wide frequency channel in supporting framework of transition from analogue to DTTB.	The outcome of frequency planning will be used for the 2nd DBNO system licence and other possible digital broadcasting services.	Can accommodate more DBNO licences.
8	Better picture quality	HDTV quality up to the market in condition of more island wide multiplex available after ASO	3D TV up to the market
9	More digital broadcasting services	NIL	MTV and/or Digital Radio up to the market
10	Digital dividend	Draft to be discussed	Restacking UHF Spectrum

Source: Production based on information and discussion with NRT of Sri Lanka

With reference to the DTTB DSO objective, some observations are given below.

1. DSO objective 1: The target timeline aims to provide DVB-T2 pilot transmission service in Northern and Western Provinces by end 2011 and mid-2012 respectively. In terms of project progress and technical consideration:
    a. It is assumed that the pilot DVB-T2 transmission equipment setup in Kokavil site should be completed on time and is most likely available for the DVB-T2 deployment before end 2011 in the Northern Province. Before forming the DBNO, the State TV broadcast network operator, SLRC was assigned to undertake the engineering work at Kokavil that is one of the proposed eight DTTB principal sites.
    b. On the other hand, the Western Province DVB-T2 coverage is mainly provided by a new developed transmitter site located in urban area of Colombo District in accordance to NRT's proposal. The DVB-T2 transmission facilities and infrastructure, e.g. station building, antenna tower and site development are still in progress. There are at least three key issues are recommended to take into account:
        i. Is the transmitter site located in Colombo District compatible with the SFN transmitted from other principal DTTB stations located in Yatiyantota and Piduruthalagala sites? The SFN coverage prediction using radio planning software indicates that the SFN overlapping area in Colombo District with the SFN coverage from Yatiyantota and Piduruthalagala sites will cause self-interference because part of the SFN overlapping area in Colombo exceeds the guard interval, see Annex 7 for details.
        ii. Is the site development in Colombo DTT site ready for DVB-T2 equipment facilities setup and meet the deployment on time, i.e. end of the second quarter of 2012?
        iii. Will the Colombo sites be designed as a multiplex centre operated by the first DBNO?
2. DSO objective 2: The system licence for the first DBNO is scheduled to be issued by mid-2012. The critical factors are:
    a Does the direction from Ministry of Mass Media and Information agree to the proposal to use system licences for DBNO by end 2011 or earlier?
    b Can the progress of the output document from the licensing policy and regulation phase 2 of the roadmap be completed in a timely manner?
3. DSO objective 3: The DBNO should set up the FTA DVB-T2 digital terrestrial television transmission network after the system licence is issued (by mid-2012) and has to deploy DTTB services by mid-2014 from all eight proposed DTTB sites including the pilot DVB-T2 sites at Kokavil and Colombo. However, these two pilot sites will be put into service earlier, by end 2011 and mid-2012 respectively, before forming the first DBNO. Therefore the NRT and TRCSL have to undertake the engineering design work in advance and ensure the SFN coverage to be compatible with the remaining six principal DTTB sites' coverage.
4. DSO objective 4: Existing broadcasters should be instructed that all analogue programme contents should be made available as a mandatory requirement in the digital platform through the respective DBNOs from the beginning. Before actually deciding the licensing regime (to include licensing framework, conditions and procedures in phase 3 of the roadmap), the NRT can organize a market consultation to check the validity and market support for its plans. It is noted that forming the first NRT does not include stakeholders from all current broadcasters.
5. DSO objective 7: Frequency planning before ASO is a critical issue. The reasons given in Figure 12 DTTB policy development phase 1 of the roadmap for the regulator (2: Determining the current available spectrum for DTTB (functional building blocks 2.3 and 2.4)) indicate that the frequency planning will provide clear and updated records of current frequency channel use in UHF Band IV and V spectrum that will enable the NRT to develop a DTTB policy document.

2.3.2 MTV objectives

Mobitel (Pvt) Ltd. was issued with a mobile TV licence using 3.5G HSUPA (High Speed Uplink Packet Access) technology to provide streaming cellular video. In the long term, NRT is of the opinion that MTV should be considered after analogue switch-off and is subject to a market driven approach. The needs of MTV networks are not included in this report.

2.3.3 Digital radio objectives

In the current market, a total of 22 radio broadcasters are in operation. The NRT considers that digital radio will be reviewed after analogue switch-off in terms of long-term DSO. Band I and III for digital radio can be released after ASO. Consequently, this report does not include digital radio.

3. National Roadmap

After having determined the aim of the roadmap as described in section 2, this section will describe the roadmap itself starting with an introduction on the concept of a roadmap, followed by the description of the construction of the roadmap in section 3.2. Section 3.3 covers the functional building blocks of the Sri Lanka roadmap. Section 3.4 describes each of the phases of the Sri Lanka roadmap.

The Sri Lanka roadmap will deal with digital terrestrial broadcasting only. Mobile TV is not included because MTV is categorized as a long term DSO objective.

3.1 Roadmap concept

A *roadmap* is a management forecasting tool and concerns the implementation of strategy and is related to project planning.

A roadmap matches short-term and long-term goals and indicates the main activities needed to meet these goals. Developing a roadmap has three major uses:

1. It helps to reach consensus about the requirements and solutions for transition to DTTB.
2. It provides a mechanism to help forecast the key milestones for the transition to DTTB.
3. It provides a framework to help plan and coordinate the steps needed for transition to DTTB.

A roadmap consists of various phases, normally related to preparation, development, and implementation of the strategy. A roadmap is often presented in the form of layers and bars, together with milestones on a time scale.

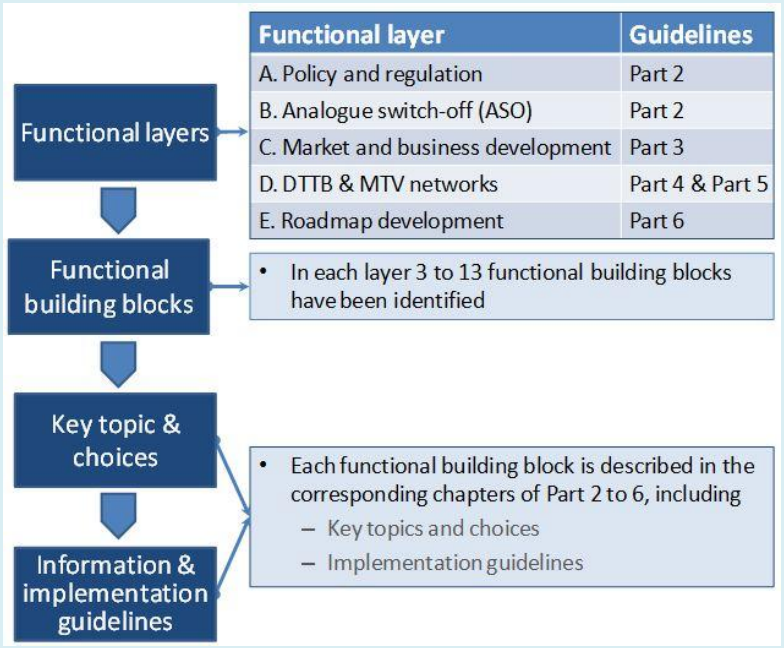
3.2 Roadmap construction

Part 6 of the ITU Guidelines for transition to digital television describes a method for developing a roadmap. A set of generic roadmaps regarding the whole process of transition to DTTB and introduction of MTV is also given. The methodology described in Part 6 of the ITU Guidelines will be followed in the development of the Sri Lanka roadmap.

The basis is a functional framework consisting of five layers (see Figure 3).

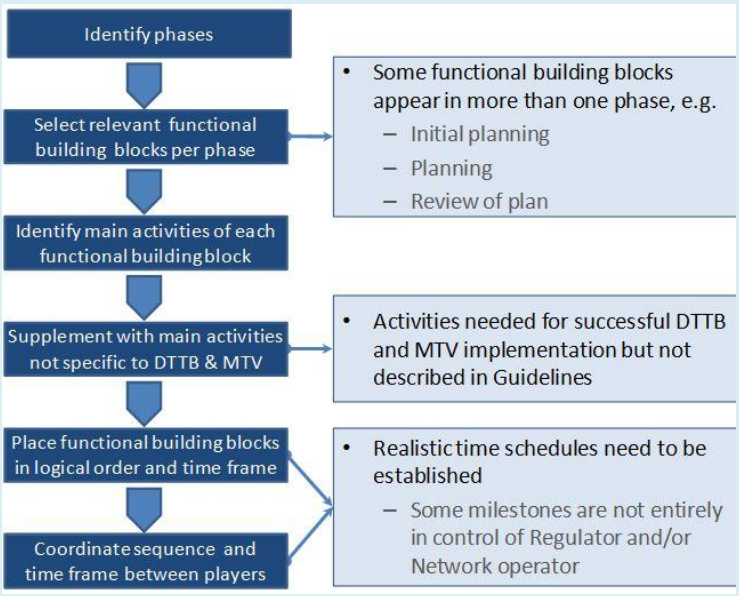
Each layer consists of a number of functional building blocks. In each functional building block key topics and choices have been identified. The roadmap is constructed by defining the phases and by placing the relevant functional blocks in each phase in a logical order and in a time frame. For each of the functional building blocks, the decisions already taken and the main activities to resolve not yet decided key topics and choices are identified. Figure 4 illustrates the construction process.

Figure 3: Functional framework



Source: Adapted from ITU Guidelines

Figure 4: Roadmap construction



Source: Adapted from ITU Guidelines

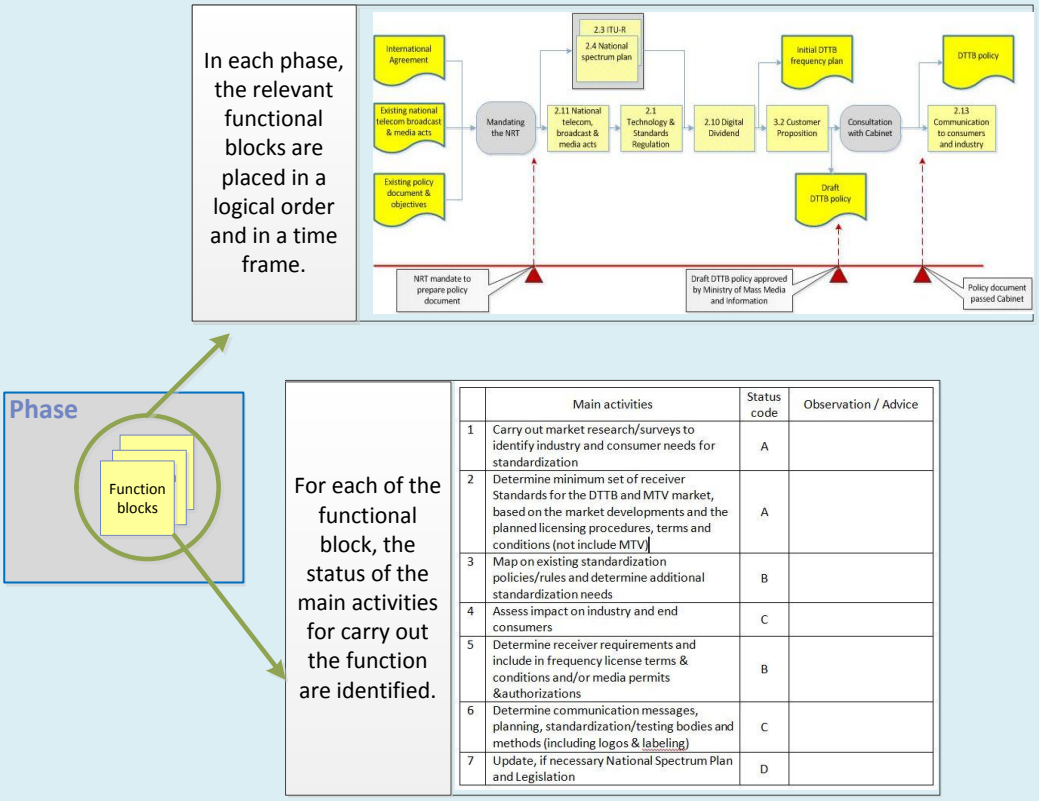
The result is a roadmap that consists of three levels:

1. Phases of the roadmap with the selected functional building blocks per phase.
2. For each phase, the functional building blocks places in a logical order and time frame.

3. For each functional building block in a phase, the status on key topics and choices and the main activities to be carried out.

The roadmap structure is illustrated in the Figure 5.

Figure 5: Roadmap structure



	Main activities	Status code	Observation / Advice
1	Carry out market research/surveys to identify industry and consumer needs for standardization	A	
2	Determine minimum set of receiver Standards for the DTTB and MTV market, based on the market developments and the planned licensing procedures, terms and conditions (not include MTV)	A	
3	Map on existing standardization policies/rules and determine additional standardization needs	B	
4	Assess impact on industry and end consumers	C	
5	Determine receiver requirements and include in frequency license terms & conditions and/or media permits &authorizations	B	
6	Determine communication messages, planning, standardization/testing bodies and methods (including logos & labeling)	C	
7	Update, if necessary National Spectrum Plan and Legislation	D	

Source: Adapted from ITU Guidelines

3.3 Functional building blocks relevant to the Sri Lanka situation

Of the five functional layers shown in Figure 3, layer E is "roadmap development" and hence covered by this report. The other functional layers, A (Policy and Regulation, B (ASO), C (Market and Business Development) and D (Networks), contain in total of 38 functional building blocks (see Figure 6 and Figure 7 for NRT and operator roadmap). Out of the 38 functional building blocks, 24 blocks were selected to construct the Sri Lanka roadmap for NRT and 14 blocks were selected to construct the Sri Lanka roadmap for operators. In this report, *operator* means the proposed DBNO and current TV broadcasters.

The roadmap covers:

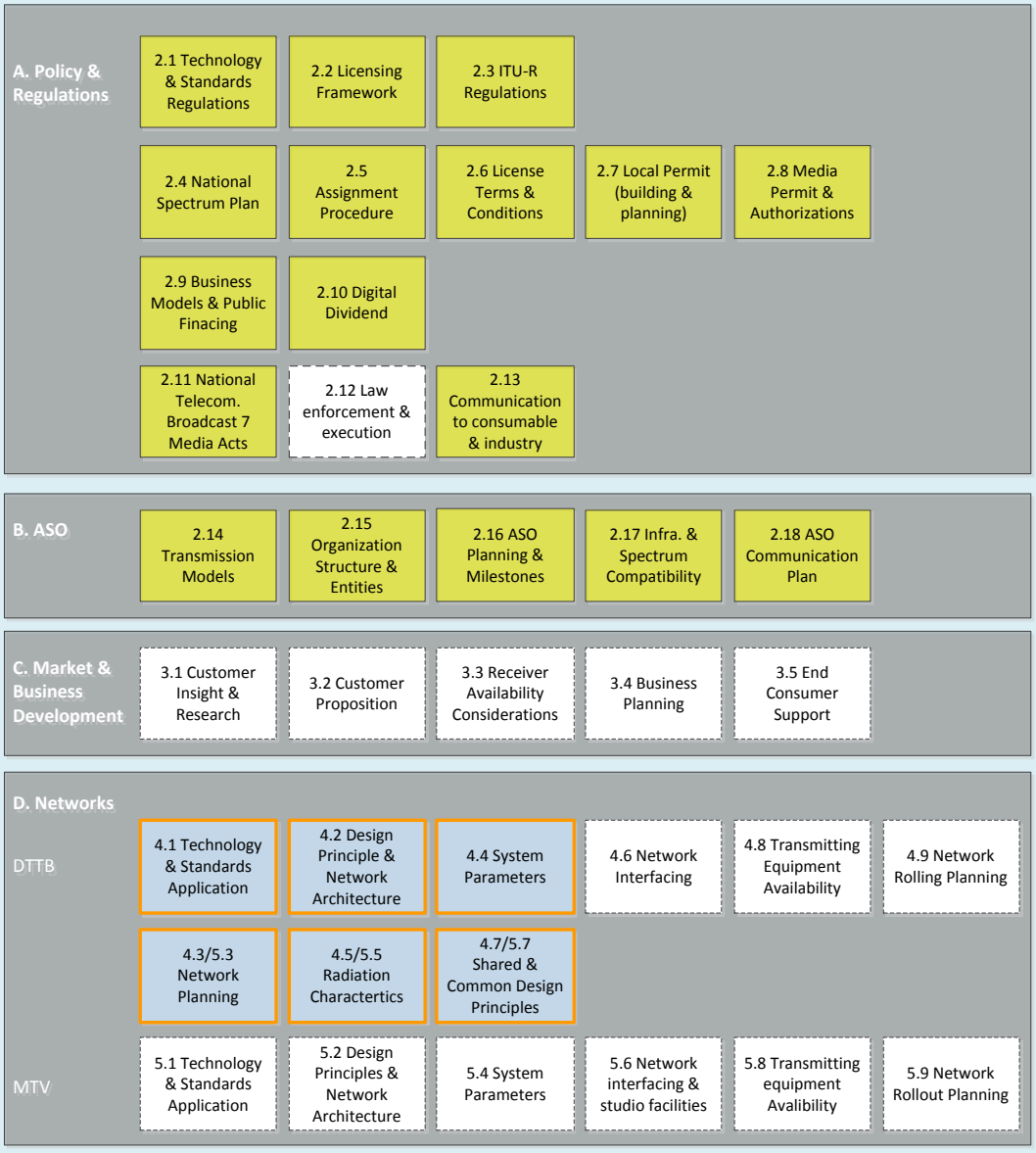
- the short DSO objectives (until one year after ASO) as defined in Table 11; and
- activities managed by NRT.

Figures 6 and 7 show various types of functional building blocks:

1. **White blocks with dashed frame:** These blocks are not included in the Sri Lanka roadmap.
2. **Yellow blocks without frame:** These blocks are included in the Sri Lanka roadmap and will be managed by NRT.
3. **Blue blocks with an orange frame:** These blocks are included in the Sri Lanka roadmap and will be managed by NRT before issuing the system licence to the DBNO.

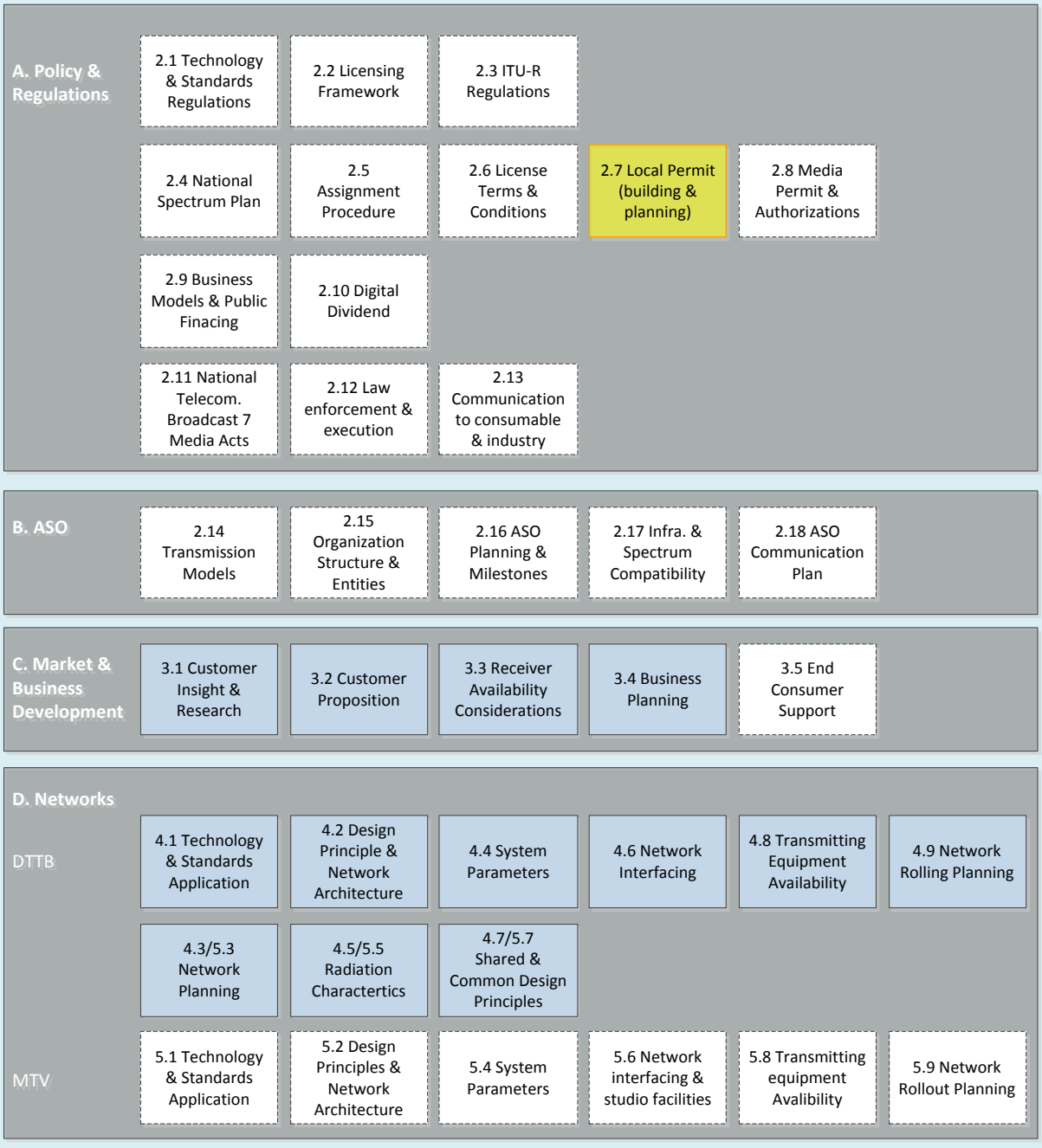
4. **Blocks with orange frame:** local building and planning permits need to be acquired and will be managed by the operator (DBNO).
5. **Blue blocks without frame:** These blocks are included in the Sri Lanka roadmap and will be managed by the operator (DBNO).

Figure 6: Selected functional building blocks (yellow) in the Sri Lanka roadmap for the regulator



Source: Adapted from ITU Guidelines

Figure 7: Selected functional building blocks (blue) in the Sri Lanka roadmap for operators (DBNO)



Source: Adapted from ITU Guidelines

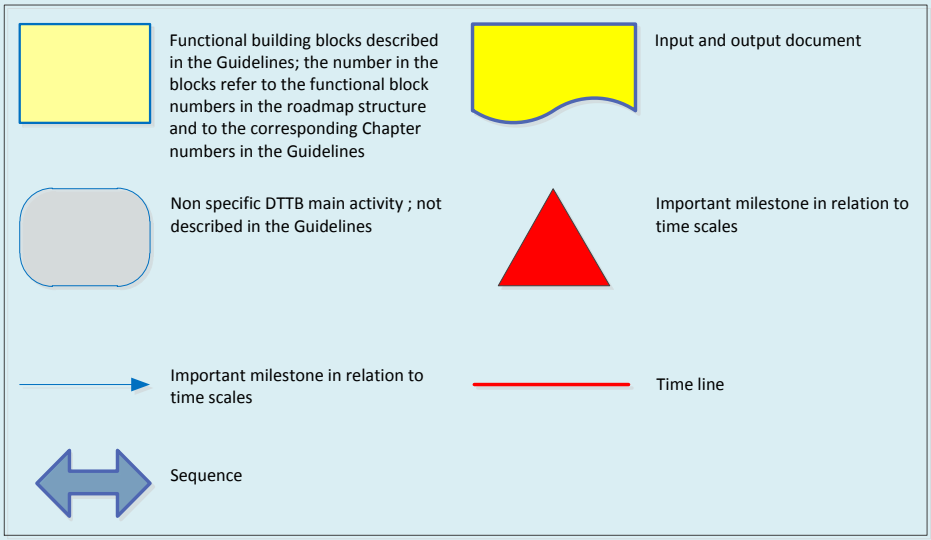
3.4 Description of the Sri Lanka roadmap

In this section the overall roadmap for Sri Lanka is outlined. The roadmap is segmented in several phases. After presenting the overall roadmap outline (subsection 3.4.1), each phase is discussed in subsections 3.4.2 to 3.4.9.

The detailed activities and considerations for each phase and its associated functional building blocks are included in Annexes 1 to 6 of this report.

The following subsections contain a number of figures. The symbols used in these figures are illustrated in Figure 8.

Figure 8: Symbols used in roadmap figures

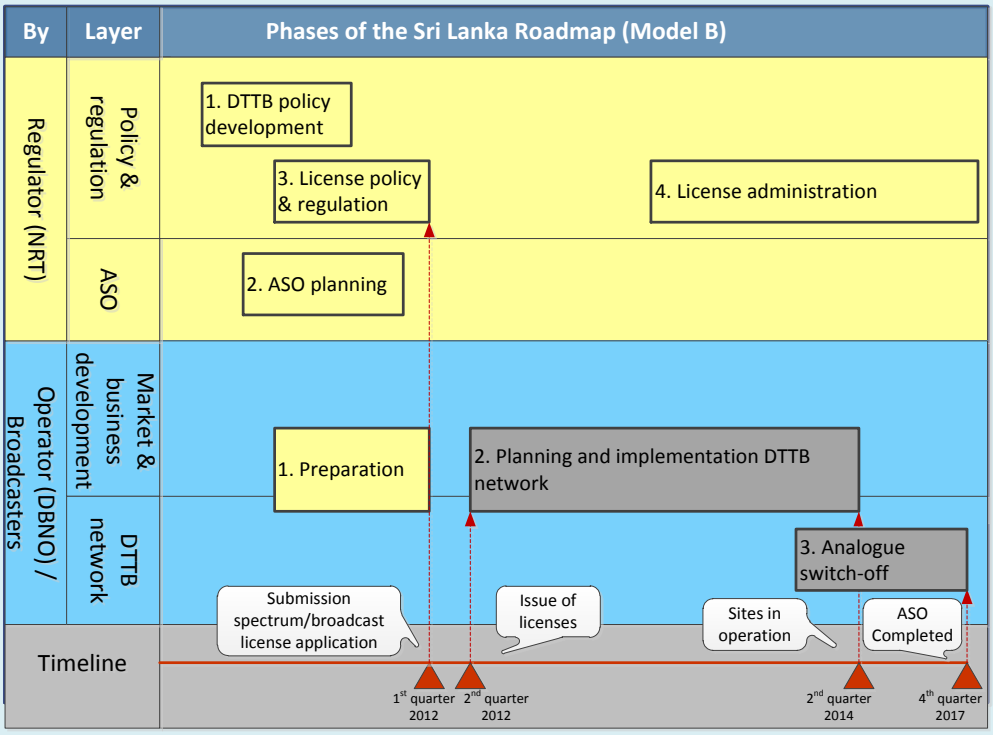


Source: Adapted from ITU Guidelines

3.4.1 Overall roadmap

As discussed in the first NRT meeting, Sir Lanka wants to switch-off all analogue terrestrial television services by the end of 2017. Figure 9 is a top level Sri Lanka roadmap under model B.

Figure 9: Top level Sri Lanka roadmap under Model B

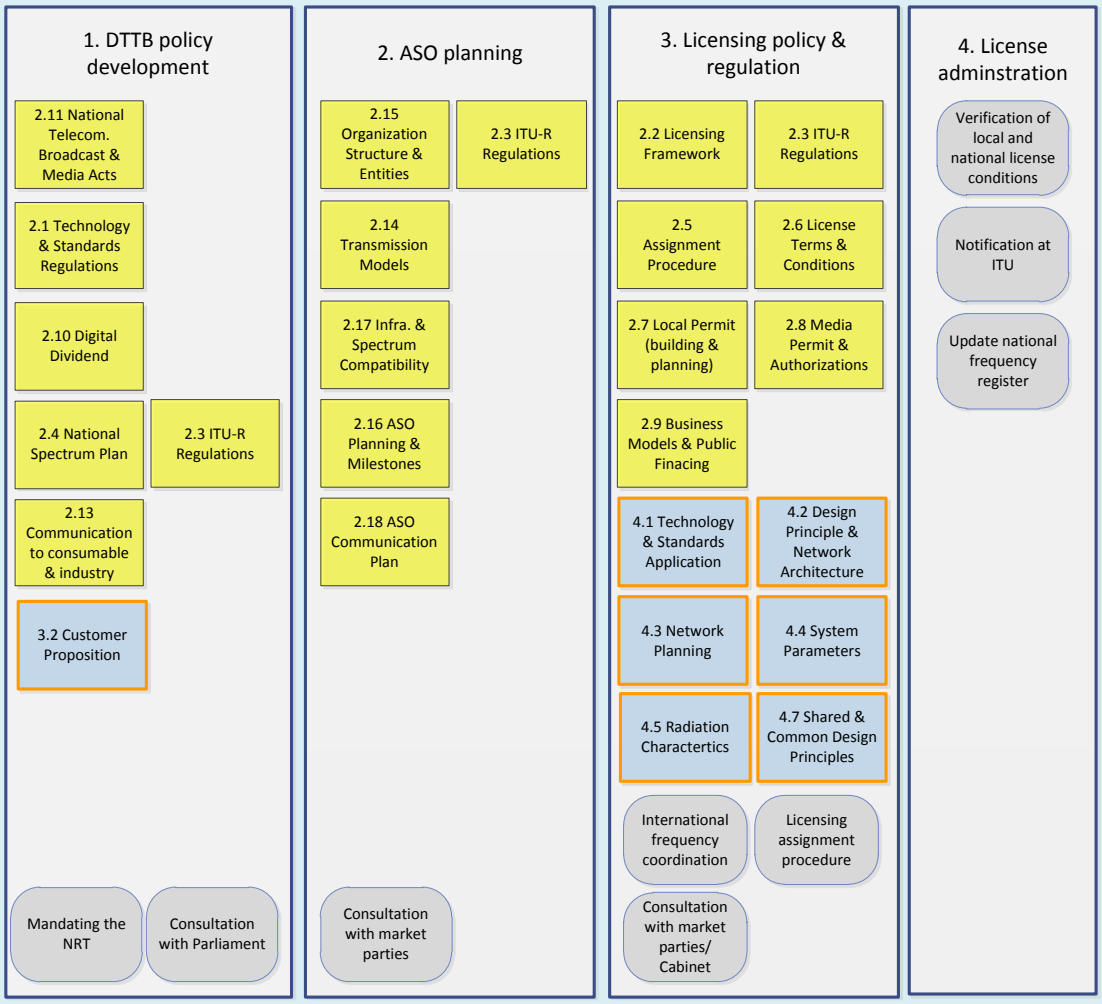


Source: Adapted from ITU Guidelines

Functional blocks in each phase

Figure 10 shows the functional building blocks to be included in Sri Lanka based on Model B selected by NRT. Please note that the yellow shaded blocks correspond to chapters in the ITU Guidelines. The blue shaded blocks with orange outline are the functional blocks that the regulator needs to undertake before forming (issuing a system licence) the proposed operator (DBNO). The grey shaded blocks are not described in the ITU Guidelines. These blocks represent activities that are not specific to the introduction of digital terrestrial television services.

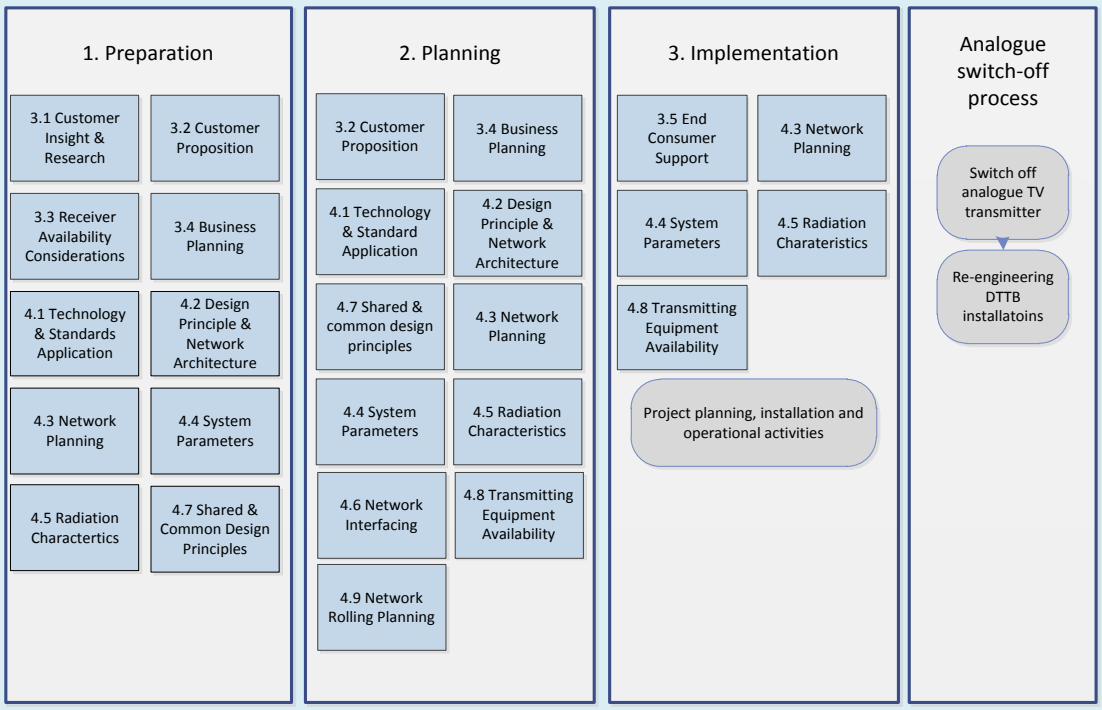
Figure 10: Functional blocks in each phase for the regulator



Source: Adapted from ITU Guidelines

Figure 11 shows the functional building blocks to be included for the operator (DBNO).

Figure 11: Functional blocks in each phase for operators (DBNO)



Source: Adapted from ITU Guidelines

3.4.2 Phase 1 DTTB policy development for the regulator

The DTTB policy development phase of the roadmap is aimed at getting the DTTB policy objectives agreed at a political level. Political consensus and commitment lies at the heart of any successful ASO project. Politicians will have to commit to the ASO objectives, deadlines, necessary budget and endorse the establishment of NRT with a clear mandate to plan and execute the ASO process.

Inputs

The inputs for this phase are existing regulatory framework (see Table 10) and objectives (see Table 11), and policy documents (e.g. the Sir Lanka Broadcasting Corporation Acts currently regulate broadcasting content; Sri Lanka Telecommunications Act No. 25 of 1991 amended by Act No. 27 of 1996, currently apply to the establishment and operation of radio frequency transmitter for broadcasting).

Outputs

The key output of the DTTB policy development phase 1 is a politically endorsed DTTB policy document to be published to the general public (in the 'Official Gazette'). Such a DTTB policy document typically includes the following items:

- Policy justification: This includes the benefits and necessities of introducing DTTB services in Sri Lanka (including the allocation of the digital dividend).
- The legal framework: This entails the legal basis (and any necessary changes) for the DTTB service introduction and the ASO.
- Technical framework: Detailing the available spectrum for the DTTB services and the current spectrum in use by existing broadcasters.
- Start and end date of ASO process: These dates have to be exact as to inform the general public and the industry accurately.

- The principle ASO model: This should be simulcasting as recommended in the subcommittee draft report
- DTTB services: Describing at a high level which current television services and additional content/services will be distributed on the DTTB platform and at which districts/provinces these service will be made available in stages.
- DTTB standards: What standards (for example the transmission and compression standard) will be mandatory and the justification.
- Funding principles: The intention to include selected ASO costs in the government budgets and the way it is going to be funded.
- Communication and Plan of Action: Outline of how viewers (and other stakeholders) will be informed about the ASO process and the plan of action with major regulatory and operational milestones (e.g. the establishment date of NRT, the date of when the Broadcast Act will be changed/updated, the decision on the assignment of frequency channel to current or new TV broadcasters, allocation of the digital dividend, stops any further issue of new media licences for analogue television broadcasting. The expansion or new assignments for current analogue transmission infrastructure in the Western Province should be terminated, etc.).

For an example of a DTTB policy document please refer to "Strategy for Switchover from Analogue to Digital Broadcasting of Radio and Television Programs in the Republic of Serbia" as published in the Official Gazette of the Republic of Serbia, No. 55/05, 71/05 – correction 101/07, the Government of the Republic of Serbia on 2 July 2009[15].

Roadmap

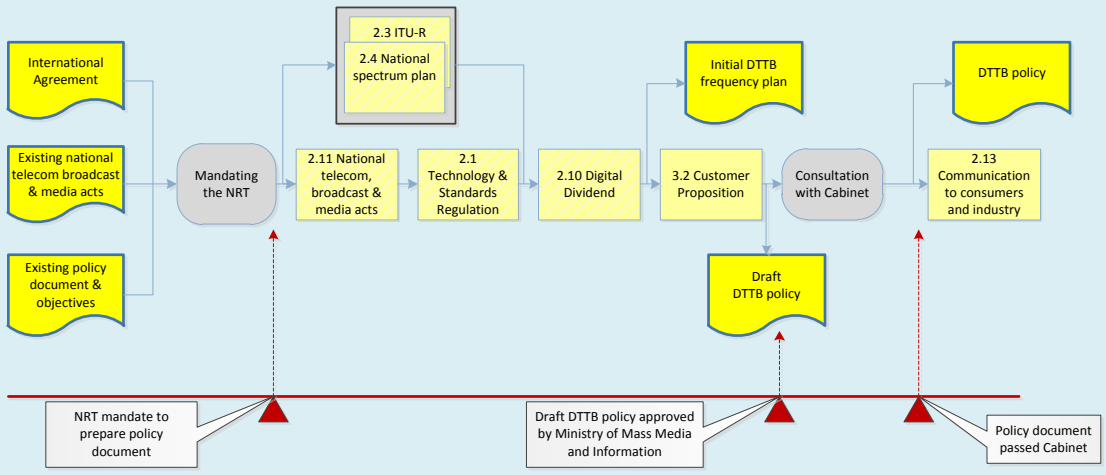
The roadmap of the DTTB policy development in phase 1 for the regulator and the associated functional building blocks is shown in Figure 12. The decisions taken, partly taken and not yet taken on the key topic and choices regarding phase 1 of the roadmap and the activities are indicated in Annex 1.

As can be derived from Figure 11, the following steps (i.e. functional building blocks and non-DTTB specific activities) are included in phase 1 of the roadmap for the regulator:

1. Mandating the NRT: Although the NRT has been formally established, its mandate should be checked. In order to deliver the DTTB policy document, it should have a clear mandate to do so. After this policy document has been validated by the Cabinet, the NRT mandate can be extended to prepare, plan and execute the roadmap. In phase 1 of the roadmap the NRT can have a limited membership. At the second phase of the roadmap (ASO planning) the NRT membership can be extended to include all stakeholders in the DTTB value chain (and structured in line with the implementation guidelines of functional building block 2.15 in the ITU Guidelines).

[15] Document can be download from www.itu.int/ITU-D/tech/OLD_TND_WEBSITE/digital-broadcasting_OLD/Bulgaria_Assistance_Transition/Serbia/Serbia_Web.pdf, and www.irex.rs/attachments/130_Strategy%20for%20Switchover%20from%20Analogue%20to%20Digital%20Broadcasting.pdf

Figure 12: DTTB policy development phase 1 of the roadmap for the regulator



Source: Adapted from ITU Guidelines

2. Determining the current available spectrum for DTTB (functional building blocks 2.3 and 2.4): A clear and updated record of current frequency channel use in UHF Band IV and V spectrum will enable the NRT to develop a DTTB policy document. As discussed during the first visit and further clarification with TRCSL about utilisation of frequency channel allocation, the available spectrum for DTTB services should be clarified (see section 4.1), taking into account:
   a. The decision and policy on proposed and reserved frequency channels for current broadcasts.
   b. The new frequency channel assignment for current broadcasters to expand / improve analogue signal coverage and/or set-up new analogue TV networks by broadcasters issued with new TV licences in 2011.
   c. The assignment of three frequency channels initially for a DBNO to operate on regional single frequency networks (SFN) for simulcast current analogue TV programmes in DTTB. Six frequency channels will be required if the proposal of two DBNOs is preferred.
   d. In addition to providing simulcast in SDTV using two regional SFN multiplexes, HDTV and other added value services should be explored if more frequency channels are available following the outcome of the DTTB transmission network coverage and frequency planning based on DVB-T2 technology.
3. Checking compliancy with current legislation and identifying required changes (functional building block 2.11): A first assessment should be carried out of what parts of the current legislation will be impacted by the introduction of DTTB services. Table 10 in this report and Table 2.11.1 in the ITU Guidelines provide a good starting point for this assessment. At this first phase of the roadmap, the assessment is focused on identifying the areas that might be impacted, how required changes can be achieved (e.g. legal and parliamentary procedures) and the time this will take. This assessment will then provide input for the plan of action (as part of the DTTB policy document). During the third phase of the roadmap (i.e. determining the DTTB regulations), specific DTTB regulations are defined (e.g. the licensing framework and procedures), a further detailed assessment of required changes may be necessary.
4. Selecting the transmission standard (function building block 2.1): Before forming the NRT, a subcommittee was appointed by the Secretary to the Ministry of Mass Media and Information to propose a suitable policy framework for the digitalization of terrestrial television broadcasting in Sri Lanka.

The subcommittee decided to use DVB-T2 as the DTTB standard in Sri Lanka for two reasons:

a. DVB-T2 is more advanced digital terrestrial transmission system offering higher efficiency, robustness and flexibility, and

b. the high bit rate of DVB-T2 make it currently the only DTTB standard that can provide simulcast for all current analogue TV programmes in a limited frequency channel.

5. Deciding the digital dividend (functional building block 2.10): At this phase it should be decided what digital dividend will become available for other services than broadcasting services as specified in the long term digital switch-over (DSO) objectives. Introduction of new mobile TV services, digital radio and high quality TV services might fit into the economic development agenda of Sri Lanka. An initial DTTB frequency plan is the output document of this phase based on current operational frequency channels and review results on proposed and reserved frequency channels under a scenario of assignment or non-assignment to current broadcasters.

6. Determining the first customer proposition (functional building block 3.2): Because the DBNO provides a common DTTB transmission platform (multiplex operator, content distributors and service providers) for all current TV broadcasters as part of the ASO plan, the customer proposition will be important in terms of the policy document.

7. Consultation with Cabinet: In this step a draft DTTB policy document is offered to the Ministry of Mass Media and Information for approval before consulting the Cabinet. This might include many consultation sessions, extensive lobbying and several revisions. Sufficient time should be planned for these activities. It should be noted that in this set-up of the roadmap, the DTTB policy document should leave room for the NRT to further detail the customer proposition, frequency plan (including the service planning process) and ASO plan (including the organizational structure, budget and planning). After any simplification/adjustments, the DTTB policy document (including the customer proposition) can then be published in the Official Gazette as a first communication to the general public and television industry.

8. Informing the public and communication to consumers and industry (functional building block 2.13): If the DTTB transmitter site is not co-located at the current analogue TV transmitter sites, the viewers' receiving antenna will need to be adjusted to obtain optimised DTTB reception performance especially in the Colombo District. The ITU Guidelines (see 2.13.3 Implementation guidelines) provide guidance on government-led communications to end-consumers and the industry.

3.4.3 Phase 2 ASO policy planning for the regulator

The second phase of the Sri Lanka roadmap is aimed at providing a detailed insight into the roles and responsibilities of the various involved parties, the process of transitioning from analogue to digital terrestrial television broadcasting, the milestone planning, and the communication/support process. The ASO planning phase also services the purpose of getting support from various involved market parties and the Cabinet.

Inputs

The key input for this phase is the DTTB policy document passed by Cabinet. As shown in Figure 13 in this report the second phase of the roadmap is the ASO planning stage for the regulator.

Outputs

The main output for the ASO planning phase is the ASO plan.

The ASO plan describes in detail the transition process from analogue to digital. The applied ASO transition model (see functional building block 2.14) in Sri Lanka is simulcast of current free-to-air (FTA) TV programmes in the common DTTB transmission platform, including the details about which services can be received, the reception conditions and areas covered.

ASO planning and milestones (see functional building block 2.16). This describes when the customer proposition will be made available and how this proposition will be provided.

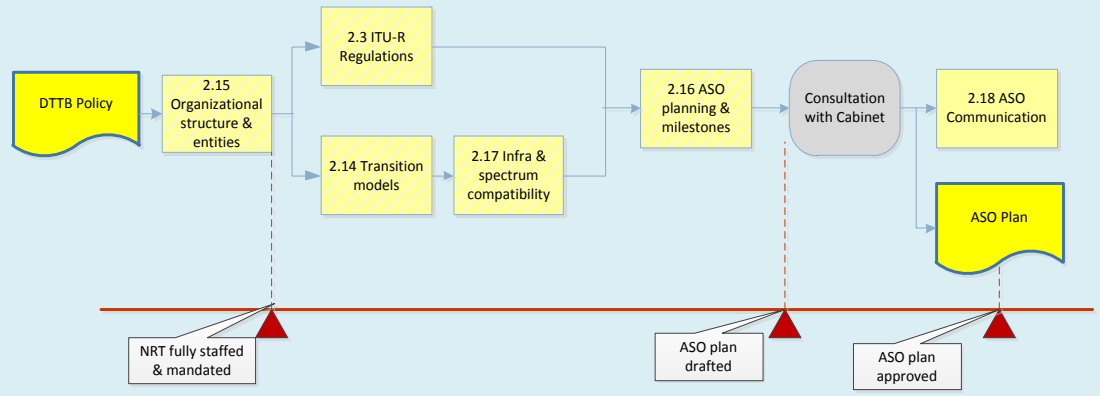
As indicated in the ITU Guidelines, this planning comprises several work streams or result paths, including:

- communications (further detailed in functional building block 2.18 ASO Communication);
- device producers and delivery;
- network plan and rollout (includes DTTB service delivery details);
- consumer and market monitoring;
- regulation and licensing (further detailed in phase 3 of the roadmap);
- financial and installation support.

Roadmap

The roadmap of the ASO planning phase and the associated functional building blocks is shown in Figure 13. The decisions taken, partly taken and not yet taken on the key topic and choices regarding phase 2 of the roadmap are indicated in Annex 2.

Figure 13: ASO planning phase 2 of the roadmap for the regulator



Source: Adapted from ITU Guidelines

As shown in Figure 13, the following steps are included in the second phase of the roadmap:

1. Establishing the organizational structure and participating entities (see functional building block 2.15): The participating parties and their responsibilities in the ASO planning process might be politically sensitive and needs further approval. In this step the reporting structure and escalation procedures should be clarified so that the NRT can efficiently operate and manage the ASO process.
2. Determining an initial transition model (see functional building block 2.14): In the first phase of the roadmap a first understanding of the available spectrum was established. In this phase of the roadmap, the NRT took the decision to recommend ASO with simulcast to meet the current situation of TV broadcasting market in Sri Lanka. Subsection 2.14.4 of the ITU Guidelines provides implementation guidelines for the ASO transition models.
3. Determining the infrastructure and spectrum compatibility (see functional building block 2.17): Infrastructure and spectrum incompatibility is likely to occur in the ASO process and should be addressed in the network planning prior to actual execution of the ASO process. Incompatibility can happen in both the transmitter infrastructure as well as in the available spectrum. The main incompatibility issues may include:
    a infrastructure or network facilities; and

b spectrum, i.e. in a (limited) geographical area where the digital and analogue frequencies cannot coexist. Subsection 2.17.2 of the ITU Guidelines provides guidance (implementation guidelines) to resolve the problems of infrastructure and spectrum incompatibility.

4. Drafting ASO planning and milestones (see functional building block 2.16): The NRT has decided the target timeline of ASO as mentioned in 2.3.1 of this report.
5. Consultation with Cabinet: In this step a draft ASO plan is sent for Cabinet approval (with several options). Again this might include many consultation sessions, extensive lobbying and several revisions. Sufficient time should be planned for these activities.
6. Finalization of the ASO plan and the detailed ASO communication plan (see functional building block 2.18): After having the ASO plan approved by Cabinet, it can be finalized for the selected scenario. This ASO plan will act as the working document for the NRT which will be continuously revised and updated. It will also include the ASO planning on the basis of which the ASO implementation can commence. As discussed previously, one work stream or result path of the ASO planning includes the ASO communication. Following the guidance provided in the ITU Guidelines (functional building block 2.18) a detailed strategy for informing/supporting the viewers and industry can be developed.

3.4.4 Phase 3 Licensing policy for regulation

The objective of this third phase of the Sri Lanka roadmap is to have the required DTTB licences defined and the associated licensing procedure and planning published. In this way, clarity is provided to interested market parties to operate on the Sri Lanka DTTB market. It also serves the purpose of ensuring uninterrupted broadcasts, free of interference from other spectrum users.

Inputs

The input data for this phase are the DTTB policy document resulting from the first phase of the roadmap and the ASO plan resulting from the second phase. As indicated in Figure 9, the third phase may start in parallel with the execution of phase 1 and 2. For example, the NRT could start working on the activities in this phase before the DTTB policy document and ASO plan have been validated by Cabinet. Such an approach might entail some later changes/revisions of the resulting documents.

Outputs

This third phase has the following output documents, of which the latter two might be published in the Official Gazette, including:

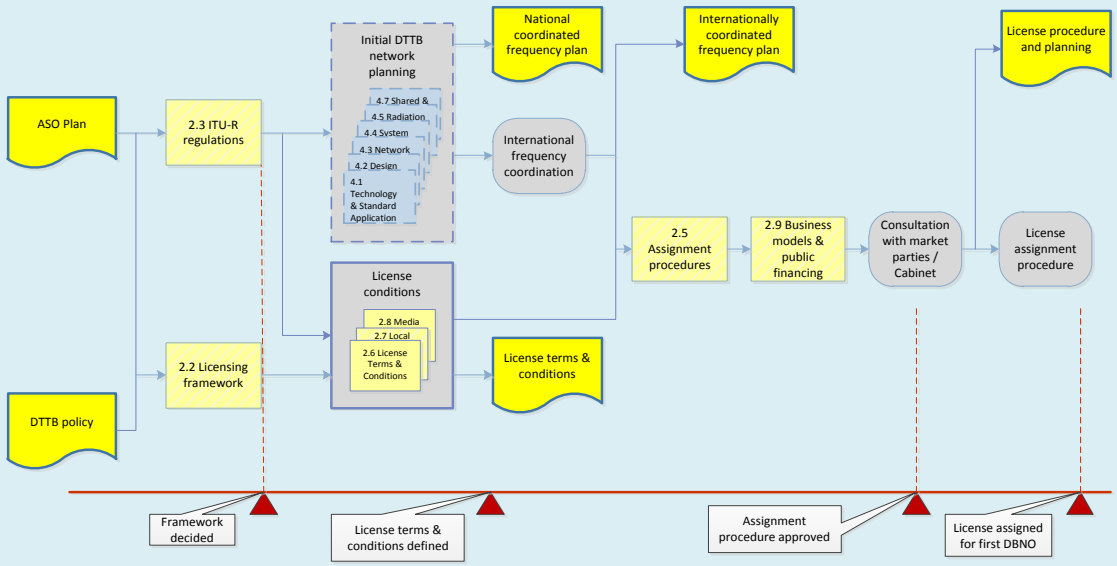
1. A nationally coordinated frequency plan defining the DTTB frequencies, when and where they will be used. This plan will have to be in line with the National Spectrum Plan (NSP) or made part of the NSP (please refer to functional building block 2.4 of the ITU Guidelines).
2. An internationally coordinated frequency plan: a bilateral coordination may be required with India, located to the North of Sri Lanka. These administrative procedures may not be part of the critical path in the ASO planning.
3. The DTTB licence conditions and terms: In the proposed DBNO, model B in 2.2 licensing framework, the system licence will be assigned to the proposed DBNO (multiplex/service operators and contents distributor). Again to ensure spectrum efficiency and compatibility, the licence will have to specify detailed frequency use. The NRT will have to recommend qualification and appropriate entity to form the proposed DBNO. TRCSL can decide the assignment of this system licence.
4. A document describing the assignment procedure and planning: In model B, the NRT will organize the tender procedure under MMMI to select the best party to fulfil the role of DBNO (multiplex/network). It will have to stipulate what entities are allowed to bid (for example consortia of existing broadcasters, foreign partnerships and public private partnerships). In addition it will have to publish open network provisioning (OPN) rules (including capacity access

and pricing rules) for this common multiplex/network operator. For re-using existing infrastructure (like towers or antennas) it may be necessary to impose site sharing rules to ensure cooperation from broadcasters. The tender procedure is covered in Appendix 2.5B of the ITU Guidelines. For a practical example of an invitation to apply for a multiplex licence we refer to the UK Independent Television Commission (now part of Ofcom) document "Multiplex Service Licences: Application Documents"[16]

Roadmap

The roadmap of the Licensing policy and regulation phase and the associated functional building blocks is shown in the Figure 14. The decisions taken, partly taken and not yet taken on the key topic and choices regarding phase 3 of the roadmap and the activities are indicated in Annex 3.

Figure 14: Licensing policy and regulation phase 3 of the roadmap for the regulator



Source: Adapted from ITU Guidelines

In Figure 14, the following steps (i.e. functional building blocks and non-DTTB specific activities) are included in the third phase of the roadmap:

1. Detailing DTTB network planning (see functional building blocks 4.1 – 4.7): After having agreed the ASO plan (including the initial DTTB service planning) a detailed network planning can now be drafted. This detailed network planning is different from the initial planning. The network planning should be detailed to enable equipment ordering (including head-end, distribution and transmitter equipment). It will have to consider the specific site locations (no fictive locations) and its characteristics (what antenna and transmitter space is available), the available distribution possibilities, the ASO plan (in which order will sites have to be put into operation). It will have to provide the details for the communication plan so that viewers know exactly what services they will receive and what they have to do (e.g. instructions for retuning their rooftop antenna or acquiring a new one). Please note that the detailed planning is a working document. On the basis of this planning the network roll-out planning will be further detailed. During the roll-out,

[16] "Multiplex Service Licences: Application Documents" can be downloaded from link www.ofcom.org.uk/static/archive/itc/latest_news/multiplex_licence/dtt_multiplex_licence_tender.asp.html

changes will take place and the detailed planning will have to be updated (a rolling forecast system is also advised here);

2. Coordinating the required spectrum with national and international users: Based on the detailed planning, stipulating the exact spectrum use, the DTTB frequencies can be coordinated with other spectrum users. Coordination should take place at a national and international level. At a national level this is carried out by matching the detailed DTTB spectrum plan with the National Spectrum Plan (NSP) or reversely the NSP should be aligned with this detailed spectrum plan. For example, this might entail changing frequencies in the detailed planning and/or changing existing digital spectrum rights. Neighbouring countries' spectrum usage should be coordinated too. However these activities do not have to be on the critical path of the ASO planning;
3. Determining the licensing framework (see the functional building blocks 2.2): The NRT has already selected a licensing model similar to model B.
    a. The business model needs to be reconsidered as currently the broadcasters' television services are free-to-air. This may not be sustainable in the case of on an independent multiplex operator (which in principle does not generate any advertising and pay-tv revenues). The business model should also be aligned with any formulated open network provisioning (ONP) rules[17].
    b. The financial possibilities for rolling out a DTTB network, considering support from other industry parties, other than the current broadcasters, may need to be explored and this may entail foreign investment.
4. License conditions and procedures (see functional building blocks 2.6, 2.7 and 2.8): The licence conditions and procedures can be defined with reference to the guidance provided in these functional building blocks.
5. Consultation with market parties and the Cabinet: Before deciding the licensing regime (to include licensing framework, conditions and procedures), the NRT can organize a market consultation to check the validity and market support for its plans. The broadcasters not represented in the first NRT should be consulted. Given the number of directly involved market players in the Sri Lanka television market (see Figure 1) this might be organized in a closed set-up with invited parties only. After market consultation, the NRT can support its proposal to the Cabinet with the feedback acquired in this consultation. Finally, before the licensing regime can be officially published the regime should be endorsed by the Cabinet. Sufficient time should be allowed in the ASO planning for this endorsement.

3.4.5 Phase 4 Licensing administration for the regulator

The objective of the license administration phase is to check compliancy with the issued licence, to update the National Frequency Register and to notify the ITU of any new DTTB station put into operation. These notifications are also important for the TRCSL to commence its task of verifying compliancy with the terms and conditions of the DBNO system licence.

The same procedure also applies for changing the station characteristics (e.g. when restrictions on the digital transmissions have been lifted after switching off analogue transmitter stations) and when taking stations out of operation. In the latter situation no approval will be issued by the TRCSL. However, as indicated before, the NRT will have to approve any analogue television transmitter of switch off.

[17] Access to and fair pricing of 'essential facilities', i.e. infrastructure that cannot duplicated under normal market conditions or infrastructure which operations is uniquely licensed to a single market party. The ONP rules stipulate under what conditions access to this infrastructure should be made available and against what costs/prices.

Inputs

The input data for this phase is the notifications from the Digital Broadcasting Network Operator (DBNO) at the TRCSL and Ministry of Mass Media and Information.

Outputs

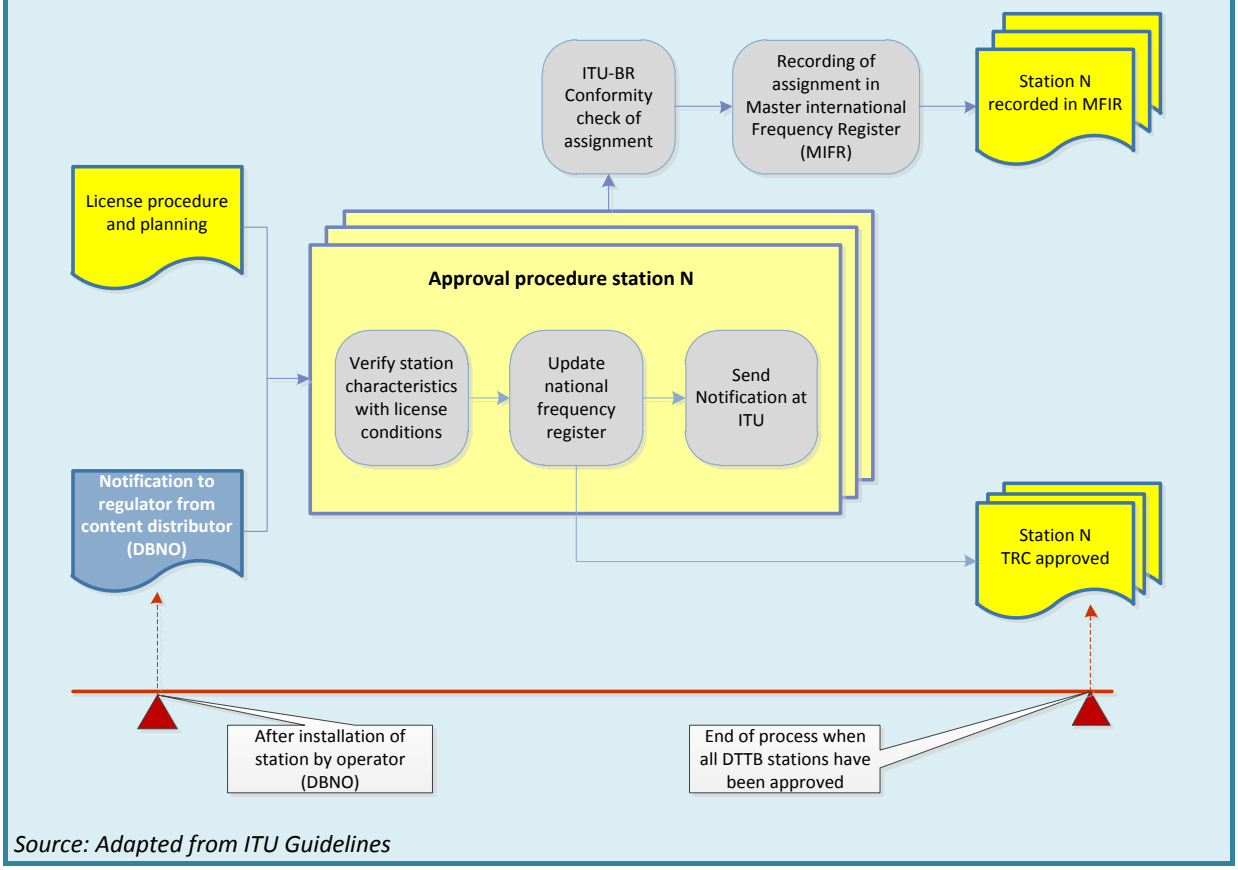
The phase will have two outputs:

- Approval by TRCSL of the stations: After having checked whether the transmitter station is compliant with the DTTB spectrum licence terms and conditions the TRCSL will provide an official approval.
- Recording of the assignment (i.e. station) in the Master International Frequency Register (MIFR).

Roadmap

The roadmap of the license administration phase and the associated activities is shown in Figure 15.

Figure 15: Licensing administration phase 4 of the roadmap for the operator



Source: Adapted from ITU Guidelines

As can be observed from Figure 15, the following are included in phase 4 of the roadmap for the operator:

1. Verification of station characteristics with licence conditions: After licences have been granted and the operator has informed the regulator that a station is in operation, the regulator should verify that the station operates in accordance with the licence conditions, including:
    - Station characteristics
    - Roll-out obligations
    - Media permits
    - Local permits

2. Send notification to ITU: Recording of the assignment (i.e. station) in the Master International Frequency Register (MIFR). In turn the TRCSL will notify the ITU (i.e. Radiocommunication Bureau) of the new DTTB station. The ITU will check the station's conformity and will, after approval, record the station/assignment in the MIFR.
3. Update national frequency register at TRCSL for each station after obtaining approval.

3.4.6 Phase 1 Preparation for the operator (DBNO)

The preparatory phase starts when the regulator is preparing the licensing policy and regulation. The aim of the preparations is to apply successfully for a DTTB licence.

Inputs

The input for this phase is licence procedure from the licensing policy and regulation phase 3 of the roadmap for the regulator. The system licence will be assigned to the proposed digital broadcast network operator (DBNO) (multiplex/service operators and contents distributor).

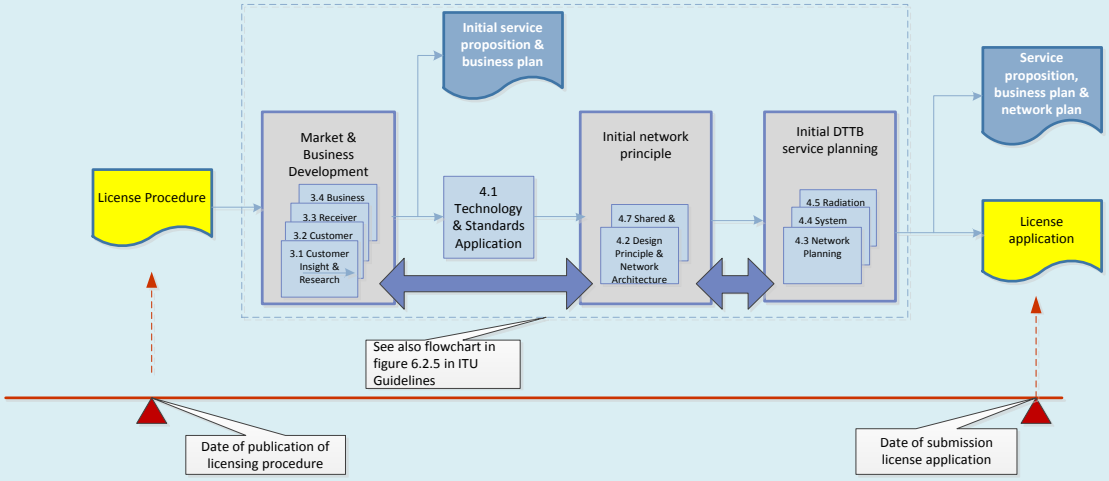
Outputs

The output of the preparation phase of the roadmap for the operator includes a) licence application document; b) service proposition and business plan.

Roadmap

The roadmap for the preparation in phase 1 for the operator (DBNO) and the associated functional building blocks is shown in Figure 16. The decisions taken, partly taken and not yet taken on the key topic and choices regarding phase 1 of the roadmap and the activities are indicated in Annex 4.

Figure 16: Phase 1 Preparation of the roadmap for the operator (DBNO)



Source: Adapted from ITU Guidelines

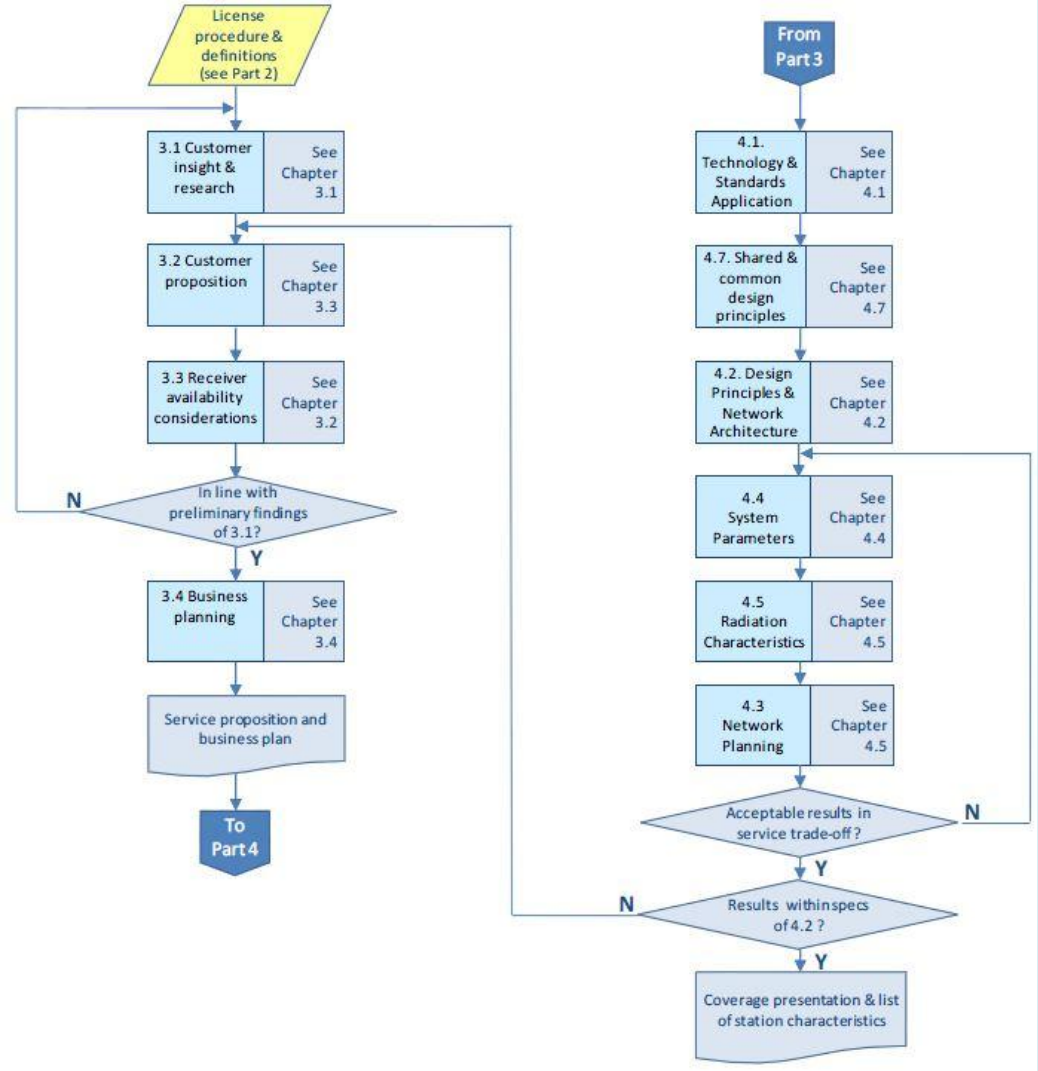
As can be observed from Figure 16, the following steps (i.e. functional building blocks and non-DTTB specific activities) are included in the phase 1 preparation of the roadmap for the operator (DBNO):

1. Market and business development: Four functional building blocks 3.1 (customer insight and research), 3.2 (customer proposition), 3.3 (receiver availability consideration) and 3.4 (business planning) deal with key business issues and choices that the DBNO faces when planning the commercial launch in terms of common DTTB transmission platform with multiplex services. It includes a set of business activities and tools for defining the DTTB service proposition and associated business case and plan, taking into account identified demand drivers, service barriers, financial feasibility and more specifically receiver availability and customer support issues.

Because the DBNO's major customer is the current TV broadcasters, in accordance with NRT's recommendation, the DBNO is responsible for the operational cost of the transmission network. DBNO revenue will come from the content providers/broadcasters paying a monthly fee on per transmission site basis. The business model should be further studied by the NRT and a suitable framework of regulation implemented. Price regulation on the rentals should be implemented under the control of the media ministry/authority.

2. Technology and standard application: The DBNO will use DVB-T2 to construct a DTTB SFN transmission network in Sri Lanka based on NRT's recommendation on DTTB standard selection. The functional building block 4.1 provides guidance on compression systems, specifications on SDTV and HDTV, etc. One of the important technical issues is to determine the best required bit rate to satisfy the simulcast of the current 28 programmes using two DVB-T2 multiplexes under a SFN transmission network to provide island-wide coverage. The choice of the video bit rate for a large number of SDTV programmes is a trade-off between picture quality and multiplex capacity. The trade-off can only be made after multiplex composition and (see ITU Guidelines section 4.2.5 of the functional building block 4.2) network planning (see functional building block 4.3 Network Planning) have been considered. In order to achieve an acceptable picture quality, MPEG4, ≥ 4 Mbit/s is recommended for flat screens. Details can be found in Table 4.1.1 in functional building block 4.1 technology and standards.
3. Initial network principle: In phase 3 of the roadmap for licensing policy and regulation, the NRT and TRCSL have to undertake initial network planning for functional building blocks (4.1, 4.2, 4.3, 4.4, 4.5 and 4.7). The DBNO is responsible for preparation tasks for functional building blocks 4.2 (design principles and network architecture) and 4.7 (shared and common design principles) in more detail. The ITU guidelines provide useful information for these blocks.
4. Initial DTTB service planning: The DBNO is responsible for preparation tasks for functional building blocks 4.3 (performance network planning), 4.4 (determining system parameters) and 4.5 (assessing radiation characteristics). In the preparatory phase not all station characteristics are known in detail, nor is it necessary to achieve a detailed initial network plan. The purpose is:
    - To verify the business plan and customer proposition.
    - To be able to react to proposals from the NRT and regulator in the studies during phase 3 roadmap of licensing policy and regulation that have been undertaken by the regulator (TRCSL).
5. The functional blocks 3.1 to 3.4 include some iteration as shown on the left hand side of the flowchart in Figure 17. The activities indicated above result in an initial customer proposition and business plan and in having sufficient information for a successful licence application.

Figure 17: Flowchart for developing the service proposition and initial network plan



Source: Adapted from ITU Guidelines

3.4.7 Phase 2 Planning for the operator (DBNO)

The planning phase starts at the date of issue of the licence and ends with the adoption of the network implementation plan. This plan describes station characteristics and a time schedule for implementation.

Inputs

The planning phase starts when the licence has been issued. License conditions and the service proposition, business plan and initial network plan, resulting from phase 1, are the input data for phase 2.

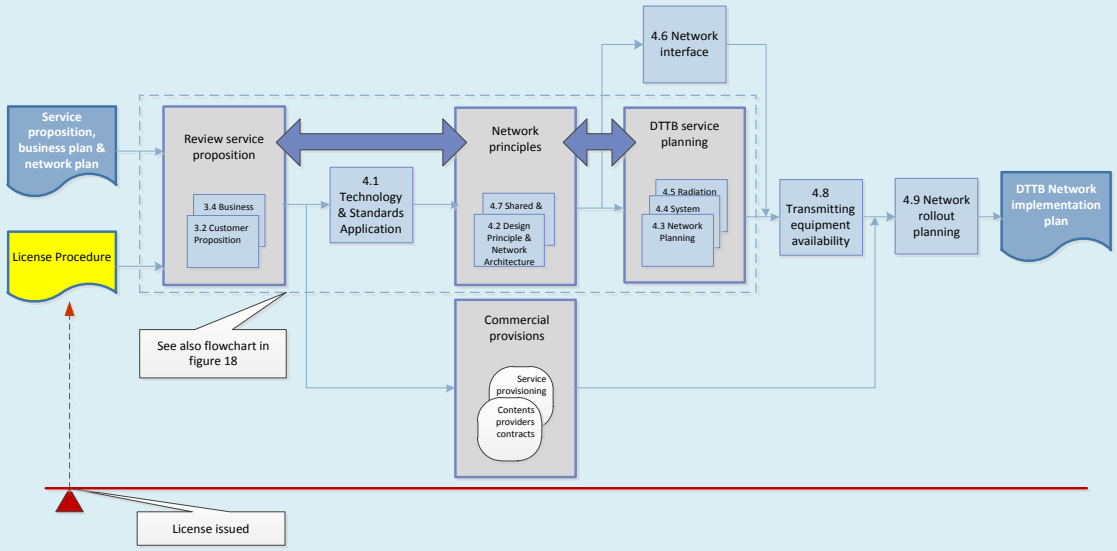
Outputs

The output document of phase 2 of the roadmap for operator is DTTB Network implementation plan.

Roadmap

The roadmap of the planning in phase 2 for the operator (DBNO) and the associated functional building blocks is shown in the Figure 18. The decisions taken, partly taken and not yet taken on the key topic and choices regarding phase 1 of the roadmap and the activities are indicated in Annex 5.

Figure 18: Phase 2 planning of the roadmap for the operator (DBNO)



Source: Adapted from ITU Guidelines

In Figure 18, the following steps (i.e. functional building blocks and non-DTTB specific activities) are included in the phase 2 planning of the roadmap for the operator (DBNO):

1. Review service proposition: Depending on the licence conditions, customer proposition and business plan (functional block 3.2 and 3.4) may need to be reviewed by carrying out appropriate activities.
2. Commercial provisions: After review of the customer proposition and business plan, the network operator will start the following commercial activities:
   - service provisioning;
   - contracting content providers with current TV broadcasters.
3. In parallel with the commercial activities, the initial technical choices will be reviewed and defined in more detail by carrying out appropriate activities related to functional blocks:
   - 4.1 Technology and standards application.
   - 4.2 Design principles and network architecture.
   - 4.7 Shared and common design principles.
4. DTTB service planning: Following the review of technical choices the DTTB service planning will be reviewed and defined in more detail by carrying out the activities related to functional blocks:
   - 4.3 Network planning.
   - 4.4 System parameters.
   - 4.5 Radiation characteristics.
5. As in the preparatory phase, this includes several iterative steps and possibly a review of the service proposition. The order of steps is similar to those in Figure 18.
6. Network interfacing: In parallel to service planning, the activities related to functional block 4.6 (network interfacing) will be carried out.
7. Transmitter equipment availability: When the optimum network plan has been achieved and network interfaces have been specified, transmitting equipment availability will be considered and network roll out will be planned by carrying out the activities related to functional blocks:

- 4.8 Transmission equipment availability.
- 4.9 Network roll-out planning.

3.4.8 Phase 3 Implementation for the operator (DBNO)

The implementation phase is the follow-up of the planning phase and ends when all DTTB transmitters are operational.

Inputs

The implementation phase of the DTTB network starts when the network implementation plan, resulting from phase 2 of the roadmap has been adopted. A number of DTTB stations contained in this plan probably have temporal restrictions, necessary to protect analogue TV during transition.

Outputs

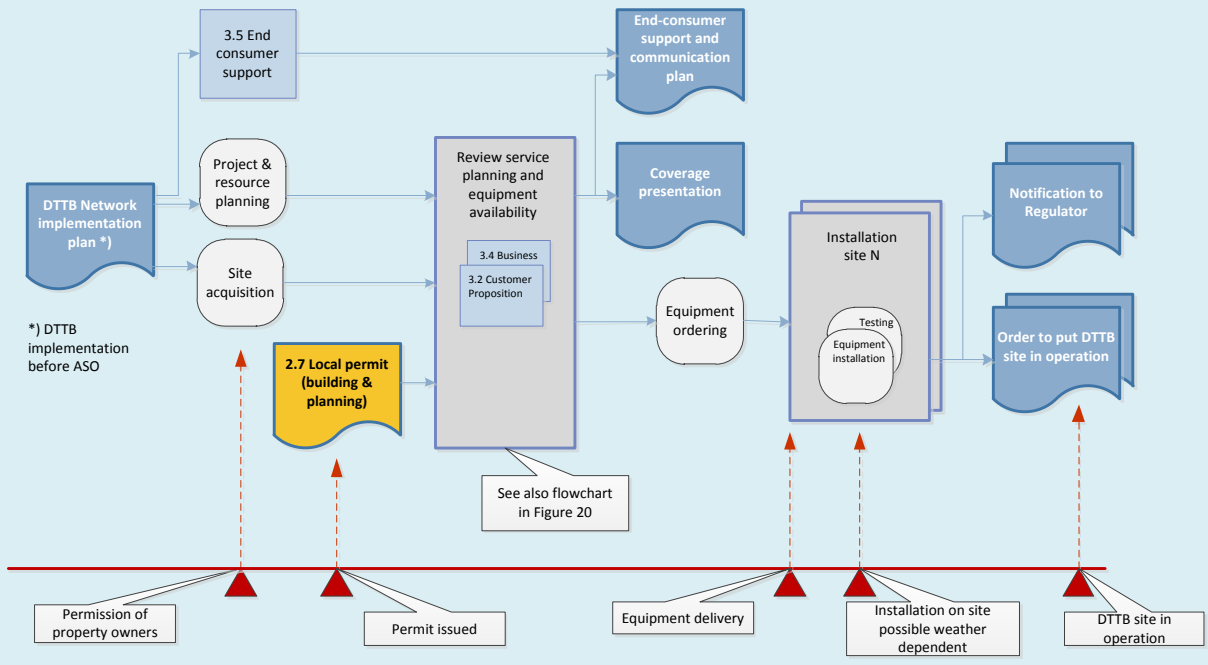
The output document of this phase 3 of the roadmap for operator listed below:

- End-consumer support and communication plan
- Coverage presentation
- Notification to regulator
- Order to put DTTB site in operation

Roadmap

The roadmap of the implementation in phase 3 for operators (DBNO) and the associated functional building blocks is shown in the Figure 19. The decisions taken, partly taken and not yet taken on the key topic and choices regarding phase 3 of the roadmap and the activities are indicated in Annex 6.

Figure 19: Phase 3 implementation of the roadmap for operators (DBNO)



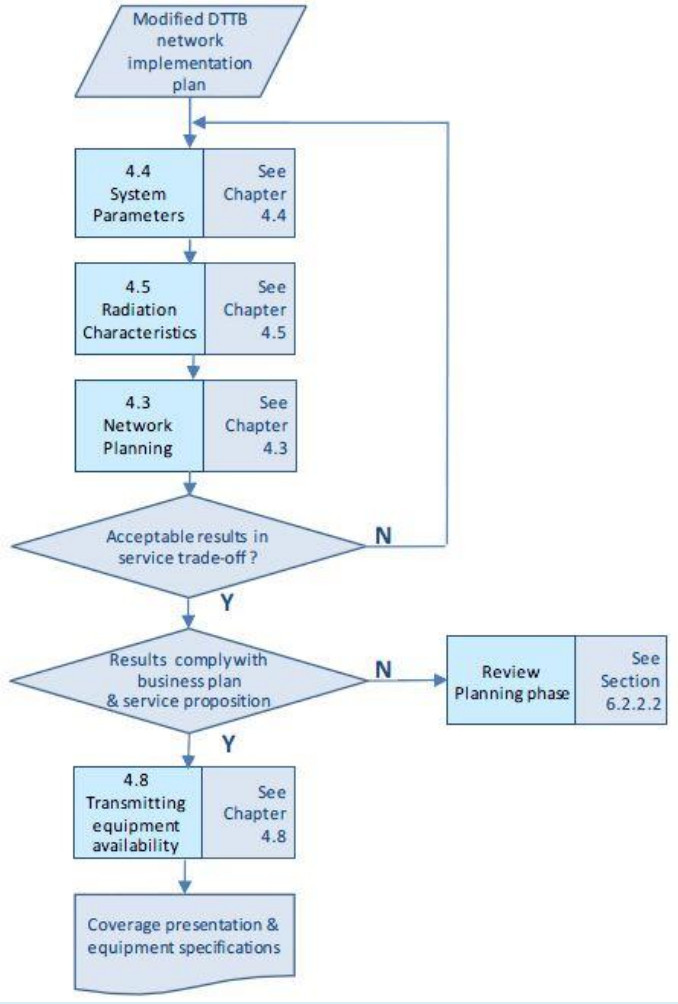
Source: Adapted from ITU Guidelines

In Figure 19, the following steps (i.e. functional building blocks and non-DTTB specific activities) are included in the phase 3 implementation of the roadmap for operators (DBNO):

1. Project and resource planning and site acquisition: On the basis of the DTTB network implementation plan, project and resources planning, and site acquisition will start and local building and planning permits need to be acquired.
2. Review of service planning and transmission equipment availability: In carrying out the above mentioned activities, modifications to the network implementation plan may have to be accepted. For instance site acquisition may not be successful or a new site may be realized at a different location than set out in the DTTB network implementation plan. In the detailed project planning, antenna heights or diagrams may be specified differently than originally set out. In such cases, service planning and equipment availability need to be reviewed by carrying out the appropriate activities relating to the following functional blocks:
   - 4.3 Network planning
   - 4.4 System parameters
   - 4.5 Radiation characteristics
   - 4.8 Transmission equipment availability

   This includes several iterative steps as shown in Figure 20.

Figure 20: Flowchart for reviewing service planning and transmission equipment availability



Source: Adapted from ITU Guidelines

If the results of the review of the service planning no longer comply with the customer proposition or business plan, the planning phase should be reviewed. When the optimum set of station characteristics has been obtained, the equipment specifications will be reviewed and detailed coverage presentations will be made. The latter will be used for communication to the public and content providers to show reception possibilities in the various implementation stages. Flowcharts for reviewing service planning and transmitting equipment availability.

3. Equipment ordering: On the basis of the equipment specifications, equipment tender procedures will be initiated. After comparing several offers, suppliers will be selected and equipment ordered.
4. End-consumer support: Before a site is brought into use, the end-consumers in the related coverage area should be informed about the new digital services and the necessary receiving equipment by addressing functional block 3.5 (end-consumer support).
5. Installation: When the equipment has been delivered, installation of transmitting equipment starts, followed by site acceptance tests. During the installation stage it could happen that, for unexpected reasons, stations cannot be installed as planned. In that case, the DTTB implementation plan may need to be reviewed in order to provide information on the consequences of the changes and to prepare amended coverage presentations. The installation work should be planned in such a way that the transmitters can be put into operation at the agreed date, taking into account that some sites may be inaccessible during certain periods of the year. When installation of a station has been completed, the regulator will be notified that the station will be put into operation in accordance with the licence terms and conditions.

3.4.9 Phase 4 Analogue switch-off process (DBNO)

The time schedule of the analogue switch-off phase is given by the ASO plan of the regulator. Engineering work on DTTB sites is likely to continue after analogue switch-off.

Inputs

The analogue switch-off phase starts during the transition period in accordance with the ASO planning and milestone documents. The DTTB station characteristics during and after simulcasting are contained in the DTTB network implementation plan resulting from phase 2 of the roadmap.

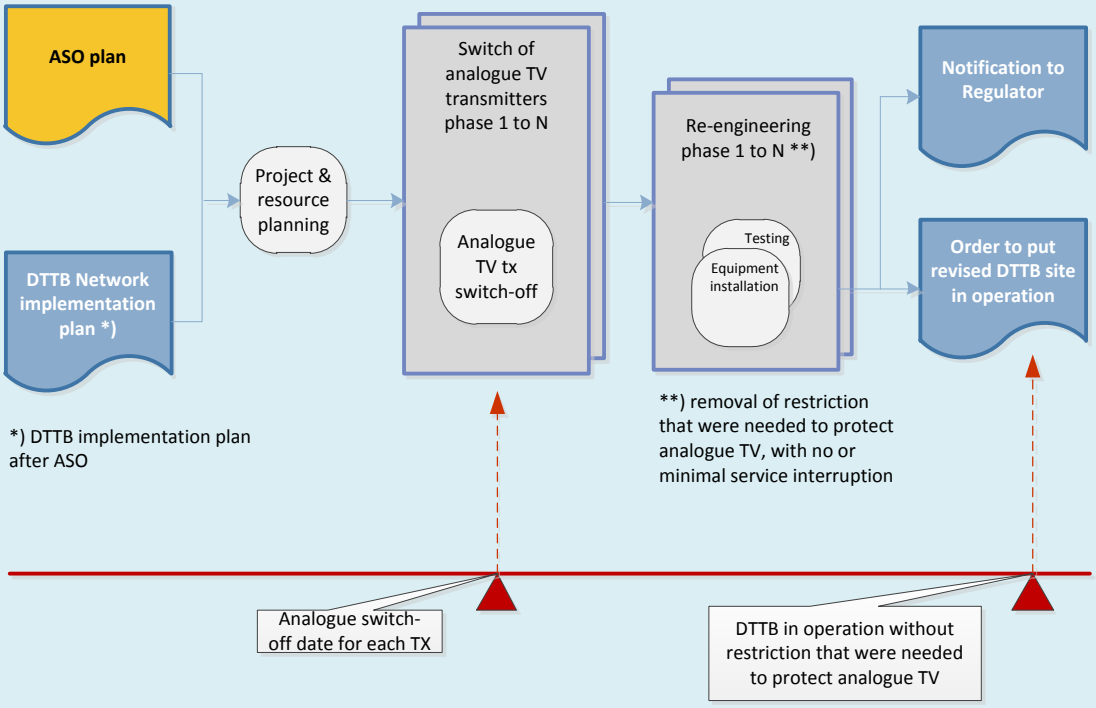
Roadmap

The roadmap of the analogue switch-off in phase 4 for operators (DBNO) and the associated functional building blocks are shown in Figure 21. As can be observed from the figure, the following steps are included in the analogue switch-off phase of the roadmap for operators (DBNO):

1. Project and resource planning and analogue switch-off: Switching-off analogue TV transmitters will be carried out in accordance with the ASO planning provided by the regulator.
2. Re-engineering: After switch-off, re-engineering of the sites begins. These activities may consist of three parts:
    1. Removal of superfluous analogue TV equipment.
    2. Modification of radiation characteristics in order to remove restrictions that were needed to protect analogue TV.
    3. Installation of additional DTTB transmitters that are licenced after analogue switch-off.

Normally it is necessary to carry out these activities with minimal interruption of the DTTB services. When the re-engineering work has been completed, the regulator will be notified that the station has been modified in accordance with the licence terms and conditions specified for the post analogue switch-off situation.

Figure 21: Phase 4 analogue switch-off of the roadmap for operators (DBNO)

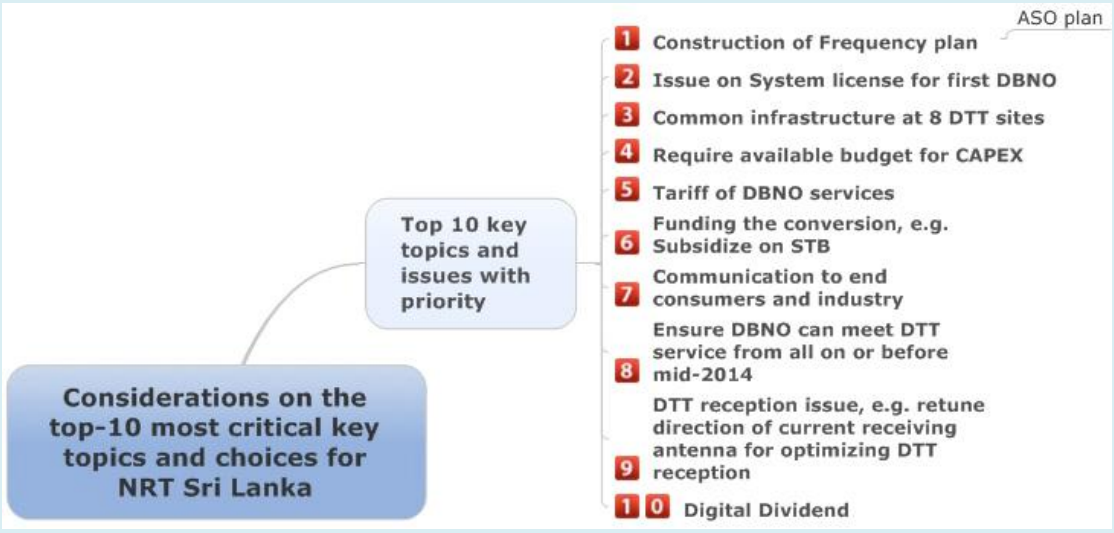


Source: Adapted from ITU Guidelines

4. Consideration of the top-ten most critical key topics

In the NRT workshop, the top-ten most critical key topics and choices were discussed and although Figure 22 lists these in order of priority, the priority is determined by its position on the critical path of the ASO plan. It should be noted that some of the top-10 most critical key topics and choices do not necessarily correspond to the complete scope as addressed in the functional building blocks of the ITU Guidelines.

Figure 22: Top-ten most critical key topics and choices



Source: NRT

4.1 Construction of a frequency plan

4.1.1 UHF spectrum utilization

The UHF spectrum utilization normally includes the frequency channels that are in operation. Under the frequency channel assignment category, some UHF frequency channels will be reserved to meet current broadcaster needs to expand the analogue transmission network coverage. Furthermore, more channels in UHF Band IV and V have to be made available to new broadcasters that obtained TV licences in the first quarter of 2011. Most of the broadcasters operate small scale transmission networks mainly providing service in the Western Province because of the high population density. The subcommittee holds the view that the existing TV licensees have been assigned frequencies beyond the allocation recommended by the International Telecommunication Union (ITU) for TV transmission referring to the Geneva Agreement 2006 (GE06). The channel identified and adopted internationally for DTTB falls in the range of UHF channels 21 to 48. Channels 49 to 62 have been already reallocated by the ITU for other services. In Sri Lanka, channels in the range of 21 to 48 have already been allocated in most of the regions other than in the Northern region. Table 12 gives the UHF channel utilisation under different conditions:

- Condition 1: 37 UHF channels in band IV/V are in operation by current TV broadcasters;
- Condition 2: 12 UHF channels are reserved for current TV broadcasters to improve signal coverage;
- Condition 3: 31 UHF channels are proposed for broadcasters; and
- Condition 4: Full channel utilization if all UHF channels in condition 2 and 3 are included with condition 1.

Table 12: Sri Lanka UHF spectrum utilisation for analogue TV broadcasting under different conditions

Assignment condition	Band IV (Ch 21 - 39)																		Band V (Ch 40 - 62)																							
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
1	4	3	4	3	4	4	1	3	4	4	3	5	1	1	3	1	3	0	4	5	5	2	1	4	0	2	1	3	2	4	5	4	3	1	1	3	0	2	0	1	0	1
2	2	2	2	0	0	1	0	0	0	0	1	0	0	1	0	0	0	2	0	0	0	0	0	1	3	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
3	1	1	3	3	1	1	1	1	1	2	2	0	1	1	1	1	1	1	1	0	1	1	2	0	0	0	1	0	1	0	2	1	0	0	4	0	2	2	2	1	1	1
4	7	6	9	6	5	6	2	4	5	6	6	5	2	3	4	2	4	3	5	5	6	3	3	5	3	3	4	3	3	4	7	5	3	1	5	4	2	4	2	2	1	2

Source: TRCSL as update at 28 September 2011

Island-wide clean UHF channels might be available if MMMI and TRCSL stop to further issue new TV licences and UHF channel assignments. Table 13 is the UHF channel estimation under different assignment conditions.

Table 13: Possible island-wide channels under frequency channel assignment conditions 1, 2 and 3

Condition of frequency assignment	Availability of island wide UHF channels	
	Band IV	Band V
1: Operational only	38	45, 57, 59, 61
2: Operational + Reserved	NIL	57, 59, 61
3: Operational + Reserved + Proposed	NIL	NIL

Source: Based on information and discussion with NRT of Sri Lanka

4.1.2 Implication of GE06

While GEO6 does not apply to the Asia Pacific, the normal provisions of the Radio Regulations do apply to coordination of frequency allocations with neighbouring countries etc. However, for many countries in the Asia Pacific, oceans, mountains, and sparsely populated areas (using low power local transmitters)

often separate one country from another and provide natural protection for transborder coordination. Asia Pacific countries should take the reference to GE06 to read as "the applicable regulations"[18].

As discussed in the first NRT meeting, TRCSL aims to complete full scale frequency planning in the second quarter of 2012 before issuing system licences to the DBNO. It is recommended that TRCSL should take into account the different conditions of channel utilisation to conduct the DTTB frequency planning.

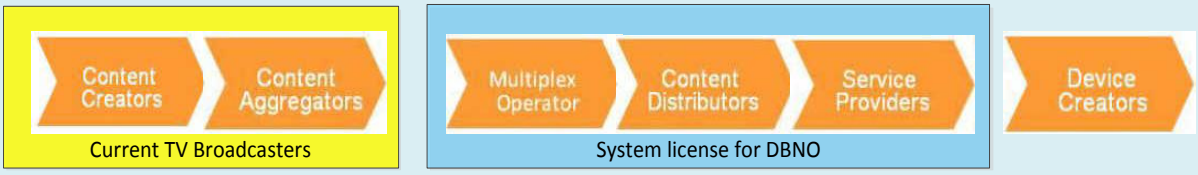
4.2 Issue on system licence for first DBNO

4.2.1 Digital value chain

The subcommittee report[19] recommends a new category of network operator to provide the service of delivering the content of the broadcasters to the viewers. The new category is termed Digital Broadcast Network Operators (DBNO). The relevant authorities shall issue required licences to facilitate the operation of DBNOs.

In connection with the DBNO concept, the digital value chain (see Figure 2.2.1 licensing framework of the ITU Guidelines) is modified to meet local circumstance of Sri Lanka, see Figure 23.

Figure 23: Current TV broadcasters and proposed new DBNO players in the digital value chain



Source: Adapted from ITU Guidelines

The key advantage of the DBNO concept is the infrastructure cost will be shared among all users, as stated in the report. Two DBNOs are proposed for the following reasons:

- *Single DBNO*: There will be no competition in the market thereby creating a monopoly situation. Ensuring quality of the broadcast delivery and the pricing of the services could be a challenge in this scenario.
- *Three or more DBNOs*: Co-location of transmitters will be difficult and costly to manage while inconveniencing the viewers.

Two DBNOs may be ideal to promote competition. It is vital that all current programme channels be accommodated in the initial digital terrestrial television broadcast. Up to 14 programme channels can be facilitated in a frequency channel available to each DBNO using DVB-T2 technology. Table 4.1.1 in functional block 4.1 of the ITU Guidelines provides information about video bit rate requirement. It is repeated here for easy reference (Figure 24).

[18] ITU Guidelines for the transition from analogue to digital broadcasting, Geneva/January 2010. The original guidelines were prepared specifically for Africa. The revisions are under drafting for use in the Asia Pacific Region.

[19] "A Policy Framework for the Digitalization of Terrestrial Television Broadcasting in Sri Lanka" was submitted to the Secretary of the Ministry of Mass Media and Information by the subcommittee, 20 August 2010.

Figure 24: Video bit rate requirements

Format	Screen	Compression	Average bit rate	Remark
SDTV	CRT	MPEG2	≥ 3 Mbit/s	
SDTV	Flat screen	MPEG2	≥ 6 Mbit/s	
SDTV	Flat screen	MPEG4	≥ 4 Mbit/s	
HDTV 720p	Flat screen	MPEG4	≥ 10 Mbit/s	When MPEG4 technology is mature ≥ 8 Mbit/s is expected to be sufficient
HDTV 1080i	Flat screen	MPEG4	≥ 12 Mbit/s	Depending on content and application of horizontal sub sampling

Source: Adapted from ITU Guidelines

The choice of the video bit rate for SDTV and HDTV services is a trade-off between picture quality and multiplex capacity. The trade-off can only be made after multiplex composition (see Section 4.2.5) and network planning (see Chapter 4.3) have been considered.

Regarding the sound quality the following guidance can be given:

- A stereo audio signal: 192 Kbit/s
- A multi-channel sound signal: about 0.5 to 1 Mbit/s.

Furthermore, the following should be taken into account:

- Once the multiplex composition has been decided and the services are on air, picture quality can only be improved by:
  - Increasing bit rate at the cost of deleting other services in the multiplex or use of a higher order modulation, higher code rate or smaller guard interval at the cost of reduced coverage (see Chapter 4.4);
  - Adopting a more efficient compression system or transmission standard requiring replacement of all set-top boxes and integrated digital TV receivers (see also section 4.1.4 of the ITU Guidelines);
  - Replacement of encoders by more efficient products, provided that technology is not mature.
- Consumers tend to purchase large flat screens, resulting in a relatively small viewing distance through which artefacts in the picture become more visible. Consequently picture quality requirements will increase.

In addition to the above guidelines, an example of total bit rate budget requirement is given in Table 14.

If the transmission parameter based on DVB-T2 is about 37 Mbit/s the maximum SDTV programme based on the bit rate budget is about 12 programmes. Therefore, two DVB-T2 SFN multiplex can accommodate 24 SDTV programmes only.

Table 14: Bit rate budget for 12 SDTV programmes

A)	Transmission parameter is assumed below. • **DTTB standard: DVB-T2** • **Modulation:256QAM** • FFT size: 32K • Guard interval: 1/6 • Code rate: 2/3 • Total bit rate: 37 Mbit/s
B)	Total bit rate under TX parameters A is = 37 Mbit/s • Video+Audio+sub-title: 2.95 x 12 = 35.4 Mbit/s • EPG for 12 SDTV: 0.5 Mbit/s • Margin: 1.1 Mbit/s
Note:	i) About 2.7 Mbit/s for video that includes the subtitle which is about 50 kb/s per language. ii) Audio forms by one stereo pair or two mono aural: 250 kbit/s

Source: Information provided by a DTT head-end system integrator

4.2.2 Duties and responsibilities

The subcommittee report further defines the duties and responsibilities in the digital value chain and the regulator/authority.

4.2.2.1 Duties and responsibilities of DBNO

1. Facilitate all current television broadcasters equally at reasonable rates.
2. Collection of content from the MCR of the broadcaster.
3. Deliver contents of the broadcasters to the viewer.
4. Provide specified service level to the television broadcaster.
5. Facilitate requests from licensed television broadcasters.
6. Maintain a backup transmission facility to ensure minimum down time.
7. Rollout the transmission network with island-wide coverage, required reliability and technical quality.
8. Provide an electronic programme guide (EPG) of all programme channels to viewers.
9. Maintain a round the clock help desk for viewers and broadcasters.

4.2.2.2 Duties and responsibilities of television broadcasters

1. Content to be provided up to the hand-over point of MCR in digital format (SDI with audio embedded).
2. Provide metadata needed for EPG to DBNO.

4.2.2.3 Duties and responsibilities of the Media Ministry/Authority

1. Stop issuing of new television broadcasting licences to operate own transmitting stations.
2. Formation of DBNOs.
3. Get the satellite and cable providers in line with the digitization plan.
4. Regulation of access and tariffs of DBNO services.

5. Type approval of broadcast quality digital video production equipment for the use of television broadcast purposes.

4.2.2.4 Duties and responsibilities of TRCSL

1. Allocate three frequency channels to each DBNO initially.
2. Issue of licences for DBNOs under the Telecommunication Act
3. Type approvals of the transmission related equipment
4. Stop granting permission for new expansions of current analogue transmission on or before a relevant date.
5. Get the satellite and cable providers to in line with the digitization plan.
6. Ensure that the DBNOs maintain a specified availability levels while providing Disaster Recovery (DR) facilities.

The report recommends issuing system licences to two DBNOs because of the aforementioned advantages. However, as mentioned in section 4.1 (construction of frequency plan) of this report, it is hard to allocate three frequency channels to two DBNOs initially if the frequency assignment conditions (i.e. reserved and proposed) policy remains unchanged. For smooth transition from analogue to DTTB, it is preferable to stop further issue of frequency channels and review the situation after completion of the DTTB frequency planning.

These ITU Guidelines functional blocks provide useful guidelines for the frequency planning issue:

- 4.2 Design principles and network architecture.
- 4.3 Network planning.

4.3 Common infrastructure at eight DTTB sites

With reference to the subcommittee report and update in the NRT meeting, a minimum of eight principal transmission sites is recommend based on experience of current broadcasters. It is recommended to have a minimum of eight principal transmission sites operating at the higher power levels. The probable locations were identified as Yatiyantota, Karagahatenna, Kokavil, Numunukula, Gongala, Piduruthalagala, Hanthana, and Colombo. The recommendation of these optimal locations of transmission sites were also based on the coverage simulation provided by TRCSL.

Wherever possible, usage of existing infrastructure should be promoted through bilateral agreements between existing broadcasters/government agencies and the DBNOs. If a second DBNO is to be licensed, it is mandatory to make the transmission infrastructure of the two DBNOs to be co-located in those identified sites. Therefore infrastructure should be able to accommodate a second DBNO to be co-located with the first one. Figure 25 is the location map of the eight DTTB sites.

Figure 25: Location map of proposed eight DTTB sites in Sri Lanka

Source: Author

Two of the eight DTTB sites located in elevation 60m and 5m, including Kokavil and a site located in the Colombo urban area under development. While the other six DTTB sites located at hilltop sites probably co-located with current TV transmission stations. Table 15 is a list of the eight DTTB sites.

Table 15: Elevation and current condition of the proposed eight DTTB sites

N	DTTB Site location name	Elevation MSL (m)	Existing TX antenna high (m)	Condition
DTT-1	Kokavil	60	172	Infrastructure feasibility study is needed. *
DTT-2	Colombo	5	75	New tower and building are under planning
DTT-3	Yatiyantota	1295	50	Infrastructure feasibility study is needed.*
DTT-4	Piduruthalagala	2524	50	
DTT-5	Karagahatenna	1082	55	
DTT-6	Numunukula	1497	30	
DTT-7	Gongala	1089	50	
DTT-8	Hanthana	1050	70	

* Infrastructure feasibility study includes space for transmitter building, capacity of the power supply, margin in peak voltage and average of current transmitting antennas, frequency band and radiation characteristic sof current transmitting antenna, etc.

Taking the DTT-4 site at Piduruthalagala as an example, the current site owner is Sri Lanka Rupavahini Corporation (SLRC) has been operating in Band III (Ch 5 and 7) since 1981. The Band III transmitting antenna is located on the top section of the 50m high tower. Two microwave receiving disc antennae are located in the middle and lower section of the tower. Next to the VHF transmitter equipment rack, there is space to accommodate channel combiner equipment. The equipment hall looks full of installed transmitting facilities without space for the accommodation of additional DTTB facilities.

When preparing the licence and regulation in phase 3 (referring to the roadmap for the regulator, under Model B as mentioned in functional block 2.2 licensing framework), TRCSL needs to undertake initial network planning. Regarding common infrastructure in the eight DTTB sites, one of the key items is the site and antenna sharing. Before issuing the system licence to the first DBNO scheduled in the second quarter of 2012, the regulator has to carry out a preliminary feasibility study on the site and antenna sharing for an inventory of the conditions at the proposed eight DTTB sites. After issuing the licence to the DBNO, a detailed study of common infrastructure planning and design for the proposed eight DTTB sites should be undertaken by the DBNO under close monitoring by the regulator.

Figure 26: Photo of the 50m tower at SLRC broadcasting station at Piduruthalagala

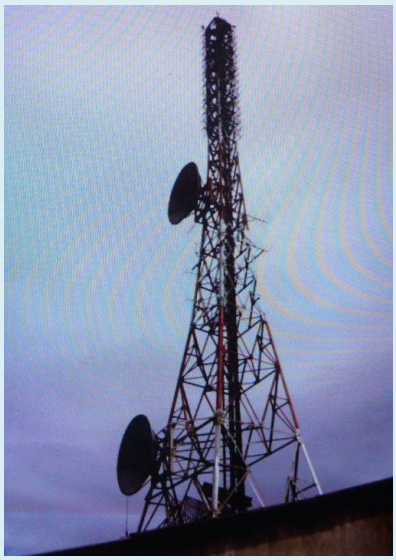


Figure 27: Drawing of the Band III TX antenna and 50m tower

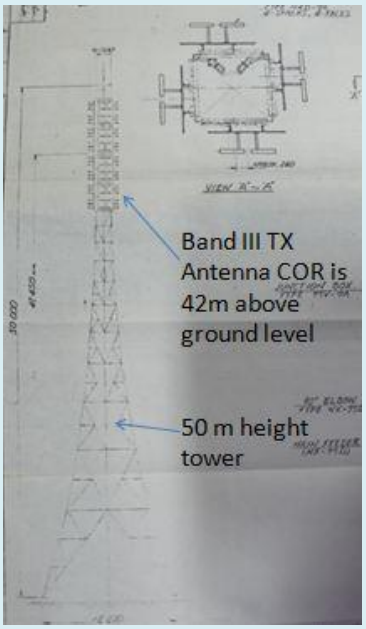


Figure 28: Equipment hall in SLRC broadcasting station at Piduruthalagala

Figure 29: Band III combiner in SLRC broadcasting station at Piduruthalagala

1.3.1 Key issues and checklist for site facility sharing

Table 16 below lists some key issues and the checklist regarding site facilities sharing at the proposed eight DTTB sites.

Table 16: Key issues and checklist for site facilities sharing

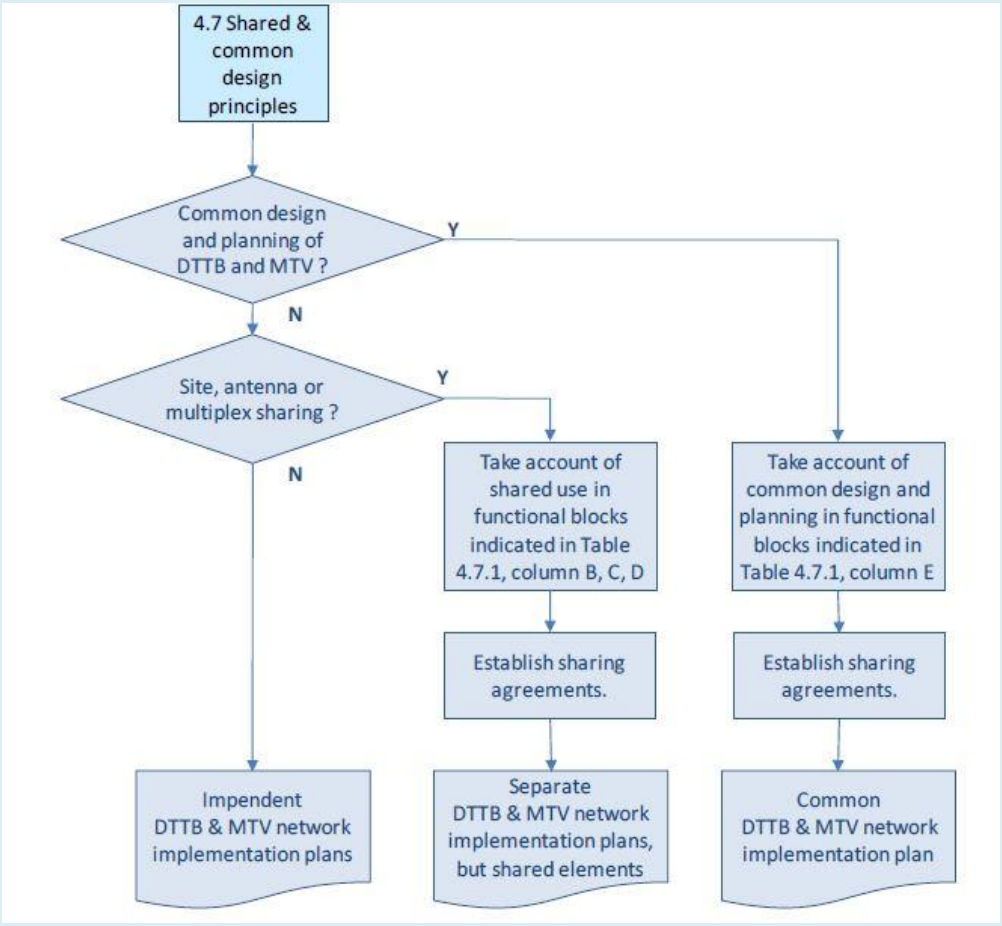
No.	Key issues	Checklist
1	Infrastructure of road/footpath accessing to the site	What is the condition and maintenance cost sharing?
2	Station site boundary	What are the site plans and lease conditions in terms of boundary expansion for new infrastructure construction?
3	Transmitter station building	What is the existing site/building plan? Can the current building space be expanded to accommodate extra DTTB facilities?
4	Power supply from city power company	What is the capacity and technical detail of current power supply system? Can it be shared and/or upgraded?
5	Emergency power generator system	Does the current emergency power generator system capacity provide extra loading of DTTB equipment?
6	UPS system	What is the current capacity? Can the UPS capacity be upgraded to meet requirement of new DTTB equipment?
7	Air-condition system	What is the limitation of current air-conditioning system and the approach to upgrade?
8	Lightning protection system	Can the current lightning protection system be shared with new DTTB equipment? Or upgrade needed to comply with technical requirements.
9	Remote control and monitoring supervision system	Can the current remote control and monitoring supervision system be shared with new DTTB equipment system? Or set-up new system to meet DTTB transmission network.
10	Distribution links system	What is the possible shared facility in current distribution link system? If new DTT distribution link system is needed, what is the design criterion?
11	Security system	Can the current security system be shared?
12	Fire extinguish system	Can the current security system be shared?
13	Fuel store for emergency generator	Is an upgrade needed?
14	Tower	Can current towers provide space for new UHF common antenna system and microwave antenna disc installation? If not, can the tower height be extended? Or, new tower has to be erected?
15	Antenna with combiner system	Can current TX antenna system be shared with DTTB operation in terms of power capacity and frequency range?

Source: Author

If a common transmitting antenna system needs to be installed, it should cover both DTTB and MTV services. The antenna system design should take the ITU Guidelines into account; see functional blocks 4.5 radiation characteristics and 4.7 shared and common design principles.

The choices made with regard to shared and common design principles have also an impact on the activities related to other functional blocks, see Figure 30 and Table 17.

Figure 30: Impact of choices regarding shared and common design principles on other functional blocks



Source: Adapted from ITU Guidelines

Table 17: Functional blocks and chapters related to choices regarding shared and common design principles

A Related functional blocks	B Site sharing		C Antenna sharing		D Multiplex sharing		E Common design and planning	
	DTTB	MTV	DTTB	MTV	DTTB	MTV	DTTB	MTV
Design principles & network architecture	4.2	5.2	–	–	4.2	5.2	4.2	5.2
Network planning	4.3	5.3	4.3	4.3	4.3	4.3	4.3	4.3
System parameters	–	–	–	–	4.4	5.4	4.4	5.4
Radiation characteristics	4.5	4.5	4.5	4.5	–	–	4.5	4.5
Transmitting equipment availability	–	–	4.8	5.8	–	–	4.8	5.8
Network roll out planning	–	–	–	–	–	–	4.9	5.9

Source: Adapted from ITU Guidelines

4.4 Require available budget for Capex

The subcommittee estimated a budget for the required capital investment in order to implement the DBNO operation excluding site specific details, see Table 18 below.

Table 18: Capex estimate for the digital broadcasting network roll-out

Item	Qty	Unit Cost (USD)	Unit cost (SLR))	Total Cost (USD)	Total Cost (SLR)
Transmitter (Approx 5 kW)	24	350 000	39 200 000	8 400 000	940 800 000
Feeder+Combiner+ Antenna	8	150 000	16 800 000	1 200 000	134 400 000
Linking to Transmitting Sites	10	500 000	56 000 000	5 000 000	560 000 000
Master Control Room	1	1 500 000	168 000 000	1 500 000	168 000 000
Connectivity to Broadcasters	8	200 000	22 400 000	1 600 000	179 200 000
Total				17 700 000	1 803 200 000
Contingencies (10%)				1 770 000	180 320 000
Total Cost				**19 470 000**	**1 983 520 000**

Source: MMMI subcommittee report

As such, it is recommended to budget LKR 2 billion for setting up this part of the infrastructure and the other site dependent costs should be properly estimated later. Once the total cost and the timeline is finalized it may be necessary for the government to seek/provide part funding in stages or full funding to set up the DBNO.

As mentioned in the key issues and checklist for site facility sharing in common infrastructure at eight DTTB sites, the Capex estimates shown in Table 18 do not include possible costs for the site facility sharing. The estimate should involve cost to undertake alternative and alteration work for current facilities or cost for set up new facilities.

Table 19 below shows the recommended key issues checklist for the alternative and alteration work s and new facilities in connection with the site and infrastructure sharing feasibility study.

Because the outcome of the estimation for the alternative and alteration works or new facilities will form part of the estimate budget for Capex, the NRT is recommended to include it as part of total Capex for applying the funding to set up the DBNO.

Functional block 3.4 business planning of the ITU Guidelines provides example business cases in 3.4.3 and covers estimated Capex and Opex (see Table 19).

A terrestrial broadcast network operator planning the roll-out of a DTTB or MTV network will have the following key cost categories:

1. Head-end: in the head-end the various programme feeds are collected (from the television studios or from satellite feeds), assembled, encoded and multiplexed onto one or more transport streams (please note that the feeds themselves are not included in the costs).
2. Distribution: the multiplexed transport streams are distributed (and monitored) to the transmitter sites in the DTTB and MTV network either through fixed wireless links, fibre or satellite links (either rented, purchased or a combination). At each site the transport stream has to be delivered (decomposed) in the individual multiplexes.
3. Sites: at each site the multiplexes are fed into the transmitters. The transmitter amplifies, modulates and coverts the signal to the right frequency and the combiner section combines the

transmitter outputs to one antenna feed. The antenna on top of a mast (or other tall construction) will emit the DTTB/MTV signal (onto various frequencies).

Table 19: Checklist of key issues for alternative and alteration works and/or new facilities

No.	Key issues	Checklist	
		Alternative and alteration works	New facilities
1	Infrastructure of road/footpath accessing to the site		
2	Station site boundary		
3	Transmitter station building		
4	Power supply from city power		
5	Emergency power generator system		
6	UPS system		
7	Air-condition system		
8	Lightning protection system		
9	Remote control and monitoring supervision system		
10	Distribution links system		
11	Security system		
12	Fire extinguishing system		
13	Fuel store for emergency generator		
14	Tower		

Source: Author

Table 20 below provides examples of Capex (excluding replacement investments) and Opex for a DTTB (DVB-T) network with 19 sites (no newly built sites), with four multiplexes and with transmitter powers varying between 5 and 20 kW ERP (Effective Radiated Power).

Table 20: Example of Capex and Opex for a small DTTB network

		Capex	Opex	
DTTB network (4 multiplexes)	Head-end	€ 2,6 m	€ 5,0 m/yr	
	Adjustments existing network	€ 1,0 m	€ 0,2 m	Site & housing rental
	Head-end	€ 1,6 m	€ 1,6 m	Energy
	Distribution	€ 1,3 m	€ 1,0 m	Distribution
			€ 2,1 m	Maintenance
	Delivery (and decompose)	€ 1,0 m		
	Monitoring	€ 0,3 m		
	Sites	€ 12,8 m		
	Transmitters and combiners	€ 11,6 m		
	Antenna system	€ 1,2 m		
	Masts	€ 0,0 m		
	Equipment housing	€ 0,0 m		
	Total	€ 16,7 m	€ 5,0 m/yr	

Source: Adapted from ITU Guidelines

The NRT proposed different options to seek funding for the Capex as summarized in Table 21.

Table 21: Option to seek funding to setup the DBNO

Option 1	Government to seek part funding in stages to set up the DBNO	
Option 2	Government to provide part or full funding to set up the DBNO	
Option 3	To seek for grants from supporting countries to set up the DBNO	A grant may have conditions and implications such as the technology used in the donor country and the cost of the equipment manufactured in the donor country and therefore the conditions need to be carefully studied. Some countries may take up the proposal for a loan rather than a grant.

Source: MMMI subcommittee report

As discussed in functional block 2.2 licensing framework in the ITU Guidelines, the public service broadcasters (PSB) refers to broadcasting intended for the public benefit rather than for purely commercial objectives. In most cases the PSB content is specified in a media or broadcast act or separate contract/charter.

The funding of defined PSB services can be organized into three basic forms, which can change or be combined (over time):

1. A public service broadcaster is established by government, with defined PSB services, fully funded by public sources (either through licensing fees and/or general taxes). For example the BBC in the UK or the VRT in Belgium operate their service under this model.
2. A public service broadcaster is established by government, with defined PSB services, funded by public sources and (later) partly by commercial income (mostly advertising based). Examples include France Television and the Publieke Omroep in the Netherlands.
3. A commercial/private broadcaster is established, fully funded by commercial income (either advertising based and/or subscription based) and has a PSB obligation assigned (very often when the broadcast or spectrum rights were granted). Examples include TV2 in Sweden, ITV in the UK and TF1 in France.

In addition to the options 1 to 3 in Table 21, there are other sources of funding the proposed DBNOs. The ITU Guidelines functional block 2.9 business models and public financing provides information about public financing for public services broadcasting. Although the DBNO is not solely a PSB service provider, the NRT should use the information in the ITU Guidelines to meet the local circumstance of Sri Lanka, including current legislation, the market structure and the position/financial means of the proposed DBNOs. Other sources of funding include:

1. Industry levies: fees as a percentage of annual revenue, on certain classes of licensed operator.
2. Various other regulatory sources such as the proceeds of licence competitions, frequency spectrum auctions and fees.
3. Alternative resources from third parties: including the World Bank, IMF, ITU/Broadcaster Unions sponsored project and NGOs.
4. Private Public Partnerships (PPPs): in such partnerships the public broadcaster and a commercial DTTB licence holder will jointly roll-out combined DTTB services. Different forms of PPPs can be applied:
    a. A commercial party rolls-out the network/service and the public service broadcaster is carried in the bouquet. In return for its investment efforts the commercial party is allowed

to use the remaining multiplex capacity of the PSB multiplex, does not have to pay any content rights for the PSB content and gets access to EPG data.

b. A public service broadcaster rolls-out the network/services with multiple multiplexes and a conditional access platform allowing pay-tv services to be billed. The public service broadcaster rents out the remaining capacity to any commercial broadcaster interested in DTTB distribution.

c. The public service broadcaster and a commercial network operator jointly finance the DTTB network, providing free-to-air DTTB services[20]. Remaining capacity will be rented out to any other commercial broadcaster.

4.5 Regulation of access and tariffs of DBNO services

With reference to the policy directives for the digital broadcast network operators (DBNO)from the subcommittee, it is recommended to introduce a new category of network operator to provide the service of delivering content to the viewers. The new category is termed Digital Broadcast Network Operators (DBNO). The relevant authorities shall issue required licences to facilitate the operation of DBNOs. Existing broadcasters should be instructed to make all channels available as a mandatory requirement in the digital platform constructed by the respective DBNOs. In view of limitations in frequency channels of DBNOs the process of accommodating new broadcasters should be done judiciously through a well-coordinated effort between the Ministry of Mass Media and Information and the TRCSL, possibly through a joint committee.

It is the responsibility of the DBNO to bear the operational cost of the transmission network. Revenue to the DBNO will come from the content providers/broadcasters paying a monthly fee on per transmission site basis. The business model should be further studied and a suitable framework of regulation must be imposed. Price regulation on fees should be implemented under the control of the media ministry/authority.

The responsibility of a DBNO in the digital value chain includes roles as a multiplex operator, content distributor and service provider (see Figure 23). Regarding the regulation of access to services and DBNO tariffs, the subcommittee report recommends basing them on well-established criteria practiced in other parts of the world.

With the help from ITU, the relationship between multiplex operator, regulator, and content service provider in Tanzania is one of the useful cases[21] for reference in the regulation of access and tariff of DBNO services.

In the digital broadcasting value chain, the DBNO operators manage transmission facilities to enable delivery of contents provided by the content service provider. The relationship among these two key players should be defined to achieve trouble free transmission of content. Taking the case from Tanzania, the NRT may take the following information as reference to develop an institutional arrangement for smooth operations.

4.5.1 Working relationship between DBNO and content service provider

- The DBNO is obliged to provide the required coverage by the content service provider.

[20] In this model the public broadcaster forms the launching client for the commercial broadcast network operator, in the form of long term distribution contract. This will facilitate access to other financial resources to further fund the DTTB investments. In addition, a variation on this model is that the broadcast network operator shares in the advertising income as a form of payment.

[21] Second Public Consultation Document on Migration from Analogue to Digital Broadcasting in Tanzania. The case for the establishment of the multiplex operator. Director General, Tanzania Communication Regulatory Authority (TCRA), August 2006.

- The DBNO is required to provide quality delivery of broadcasting services in accordance with the contract between the DBNO and content service provider.
- The DBNO is obliged to promptly invoice the content service provider to enable early payment for services rendered.
- The DBNO should ensure that content service providers enjoy the same (or less) total costs in the delivery of broadcasting services to the consumer.

4.5.2 Working relationship between DBNO and the regulator

1. All parties should comply with the stipulations of the contract.
2. The DBNO has the mandate to establish a dispute resolution mechanism.
3. If a dispute arises between the operator and content service provider and it is not resolved amicably by them, the regulator may be approached to resolve the dispute. If the dispute is not resolved by the regulator, they may resort to the Fair Trading Commission (FTC).
4. The DBNO should appraise the regulator on a quarterly basis, on the utilization of frequency channels and content service provider data base.
5. The DBNO should ensure that all contracts entered into with content service providers are made available to the regulator.
6. The DBNO is obliged to indicate the applicable fee structure and submit it to the regulator for approval.
7. The DBNO should make available to the regulator all the network configurations for broadcasting purposes.
8. The DBNO should ensure that there is infrastructure sharing in delivering broadcasting services.
9. Assignment of frequency channels to DBNOs shall be based on market demand.
10. The DBNO should ensure that the tariffs charged to content service providers should not exceed the current total costs incurred by content service providers in the delivery of services to the consumer.
11. The regulator should not charge licence fees to the DBNO and content service provider that will adversely affect the delivery of broadcasting services to the consumer compared to the current applicable fees.
12. The DBNO should ensure that content service providers enjoy the same or less total costs in the transmission and delivery of broadcasting services to the consumers.

4.5.3 Working relationship between the regulator and content service provider

1. The regulator shall not charge licence fees to the content service provider that will have adverse effects on the delivery of broadcasting services to the consumers as compared to the current applicable fees.
2. The content service provider shall inform the regulator of any intended expansion of service area.
3. The content service provider shall ensure that the annual licence fee is paid promptly to the regulator as per licence conditions.
4. The content service provider shall submit frequency assigned by MUX whenever there is expansion of service area or any modifications of frequency assignment.
5. The regulator shall be informed of any modification of shareholding structure by the content service provider.

6. The regulator shall be informed of any modification made to the programme line up by the content service provider.

4.6 Funding the conversion, e.g. subsidies for set-top-boxes

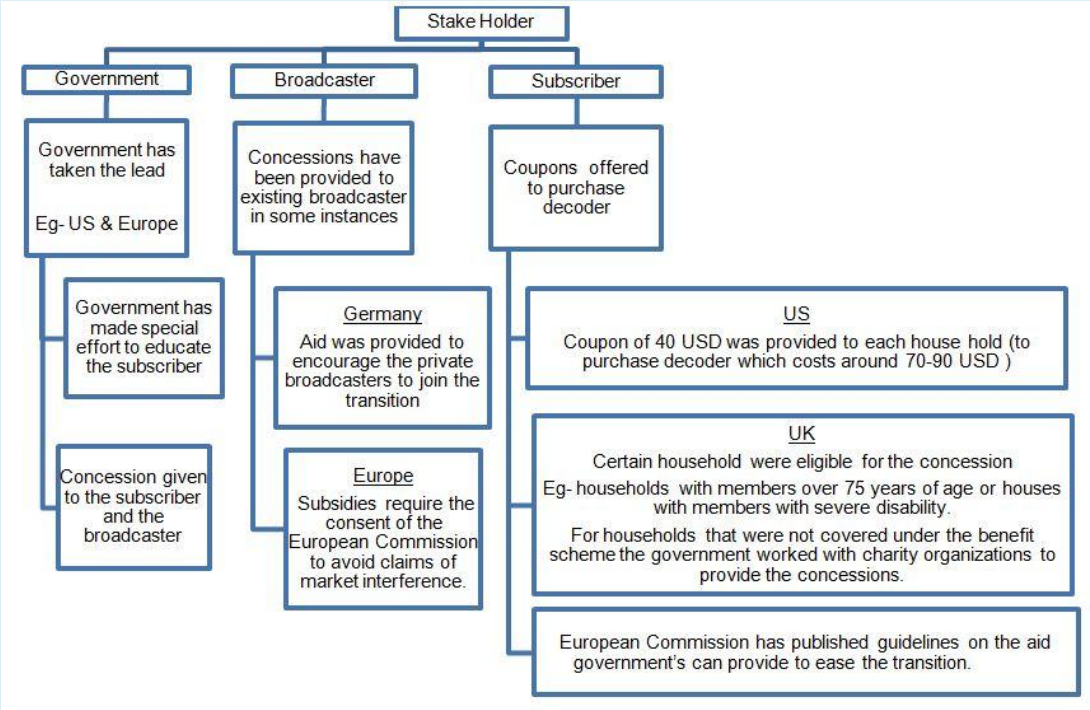
This section analyses the consumer/viewer take-up in the subcommittee's report.

4.6.1 Concession to subscribers in other countries

The approach to DTTB implementation will depend largely on consumer take-up of digital transmission and the availability of digital transmission. In order to minimize disruption to existing service and to ensure that the viewers are prepared for the new service, existing broadcasters are expected to simulcast their programmes, both in analogue and digital.

Studies show that, in some countries a concession in the form of coupons has been offered to subscribers to purchase decoders (set-top-box) that will enable the subscriber to view digital television transmission on an analogue television set. In the US a coupon of USD 40 was provided to each household. The European Commission has published guidelines on the aid governments can provide to ease the transition. In the UK certain households were eligible for the concession such as households with members over 75 years of age or members with severe disability. For households that were not covered under the benefit scheme, the government worked with charity organizations to provide the concessions. Figure 31 is a summary of approaches used by other countries.

Figure 31: Summary of approaches used by other countries



Source: A Policy Framework for the Digitalization of Terrestrial Television Broadcasting in Sri Lanka

In light of the above, it is also necessary to assess the spending power of viewers in Sri Lanka (see Table 22).

The recreational spending of the viewer ranges from LKR 41 to LKR 528 with the highest spending in Colombo District. We can assume that this will be the approximate amount each household can afford to pay per month for any additional procurement. Information on the North and East was not available.

Customer premises equipment (CPE), such as digital TV receivers and set top boxes, needs some subsidizing and also the type approval in Sri Lanka. In this respect the introduction of bank loans with easy payment schemes is strongly recommended.

In the type approval process, CPEs with hybrid systems should be encouraged. Furthermore, the government should insist that the vendor submit a statement certifying the number of previous CPE sales when applying to import such equipment to prevent hoarding for tax concession advantage.

In addition to subsidizing the set-top-boxes proposed in the subcommittee's report, the cost of subsidizing the CPE should be worked out under different scenarios in order to estimate and update the funding for the conversion of CPE in meeting with the ASO plan.

Table 22: Statistics of viewers spending power by District

District	Mean house hold income (LKR)	Mean house hold Expenditure (LKR)	Recreations/ Entertainments/ Training and Cultural activities (group total) (LKR)	Televisions per household (%)	Mean house hold Savings (LKR)
Colombo	42,825	37,011	528	90.8	5,814
Gampaha	29,038	29,145	393	87.2	(107)
Kandy	24,444	21,762	282	79.3	2,682
Badulla	22,035	17,334	263	74.4	4,701
Galle	24,907	23,079	238	76.4	1,828
Matara	22,914	21,348	233	75.8	1,566
Kurunegala	22,870	18,453	227	75.3	4,417
Anuradhapura	21,995	20,290	218	70.9	1,705
Puttalam	21,939	21,332	216	72.5	607
Polonnaruwa	30,530	21,202	203	76.6	9,328
Matale	19,678	19,067	200	72.1	611
Hambantota	24,076	20,568	200	70	3,508
Kalutara	27,721	24,911	197	79.7	2,810
Ampara	20,676	22,311	154	62.5	(1,635)
Ratnapura	22,741	16,423	143	70.7	6,318
Kegalle	18,062	15,773	125	76.6	2,289
Batticaloa	21,032	21,592	110	56.4	(560)
Nuwara Eliya	25,621	14,220	58	72.9	11,401
Moneragala	20,118	13,155	41	62.3	6,963

Source: Department of Census and Statistics – 2006/2007

4.7 Communication to end-consumers and industry

Customer awareness is also vital for the digital take-up. Therefore it is recommended to launch a strong media awareness campaign by the government and broadcasters to get consumers on board for the migration from analogue to digital.

In functional block 2.13 of the ITU Guidelines, the implementation guidelines can be provided on government-led communications to end-consumers and the industry:

1. Limit the risks of distorting or confusing the market by communications based on the principles of:
    a. Impartiality and accountability: ensure that certain market parties or end-consumer groups are not favoured, that policy decisions are evidence supported and are based on a legal framework.

   b. Responsibility: only communicate about topics where there is direct responsibility as indicated in section 2.13.1 of the ITU Guidelines. For example, informing the market about available transmitter or receiver equipment might be best left to the market.
   c. Transparency: keep the audiences continuously up-to-date on the regulatory process and decisions (even when there is no progress). Provide timely and complete information so that end-consumers and industry can have a reasonable preparation time.

2. Select appropriate communication tools for the target audiences. Communication tools should be tailored and a one-fits-all approach should be avoided. The following tools are generally applied for the two main audiences:
   a. End-consumers/general public:
      i. Consumer associations and interest groups (and they inform their members);
      ii. Website (depends on the internet access and availability);
      iii. Printed media (official Gazette, newspapers and magazines);
      iv. Radio and television channels (for specific events like the ASO, for more details see functional building block 2.18);
   b. Industry:
      i. Market consultation and information sessions;
      ii. (International) conferences and fairs;
      iii. Direct mail (using the regulators' licence holder registers);
      iv. Website (perhaps with a special login for licence holders);
      v. Printed media (official Gazette, newspapers and professional magazines).

The ITU Guidelines functional blocks provide further information on this subject.

- 2.13 Communication to end-consumers and industry
- 2.14 Transition models
- 2.18 ASO Communication Plan

In addition to the guidelines mentioned above, NRT is recommended to work out the communication plan most suitable to the situation in Sri Lanka.

4.8 Ensure DBNO can meet DTTB services from eight DTTB principal stations

As discussed in the first NRT meeting, the key milestones in implementing the transition to DTTB and recommendation are given in Figure 32.

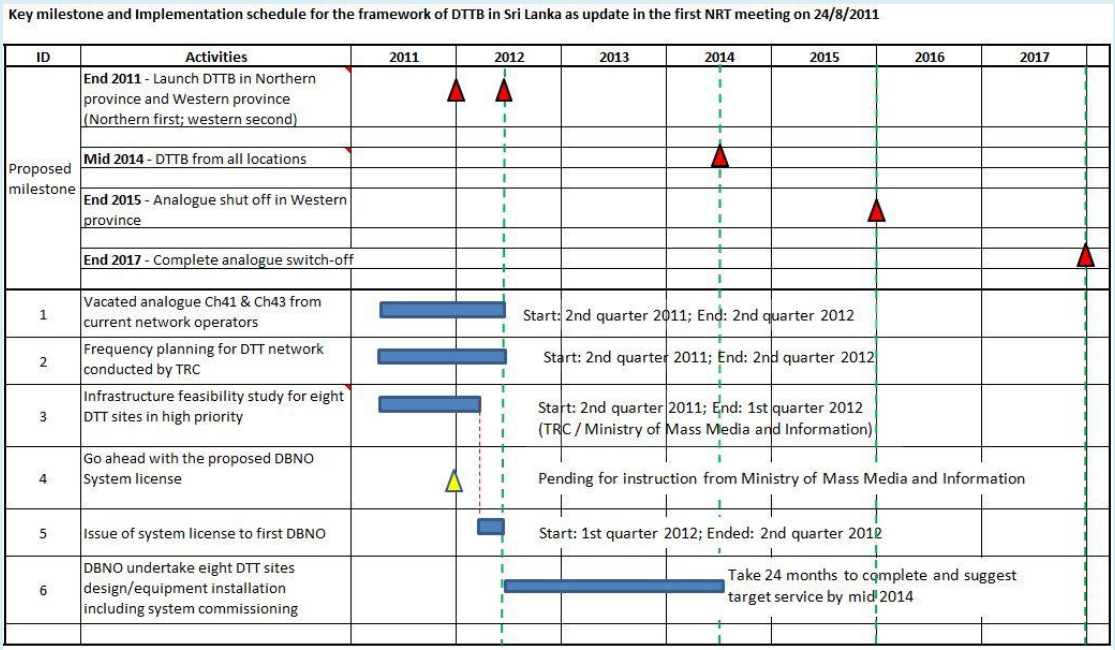
The update milestones are based on the timelines originally stated in the subcommittee report[22] submitted to MMMI, and include:

- End-2011 to mid-2012: Deployment of DTTB pilot transmission services in Northern Province and Western Province.
- Mid-2014: Deployment of DTTB services from eight DTTB principal stations.
- End-2015: Analogue shut off in Western Province.
- End-2017: Complete analogue switch-off.

[22] *A Policy Framework for the Digitalization of Terrestrial Television Broadcasting in Sri Lanka*, drafted by the subcommittee on 20 August 2011.

Proposed action(s) recommended on critical issues to achieve the ASO (analogue-switch-off) plan before issuing a system licence for the first DBNO (see Table 23).

Figure 32: Key milestone and implementation for ASO in Sri Lanka



Source: NRT

Table 23: Critical issues to achieve the ASO plan

ID	Critical issues	Deadline to complete	Proposed action(s) plan	By	Priority*)
1	Proposal of DBNO as multiplex operator and contents distributor to carry TV contents from current TV broadcasters	End 2011	Seek *direction* from MMMI on the proposed DBNO in order to enable execution of the ASO plan based on the roadmap for Sri Lanka in transition from analogue to DTTB	MMMI	1
2	System licence for the first DBNO	Mid 2012	Seek direction from MMMI on qualification and appropriate entity to form the proposed DBNO; 1st quarter 2012: complete system licence drafting in consultation with MMMI; 2nd quarter 2012: system licence terms and conditions ready to issue	MMMI and TRCSL	1
3	Provision of pilot DTTB services in Northern Province	End 2011	SLRC has been assigned to undertake the DVB-T2 TX system setup at Kokavil site.	SLRC	2
4	Provision of pilot DTTB services in Western Province	Mid 2012	Seek *direction* from MMMI to assign the proper entity to undertake the DVB-T2 TX system setup in sharing with the TV	MMMI	1

ID	Critical issues	Deadline to complete	Proposed action(s) plan	By	Priority*)
			broadcaster's transmitter site.		
5	Establishing the organizational structure and participating entities in the ASO planning roadmap for the regulator.	4th quarter 2011	Seek *direction* from MMMI to form a project management office (PMO) and NRT under the proposed broadcasting authority and start drafting an initial detailed ASO plan and determine the progress reporting procedures and structures	MMMI and TRCSL	1
6	Policy direction on new media licence for analogue television broadcasting	3rd quarter 2011 (with immediate effect)	Seek direction from MMMI to stop issuing new media licence for analogue television broadcasting.	MMMI	1
7	Completion of initial planning for DTTB frequency plan, DTTB network and coverage plan in supporting output document of the DTTB Policy in phase 1 of roadmap for the regulator	1st quarter 2012	Seek direction from MMMI to limit the scale of frequency channel assignment furthermore for current and new broadcasters in order to release DTTB frequency channels to the DBNOs; TRCSL undertakes initial DTTB network planning before forming the DBNO.	MMMI and TRCSL	1
8	Infrastructure sharing with current TV broadcasters at the proposed eight DTTB sites	1st quarter 2012	To seek direction from MMMI for undertaking initial feasibility study and design of SFN transmission network and coverage planning based on DVB-T2	MMMI and TRCSL	2
9	After the system licence to be issued on mid-2012, the first DBNO will undertake DVB-T2 SFN transmission network design/equipment installation including system commissioning.	Mid 2014	The first DBNO takes 24 months to complete the DVB-T2 transmission network based on the proposed eight principal DTTB sites (The final DTTB sites location is subject to the DVB-T2 SFN network coverage planning)	DBNO and TRCSL and NRT	3

*) Priority: 1 = High; 2 = Middle; 3 = Low

Source: Author

The NRT is recommended to carry out the following steps for a smooth transition to digital television broadcasting and switch-off of analogue services:

1. Get the roadmap report approved by the Ministry of Mass Media and Information and TRCSL;
2. After approval, acquire a mandate to plan and manage the ASO process in accordance with the phase 1 of the roadmaps (see Figure 12) for NRT and regulator and work out the output documents for phases 1, 2 and 3 in order to prepare the system licence and issue to the first DBNO by mid-2012;
3. Form a project management office and the NRT under the proposed broadcasting authority and start drafting an initial detailed ASO plan and determine the progress reporting procedures and structures.

4. The frequency channels in categories of reserved, proposed, expired and cancelled should be reviewed with high priority. It is recommended to limit the scale of frequency channel assignment for current and new broadcasters in order to release island-wide frequency channels to the DBNOs (see Table 13). The TRCSL is recommended to complete an initial DTTB frequency plan to support the output document of the DTTB policy in phase 1 of the roadmap for the NRT and regulator.
5. As the milestone to issue a system licence for the first DBNO is scheduled in mid-2012, initial DTTB network planning is a key issue to prepare the output document, a national coordinated frequency plan, and support the output document, including licence terms and conditions in phase 3 of the roadmap for the NRT and the regulator..
6. The initial feasibility study for site infrastructure sharing between current TV broadcasters at the proposed eight DTTB sites and the design of SFN transmission network and coverage planning based on DVB-T2 are key issues. The NRT and the project management office under the broadcasting authority are recommended to start the feasibility studies before the awarded DBNO undertakes detailed DVB-T2 transmission network design.

The proposed DTTB site in Colombo District will be developed as landmark infrastructure, the Colombo Lotus Tower Project, functioning as a DTTB multiplex and DTTB transmitter centre for the DBNO. However, the development of this centre might not be completed before mid-2012. The NRT and regulator are recommended to undertake initial SFN network coverage and frequency planning and review the suitable DTTB site to provide DTTB SFN coverage for Western Province and ensure the DBNO can provide DTTB services from all DTTB sites before mid-2014. Annex 7 provides examples of SFN coverage probability with computer simulation based on different scenarios, i.e. rooftop reception for a limited area SFN and rooftop reception for a large area SFN.

4.9 DTTB reception issue

In current TV broadcasting market, there are 23 broadcasters with a TV licence. Among the 23 broadcasters, 16 broadcasters were operational in September 2011 according to TRCSL records. In Colombo District, the population density is 3 330 per sq. km[23], the highest in Sri Lanka. A total of 24 programme channels are provided by 16 broadcasters for the Colombo District, see Table 24.

Taking the Colombo District as an example, most of the transmitting stations from the current broadcasters are not co-located. , and viewers therefore find it difficult to use one receiving antenna to receive all TV services because of the differences in direction of the transmitting antenna. Figure 33 illustrates the location of the some broadcaster transmitter stations in the Colombo District.

[23] Population and Housing Censuses in Sri Lanka 2001, www.statistics.gov.lk

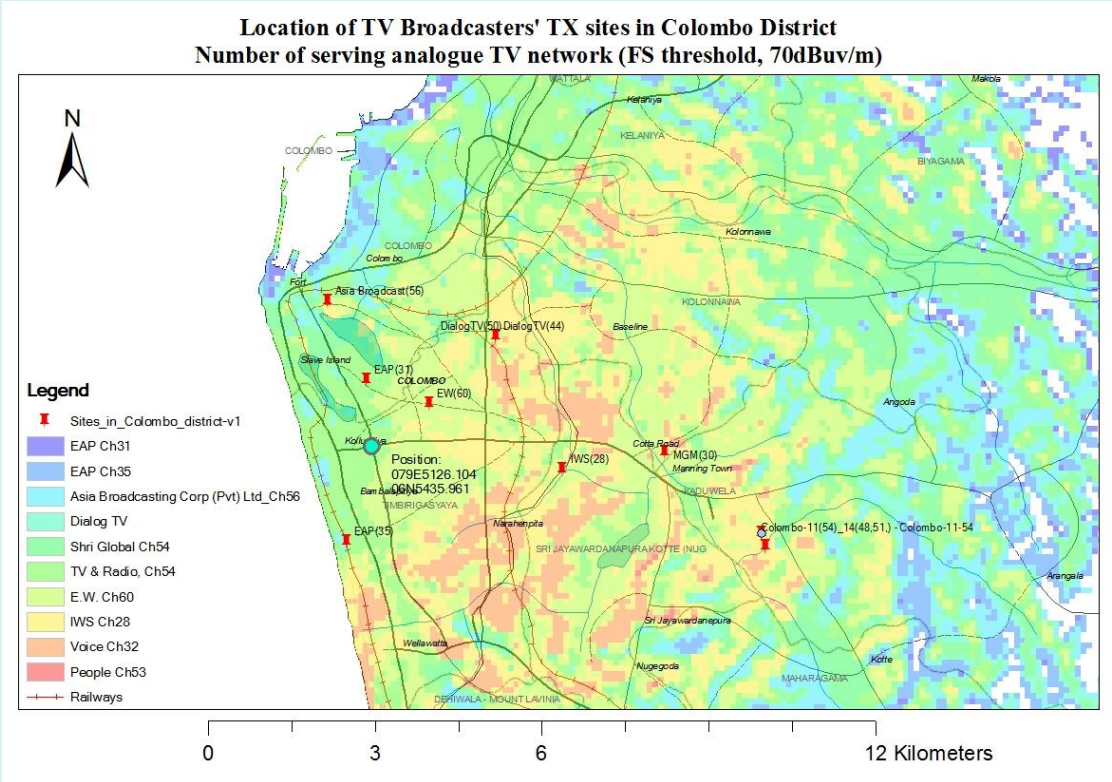
Table 24: TV broadcasting services channel in Colombo and other districts

Broadcasters with operational UHF channel as at September 2011

No.	ID	Name of the Broadcaster	Number of UHF Channel per location	
			Colombo	Other location
1	*2*	Dialog Television (Pvt) Ltd	2	3
2	*3*	E.A.P.Networks (Pvt) Ltd	2	10
3	*4*	E.W.Balasuriya & Company Ltd	1	0
4	*5*	Independant Television Network Ltd	1	3
5	*6*	IWS Holdings (Pvt) Ltd	1	1
6	*7*	MGM Network (Pvt) Ltd	1	1
7	*8*	MTV Channel (Pvt) Ltd	3	10
8	*9*	People's Media Network (Private) Limited	1	1
9	*10*	Power House Ltd	1	6
10	*12*	Sri Lanka Rupavahini Corporation	3	11
11	*13*	Sumathi Holdings	1	0
12	*14*	Television and Radio Network	2	4
13	*15*	Telshan Network (Pvt) Ltd	1	4
14	*16*	VIS Broadcasting (Pvt) Ltd	1	0
15	*17*	Voice of Asia Network (Private) Limited	2	6
16	*19*	Carlton Sports Network (Private) Limited	2	20
		Total Channel number	**25**	**80**

Source: TRCSL's UHF Television Channel Assignments

Figure 33: TV broadcaster transmitter stations in the Colombo District



Source: NRT

It should be noted that the current analogue TV signal reception problem will be one of the DTTB reception unless this issue is solved in the transition from analogue to DTTB. The case of reception problems in Colombo District will also apply to other districts.

The number of serving networks (analogue TV services) at test position is shown in Table 25. Because the analogue TV transmitter stations are not co-located, the receiving antenna has to be adjusted to different directions to obtain a satisfactory TV receiving signal.

Table 25: Number of serving networks at sample receiving location

Number of serving networks

Raster:	Colombo area-Number of serving network (Number of serving networks, 70)
Position:	373750 763950 14.0 (079E5126.104 06N5435.961)
Clutter code:	190
Raster cell value:	6
Created:	2011-09-20 12:21:03

Value	Raster
108.0	Colombo-3(31) - Colombo-3-31 (50% 10m)
95.9	Colombo-3(35) - Colombo-3-35 (50% 10m)
87.0	Colombo-1(56) - Colombo-1-56 (50% 10m)
79.9	Colombo-2(44,50) - Colombo-2-50 (50% 10m)
73.8	Colombo-11(54)_14(48,51,) - Colombo-11-54 (50% 10m)
73.2	Colombo-11(54)_14(48,51,) - Colombo-14-48 (50% 10m)
63.2	Colombo-4(60) - Colombo-4-60 (50% 10m)
59.7	Colombo-6(28) - Colombo-6-28 (50% 10m)
41.1	Colombo-7(30) - Colombo-7-30 (50% 10m)
39.1	Colombo-9(53)_16(22,29) - Colombo-16-22 (50% 10m)
36.4	Colombo-17(32,46) - Colombo-17-32 (50% 10m)
26.0	Colombo-9(53)_16(22,29) - Colombo-9-53 (50% 10m)

Source: NRT

4.10 Digital dividend

The digital dividend is the spectrum in Band III, IV and V that is available after analogue television has been switched to digital television. Any spectrum available after digital television services have been rolled out should be reallocated. As a first step the digital dividend should be defined and all possible allocations should be identified.

With reference to the short and long-term objectives after ASO, the DSO objective is repeated here for easy reference (see also Tables 1 and 11).

No	Objective	Short term (1 year after analogue switch-off)	Long term (5-10 years after analogue switch-off)
7	Frequency planning before ASO Before ASO, conduct full scale frequency planning in order to sort out possible island wide frequency channel in supporting framework of transition from analogue to DTTB.	The outcome of frequency planning will be used for the second DBNO system licence and other possible digital broadcasting services.	Can accommodate more DBNO licences.
8	Better picture quality	HDTV quality up to the market in condition of more island-wide multiplex available after ASO	3D TV up to the market
9	More digital broadcasting services	NIL	MTV and/or digital radio up to the market

Based on the short-and long-term objectives, NRT needs to go through a series of planning processes. ITU Guidelines in functional building block 2.10 digital dividend provides a comprehensive overview of the relevant considerations to inform further discussion and decisions.

The functional block 2.10 includes list of topics:

1. Definition of the digital dividend and its application;
2. Determining the size of the digital dividend;
3. Digital dividend options;
4. Implementation guidelines.

It is recommended that the NRT and regulator plan for the most suitable use of the digital dividend based on the DSO objectives as it is up to individual countries to decide the allocation of the digital dividend after ASO.

5. Recommendations

Before forming the Sri Lanka NRT, a subcommittee was appointed by the secretary to the Ministry of Mass Media and Information (MMMI) to propose a suitable policy framework for the digitalization of terrestrial television broadcasting in Sri Lanka. The *Policy Framework for the Digitalization of Terrestrial Television Broadcasting in Sri Lanka* report was drafted by the subcommittee on 20 August 2011 and submitted to MMMI. In accordance with this report and discussions with the Sri Lanka NRT members during the two country visits, the NRT recommends to undertake the following steps for a smooth transition to digital television broadcasting and analogue services switch-off:

1. In order to prepare supporting documents to the draft Policy Framework for the Digitalization of Terrestrial Television Broadcasting for review by the Cabinet, the NRT has to first get the roadmap report approved by the Ministry of Mass Media and Information and TRCSL.
2. Acquire a mandate to plan and manage the ASO process in accordance with phase 1 of the roadmap (see Figure 12) for the NRT and the regulator and work out the output documents for phases 1, 2 and 3 in order to prepare and issue system licences to the first DBNO.
3. To form a project management office and the NRT under the proposed new broadcasting authority and draft an initial detailed ASO plan and determine the progress reporting procedures and structures.
4. In order to release island-wide frequency channels to the DBNOs, TRCSL is recommended to complete an initial DTTB frequency plan to support the output document of the DTTB policy in phase 1 of the roadmap for the NRT and regulator and a policy at either ministerial level and/or political level to limit the scale of frequency channel assignment for current and new broadcasters in order to release island-wide frequency channels to more than one DBNO.
5. The milestone to issue a system licence for the first DBNO is scheduled in mid-2012. Initial DTTB network planning undertaken by the NRT and regulator is a key issue in preparation of the output document for the licence terms and conditions in the phase 3 of the roadmap for the NRT and regulator.
6. The initial feasibility study for site infrastructure sharing between current TV broadcasters at the proposed eight DTTB sites and the design of SFN transmission networks and coverage planning based on DVB-T2 are key issues. The NRT and project management office under the broadcasting authority are recommended to start the feasibility studies before the awarded DBNO undertakes a detailed DVB-T2 transmission network design.

Apart from the above steps for the Sri Lanka NRT to take, some critical technical issues remain:

1. The proposed DTTB site in Colombo District will be developed as landmark infrastructure, the Colombo Lotus Tower Project, functioning as a DTTB multiplex and DTTB transmitter centre for

the DBNO. However, the development of this centre might not be completed before mid-2012. The project management office and NRT are recommended to undertake initial SFN network coverage and frequency planning and review suitable alternative DTTB transmitter sites to provide the DTTB SFN coverage for Western Province.

2. Annex 7 provides examples of SFN coverage probability computer simulation based on different scenarios of DVB-T2 transmission parameter settings, i.e. rooftop reception for limited area SFN and rooftop reception for large area SFN. In order to verify the best transmission parameters versus the maximum bit rates that can be used to meet the simulcast of current analogue programmes based on two SFN multiplex channels, it is recommended that the project management office and NRT complete further works in network and coverage simulation and planning.
3. In the case of DVB-T2 SFN transmission in Northern and Western Provinces, the project management office and NRT are recommended to undertake DVB-T2 receiver reception performance evaluations under severe SFN echo conditions, and coordinate the possible reception problems under SFN with chipset makers in order to allow for improvement in the chipset design.

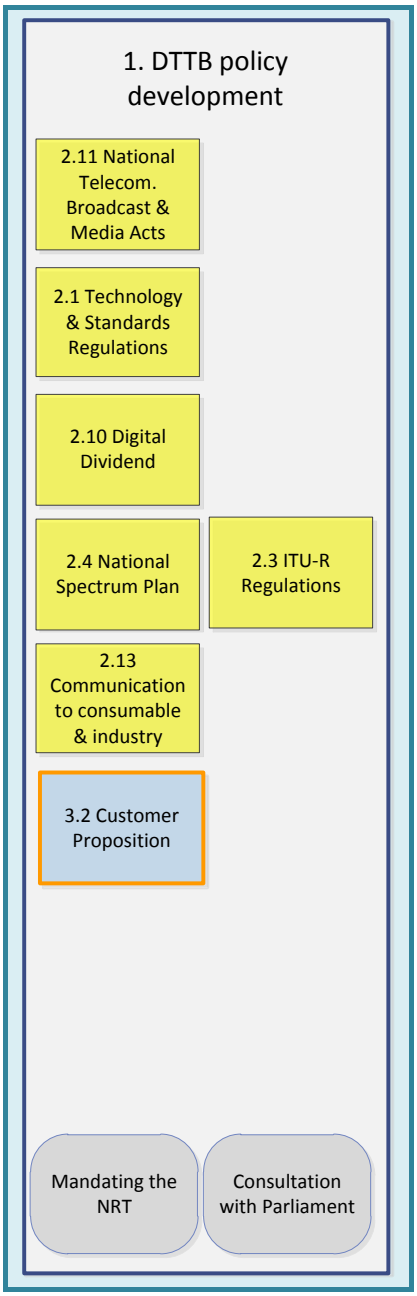
Glossary of Abbreviations

ASO	Analogue Switch-Off
C/N	Carrier to Noise ratio
CA	Conditional Access
CAPEX	Capital Expenditure
CABLE-TV	Cable TV Distribution Network
CPE	Customer Premises Equipment
DIALOG	Dialog Television (Pvt) Ltd in Sri Lanka
dB	Decibel
DBNO	Digital Broadcast Network Operator
DRM	Digital Rights Management
DSO	Digital Switch Over
DTTB	Digital Terrestrial Television Broadcasting
DTH (TV)	Direct-to-Home Satellite Broadcasting Service
DVB	Digital Video Broadcasting
DVB-T	Digital Video Broadcasting – Terrestrial
DVB-T2	Digital Video Broadcasting – Terrestrial 2nd generation
EAP	EAP Networks (Pvt) Ltd. in Sri Lanka
EPG	Electronic Programme Guide
ERP	Effective Radiated Power
FTA	Free-To-Air (unencrypted)
GDP	Gross Domestic Product
GE06	Geneva Agreement 2006
HDTV	High Definition Television
ITN	Independent Television Network Ltd. in Sri Lanka
ITU	International Telecommunication Union
ITU-BDT	ITU Telecommunication Development Bureau
ITU Guidelines	ITU Guidelines for the Transition from Analogue to Digital Broadcasting
ITU-R	International Telecommunication Union – Radiocommunication Sector
MMMI	Ministry of Mass Media and Information in Sri Lanka
MPEG	Moving Picture Expert Group
MUX	Multiplexer
TRCSL	Telecommunication Regulatory Commission in Sri Lanka
MBC	MBC Network (Pvt) Ltd. in Sri Lanka
MTV	Mobile Television
MTVC	MTV Channel (Pvt) Ltd. in Sri Lanka
NRT	National Roadmap Team
OPEX	Operating Expenditure
NSP	National Spectrum Plan

OPEX	Operational Expenditure
OPN	Open Network Provisioning
PMO	Project Management Office
PPP	Public Private Partnership
PSB	Public Service Broadcaster
QPSK	Quadrature Phase Shift Keying
RR	Radio Regulations
SDTV	Standard Definition Television
SFN	Single Frequency Network
STB	Set-Top-Box
T-DAB	Terrestrial-Digital Audio Broadcasting
T-DMB	Terrestrial-Digital Multimedia Broadcasting
SLRC	Sri Lanka Rupavahini (TV) Corporation
UHF	Ultra High Frequency (frequency range between 300 and 3000 MHz)
VHF	Very High Frequency (frequency range between 30-300 MHz)
WRC-07	World Radiocommunication Conference 2007

Annex 1: Functional building blocks related to phase 1 of the roadmap for the regulator

DTTB Policy development



The selected functional building blocks related to phase 1 of the roadmap are shown in Figure 10 and are reproduced here.

Section 3.4.2 describes phase 1 of the roadmap.

This Annex gives an overview in the form of tables of the status of each of the selected functional building blocks related to phase 1 by means of the following status codes:

A. the activities on key topics and choices that are **already decided**;

B. the activities on key topics and choices that are **partly decided**;

C. the activities on key topics and choices that are under consideration and are **not decided**;

D. the activities on key topics and choices that **need revision**;

NA. the activities on key topics and choices that are **not considered yet**.

The selected functional building blocks are presented in the order of the number of the block. This number refers to the corresponding Chapter in the ITU Guidelines, where more information and implementation guidelines can be found.

The grey blocks are not described in the ITU Guidelines and not described in the tables below. These blocks represent activities that are not specific to digital terrestrial television.

2.11 National Telecommunications Broadcast and Media Acts

Brief description	This section addresses the compliancy of the intended policy decisions with the existing and relevant regulatory framework. Very often this regulatory framework comprises national telecommunications, broadcast and media Acts. The relevant regulatory framework in Sri Lanka is given in Table 10.
Objective	To be compliant with existing regulations, which might also include regulations on cross and foreign ownership and state aid.

2.11	Main activities	Status code	Observation/Advice
1	Make inventory of current legislation	A	
2	Map inventory on DTTB/MTV introductions and compare with 'best practices'	C	
3	Identify gaps and draft proposals for additional and/or changes in legislation (based on 'best practices')	C	E.g. Sri Lanka Rupavahini Corporation Act no. 6 of 1982 will be amended to incorporate digital TV broadcasting services.
4	Determine planning for changes in the law and determine 'must haves' for launching DTTB/ASO and MTV	NA	The DBNO system licence will incorporate the carry of current TV programme via the DTTB platform

2.1 Technology and standards regulation

Brief description	In this section the key policy decisions are outlined on adopting or promoting DTTB technology and associated standards.
Objective	This section deals with the question whether a standard should be prescribed/promoted and for what system/network elements.

2.1	Main activities	Status code	Observation/Advice
1	Carry out market research/surveys to identify industry and consumer needs for standardization	A	
2	Determine minimum set of receiver standards for the DTTB and MTV market, based on market developments and planned licensing procedures, terms and conditions (not include MTV)	A	Subsidization is mainly for STB. The iDTV may be demanded from viewers with higher income.
3	Map on existing standardization policies/rules and determine additional standardization needs	B	
4	Assess impact on industry and end consumers	C	
5	Determine receiver requirements and include in frequency licence terms and conditions and/or media permits and authorizations	B	To meet DVB-T2 deployment in period from end 2011 to mid-2012, DTTB receiver specification should be available before DTTB deployment. To plan the STB distribution channel for those viewers wishing to receive DTTB programmes in Northern and Western Provinces. 20 to 50 sample STBs (MPEG4 SD/HD) are available in initial DTTB transmission tests. These STBs are recommended to form part with other sample STBs to conduct the DVB-T2 reception performance tests.
6	Determine communication messages, planning, standardization/testing bodies and methods (including logos and labelling)	C	TRCSL prefers international test certificates as one of the conditions to issue type approval for STB
7	Update, if necessary National Spectrum Plan and legislation	D	

2.10 Defining digital dividend

Brief description	The digital dividend is the spectrum in Band III, IV and V that is available after analogue television has been switched over to digital television.
Objective	Freeing up spectrum for more valuable services.

2.10	Main activities	Status code	Observation/Advice
1	Analyse current and future market developments and possibly conduct market consultation(s) in the broadcast (and telecommunication) industries	B	
2	Assess current and future market needs for DTTB and MTV services, possibly based on formulated legislation and policies	NA	
3	Assess available spectrum after ASO, based on ASO plans, National Spectrum Plan and ITU-R Regulations	C	
4	Map spectrum needs on available spectrum and determine priorities and assign spectrum to broadcasting	B	
5	Possibly draft spectrum re-farming plans and compensation schemes (for network and receiver re-tuning activities), reserve budgets	C	
6	Update National Spectrum Plan and align licence terms and conditions for DTTB and MTV services	D	

2.4 Update of the national spectrum plan

Brief description	The National Spectrum Plan reflects the long, medium and short-term planning of the available national spectrum resources for DTTB and MTV services in a particular country. It may also include the stipulated assignment procedures for the various services and a national frequency register, including all the assigned licences and licensees.
Objective	With a National Spectrum Plan the regulator strives to ensure effective and efficient spectrum usage and compliance with international standards. As well as informing market parties on the current and future (intended) use of spectrum.

2.4	Main activities	Status code	Observation/Advice
1	Make an inventory of current spectrum use in the broadcast bands (Bands III, IV and V)	A	
2	Register use and provide rules for self-registration	C	
3	Carry out market analyses and consultations and forecast future spectrum needs	C	
4	Determine re-farming needs and assess impact on existing and future users (including service and financial impact), possibly reserve budget for re-farming efforts and damages	C	
5	Determine publication content, dates and formats for the National Spectrum Plan	C	
6	Determine budget for spectrum management and administrative fees	B	

2.13 Communication to end consumers and industry

Brief description	Providing adequate and timely information ensure and support a rapid service take-up, a profound market development (i.e. content development and receiver supply/availability) and a smooth service transition.
Objective	Informing the public and the television industry about the changes in the areas of legislation, policies and regulations is a government led task.

2.13	Main activities	Status code	Observation/Advice
1	Make inventory of communication scope	C	
2	Determining the key communication moments and topics	C	
3	Determine communication tools for each target group/audience	C	
4	Instruct communication bodies and committees	C	

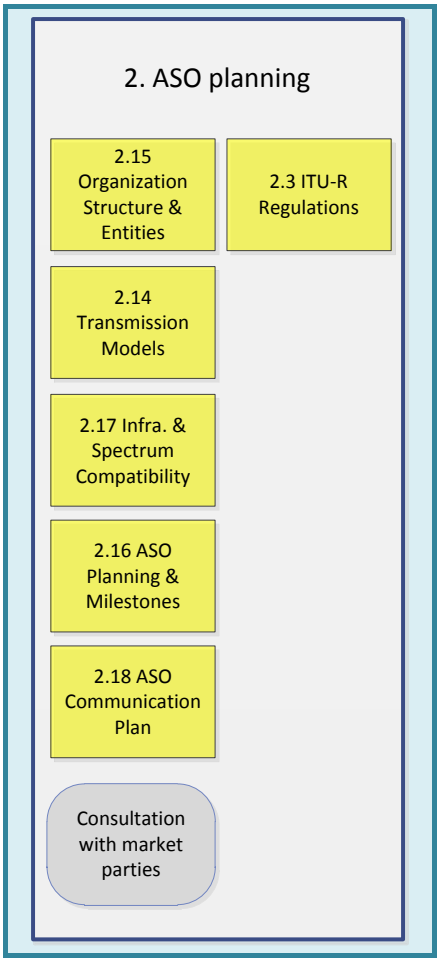
2.3 ITU-R regulation

Brief description	ITU-R regulations entail the Radio Regulations (RR) and in particular the table of Frequency Allocations (Region 3) and the relevant provisions of the World Radiocommunication Conference 2007 (WRC-07).
Objective	In this phase of the roadmap, to identify at a high level the spectrum availability and requirements for DTTB (and other services)

2.3	Main activities	Status code	Observation / Advice
1	Make inventory of communication scope	C	
2	Determining the key communication moments and topics	C	
3	Determine communication tools for each target group/audience	C	
4	Instruct communication bodies and committees	C	

Annex 2: Functional building block related to phase 2 of the roadmap for regulator

ASO Planning



The selected functional building blocks related to phase 2 of the roadmap are shown in Figure 10 and are reproduced here.

Section 3.4.3 describes phase 2 of the roadmap.

This Annex gives an overview in the form of tables of the status of each of the selected functional building blocks related to phase 2 by means of the following codes:

A. the activities on key topics and choices that are **already decided**;

B. the activities on key topics and choices that are **partly decided**;

C. the activities on key topics and choices that are under consideration and are **not decided**;

D. the activities on key topics and choices that **need revision**;

NA. the activities on key topics and choices that are **not considered yet**.

The selected functional building blocks are presented in the order of the number of the block. This number refers to the corresponding Chapter in the ITU Guidelines, where more information and implementation guidelines can be found.

The grey block is not described in the ITU Guidelines and not described in the tables below. This block represents activities that are not specific to digital terrestrial television.

2.15 Establishment of organizational structures and entities

Brief description	The ASO process is a complex and time consuming operation and a special purpose entity (e.g. Task Force, Committee or separate company) may coordinate the overall process and planning. In Sri Lanka this task is assigned (not formally yet) to the NRT.
Objective	A coordinated ASO process between all involved parties and stakeholders.

2.15	Main activities	Status code	Observation / Advice
1	Establish overall coordination needs	B	
2	Form or extend special purpose vehicle, establish clear mandate	B	
3	Establish budget and communication means (air-time, website, etc.)	C	

2.14 Defining transition models

Brief description	This section deals with the situation that analogue television broadcasts have to be stopped and the existing analogue services are migrated to a DTTB platform in one coordinated effort, led by the government (i.e. the ASO process). This section deals with what ASO or transition model will be applied in Sri Lanka.
Objective	Existing analogue services are migrated to a DTTB platform in one coordinated effort and without service interruptions.

2.14	Main activities	Status code	Observation / Advice
1	Check existing legislation and policies for public (and commercial) television service (e.g. FTA) and coverage stipulations (e.g. nationwide coverage)	A	
2	Check ITU-R Regulations and any existing/formulated receiver regulations for impact on ASO	B	
3	Carry out market research on ASO affected viewers/listeners. Identify any hidden viewers/listeners (2nd television sets, regional programming, prisons, etc.), Identify impact and risk areas	C	
4	Analyse and assess complexity and size of network modifications and receiver transitions	C	
5	Involve and discuss ASO with content aggregators (esp. public broadcaster) and consumer associations	B	
6	Decide transition model (simulcast period and ASO phasing)	B	

2.16 Setting up ASO planning and milestones

Brief description	**Overall ASO planning and its key milestones, managed by the NRT.**
Objective	ASO planning respecting the set dates for ASO and providing a progress monitoring

2.16	Main activities	Status code	Observation / Advice
1	Draft comprehensive ASO planning (milestones and activities) and assign tasks and responsibilities (including core project management team)	B	
2	Establish ASO project monitoring framework and reporting structure	NA	
3	Identify ASO project risks and draft risk mitigation plans (including fall back and/or roll back scenarios)	NA	

2.17 Identifying infrastructure and spectrum compatibility

Brief description	This section deals with incompatibility in the case of both digital and analogue services in the same geographical area and the digital and analogue frequency cannot coexist.
Objective	Incompatibility can happen in both transmitter infrastructure (e.g. antenna system, equipment space and power/back-up/no break, etc.) and trade off in network design due to spectrum in limited geographical area cannot coexist.

2.17	Main activities	Status code	Observation / Advice
1	Check Legislation, ITU-R Regulations, National Spectrum Plan and establish service priorities and acceptable interferences levels	B	
2	Assess available antenna space and sites and site/antenna sharing possibilities/options	C	Yatiyantota is one of the eight proposed DTTB sites. The alternative DTTB site is recommended to use Yatiyantota because it can provide good coverage in Western Province including Colombo District. Feasibility study for site

2.17	Main activities	Status code	Observation / Advice
			and infrastructure sharing at the mentioned site should be carried out with high priority.
3	Calculate inference levels, service coverage and check EMC compatibility	C	In order to conduct evaluation of interference and service coverage, TRCSL is recommended to use radio planning software with detailed digital map data.
4	Develop site transition scenarios (including temporary installations and sites)	C	Because development of the Colombo multiplex and Transmission Centre will not be completed before mid-2012, therefore the target to deploy DVB-T2 services in Western Province will not be met. In connection with this situation, the NRT is recommended to adopt Plan B, to set up the DTTB equipment at an alternative hilltop site.
5	Assess costs, time lines and service impact	B	

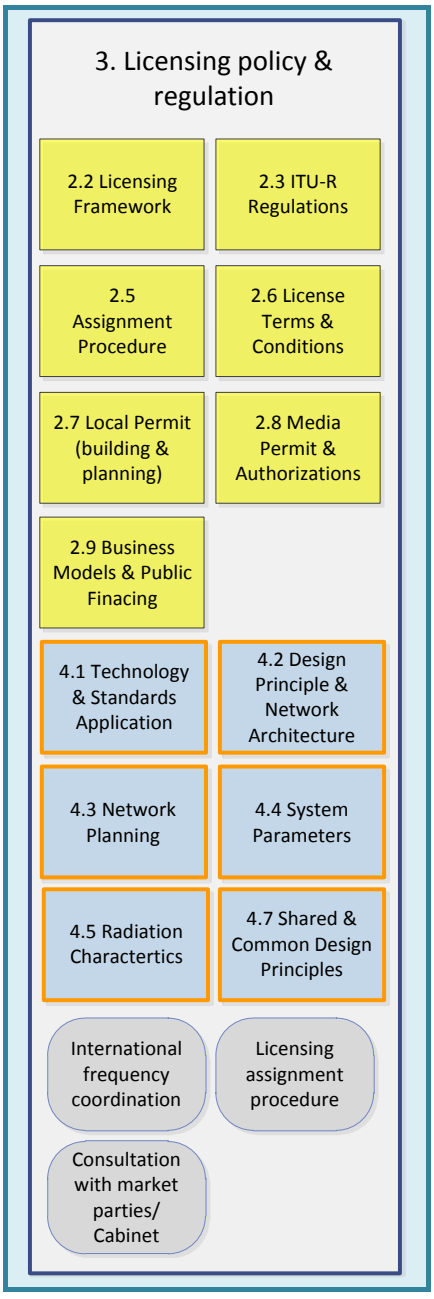
2.18 Drafting ASO Communication Plan

Brief description	**This section focuses on communication to the viewers and other stakeholders in the DTTB value chain.**
Objective	To help viewers prepare adequately, the whole broadcast community needs to address all viewers relying on the analogue terrestrial platform using targeted communication tools that can reach out to diverse population segments.

2.18	Main activities	Status code	Observation / Advice
1	Draft communication plan (including target audiences, timing, means, etc.)	NA	
2	Continuous alignment with ASO planning	B	
3	Determine and establish compensation schemes and systems, include in communication plan	C	

Annex 3: Functional building block related to phase 3 of the roadmap for the regulator

Licensing policy and regulation



The selected functional building blocks related to phase 3 of the roadmap are shown in Figure 10 and are reproduced here.

Section 3.4.4 describes phase 3 of the roadmap.

This Annex gives an overview in the form of tables of the status of each of the selected functional building blocks related to phase 3 by means of the following codes:

A. the activities on key topics and choices that are **already decided**;

B. the activities on key topics and choices that are **partly decided**;

C. the activities on key topics and choices that are under consideration and are **not decided**;

D. the activities on key topics and choices that **need revision**;

NA. the activities on key topics and choices that are **not considered yet**.

The selected functional building blocks are presented in the order of the number of the block. This number refers to the corresponding Chapter in the Guidelines, where more information and implementation guidelines can be found.

The grey blocks are not described in the ITU Guidelines and not described in the tables below. These blocks represent activities that are not specific to digital terrestrial television.

2.2 Setting up the licensing framework

Brief description	**For Sri Lanka the licensing framework concentrates on the selection of the model B.**
Objective	The objective of the licensing framework should be to actually implement the defined policy objectives for the introduction of DTTB, including the Analogue Switch-Off (ASO).

2.2	Main activities	Status code	Observation / Advice
1	Make inventory of current licensing framework and check applicability for DTTB and MTV service introductions	A	
2	Assess and evaluate different options for licensing DTTB and MTV services	A	
3	Assess compatibility with ASO plans and National Spectrum Plan	A	
4	Possibly revise current licensing framework and assess impact	B	
5	Draft planning for licence assignment, framework changes and update National Spectrum Plan (and possibly Legislation)	B	

2.5 Formulation of assignment procedures

Brief description	Assigning spectrum/broadcast rights for DTTB services and the common instruments and procedures applied.
Objective	Assign spectrum/broadcast rights to the public service broadcaster, commercials broadcasters or any other entity (such as the common multiplex/network operator) in a transparent manner in line with the ASO plan.

2.5	Main activities	Status code	Observation / Advice
1	Consult market (industry players and consumers) on assignment methods and licence Terms and Conditions	B	
2	Evaluate results and select assignment method and procedures	C	
3	Draft detailed plans and planning for DTTB and MTV assignment procedures	C	
4	Publish assignment planning and procedures and update National Spectrum Plan (and possibly Legislation)	C	

2.6 Formulating licence terms and conditions

Brief description	The licence terms and conditions of the DTTB frequency or spectrum licences.
Objective	Assigning DTTB/MTV frequency rights is carried out in conjunction with assigning the other two types of rights as well. The objective is to have all rights covered, in the right balance, between the various licence types.

2.6	Main activities	Status code	Observation / Advice
1	Check relevant paragraphs/ entries in legislation/policies, ASO plans, National Spectrum Plan	C	
2	Analyse market conditions and assess 'level-playing-field' requirements/provisions	B	
3	Determine DTTB/MTV licence terms and conditions and align with local building permit policies and media permits/authorizations and their planning	C	
4	Update National Spectrum Plan (and possibly ASO plans)	B	

2.7 Drafting policies for local permits

Brief description	This section addresses the necessary permits and authorizations from local governments required to establish and operate broadcasts transmitter stations.
Objective	For economics of rolling out transmitter sites, the regulator and local governments do have an important role to facilities transmitter site build-up and site sharing arrangements. Introduction of instruments to facilitate transmitter site erection, e.g. building permit and site sharing rules are introduced.

2.7	Main activities	Status code	Observation / Advice
1	Check relevant paragraphs/ entries in legislation/policies and licensing framework for DTTB and MTV service introductions	A	
2	Determine and align building permit policies with intended DTTB/MTV licence Terms and conditions	A	
3	Publish policies for DTTB/MTV planning and building permits (may include waivers)	A	

2.7	Main activities	Status code	Observation / Advice
4	Possibly conduct local hearings and/or expert investigations which may result in changes in permitted spectrum usage/transmitter site parameters (and delays)	A	
5	Monitor actual transmitter site operations and check/test emitted radiation	A	
6	Possibly update National Spectrum Plan	A	

2.8 Drafting of media permits and authorizations

Brief description	The right or permission to broadcast television content on a defined broadcast DTTB platform in a designated geographical area and for a specified period. In this section we focus on granting media/broadcast permits/authorizations for commercial broadcasters (for public broadcasters see Subsection 2.2.3 in the ITU Guidelines).
Objective	In regulating access to the DTTB platform and/or to determine content composition on the DTTB and MTV platforms, the regulator can avoid unwanted broadcasts, promote defined broadcasts or avoid duplication of content.

2.8	Main activities	Status code	Observation / Advice
1	Check existing media legislation, policies and licensing framework	A	
2	Check technology and standards regulation (receiver regulations) and include in media permits policies	A	
3	Determine media permits/authorizations and procedures and align with DTTB/MTV licence terms and conditions and planning	B	
4	Publish policies for media permits and authorizations (may include waivers)	C	

2.9 Determining business models and public financing

Brief description	This section addresses the financing models and sourcing of public service broadcasting (PSB) and DTT financing issues.
Objective	Introduce different sources for funding the PSB services and specify financing issues for DTTB, e.g. financing of digital receivers, the simulcast period and revision of TV licensing fee system, etc.

2.9	Main activities	Status code	Observation / Advice
1	Check existing media legislation, policies and licensing framework	A	
2	Consult public roadcaster(s) on current/future analogue television, DTTB and MTV transmissions	A	
3	Analyse market situation and assess possible market distortions	C	
4	Define or complete required public service offering on DTTB and MTV platform (if not defined in Legislation yet)	B	
5	Align defined public service offering with other DTTB/MTV licence terms and conditions and media permits, and their planning	B	
6	Determine and establish budget for public broadcast service offering and/or subsidizing consumer equipment	B	

4.1 Technology and standards application

Brief description	Technical comparison of key DTTB standards and the characteristics of associated systems.
Objective	Technical evaluation of DTTB transmission standard and choice of systems for required services

4.1	Main activities	Status code	Observation / Advice
1	Describing tests	A	
2	Evaluation of SDTV and HDTV specifications (including sound channels) and estimation of required bit rate	B	
3	Evaluation of standards characteristics with GE06 provisions, business plan and receiver availability	B	
4	Evaluation of characteristics of compression systems	A	

4.1	Main activities	Status code	Observation / Advice
5	Evaluation of conditional access systems	A	
6	Evaluation of additional systems (including access systems if needed) and estimation of required bit rate	C	In order to carry 12 to 14 SDTV in one SFN MUX, it is suggested to evaluate trade off of bit rate versus transmission network coverage design; and evaluate acceptable picture/sound performance versus bit rate for SDTV H.264.

4.2 Developing design principles and network architecture

Brief description	Implementation priorities and network architecture
Objective	Initial technical description of the main network elements in relation to service quality, coverage, costs and timing requirements, serving as input document for preparing the initial frequency plan and ASO plan.

4.2	Main activities	Status code	Observation / Advice
1	Education and training of technical staff	C	
2	Evaluation of roll-out options	C	
3	Evaluation of type of distribution network	B	
4	Evaluation of network topology	B	
5	Drafting multiplex composition plan	B	
6	Establishing frequency plan per multiplex/network	B	
7	Drafting transmitting station lay out	C	

4.3 Performing network planning

Brief description	Iterative process of achieving optimal coverage and multiplex capacity using several system parameters and varying radiation characteristics. Several network plans are likely to be made (e.g. before and after ASO, for rooftop and indoor reception, with normalized and calculated transmitting antenna characteristics, or for testing different service quality or coverage targets).
Objective	Basis for verifying service proposition and financing (see functional building blocks 2.9, 3.2 and 3.4).

4.3	Main activities	Status code	Observation / Advice
1	Specification of station characteristics	B	
2	Coverage analysis	B	In Annex 7, the SFN coverage design for DVB-T2 in Sri Lanka may need to use Scenario 3b: Rooftop reception for large area SFNs. The NRT and TRCSL are recommended to carry out further network and coverage design and planning in order to conclude the best transmission parameters suitable for DVB-T2 used in Sri Lanka.
3	SFN optimization	C	
4	Performing GE06 (annex 4, section II) conformity check	NA	
5	Gap-filler planning	C	
6	Proposing modifications to multiplex composition, network architecture or business plan (as far as necessary)	NA	

4.4 Determining system parameters

Brief description	Parameters related to the DTTB transmission standard
Objective	Selecting system parameter by trading-off between coverage, multiplex bit rate and radiation characteristics, serving as input in the initial network planning

4.4	Main activities	Status code	Observation / Advice
1	Evaluation of FFT size to meet DVB-T2	C	
2	Evaluation of carrier modulation to meet DVB-T2	C	
3	Evaluation of code rate to meet DVB-T2	C	
4	Evaluation of guard interval to meet DVB-T2	C	

4.5 Assessing radiation characteristics

Brief	Determination of transmitter power and transmitting antenna gain in

description	order to achieve the required or allowed effective radiated power and configuration of the optimum antenna diagram and polarization.
Objective	Specification of transmitter power, antenna gain and antenna diagram as input for initial network planning.

4.5	Main activities	Status code	Observation / Advice
1	Evaluation of transmitter power, antenna gain and polarization	B	To evaluate the optimized transmitter power to meet the SFN coverage requirement.
2	Evaluation and optimizing antenna diagram	C	It is suggested to use radio planning software to simulate the optimized SFN coverage and evaluate and the best antenna diagram in order to reduce loss of radiation power over sea area and minimise the radiation power to overlapping area that may exceed the guard interval with other SFN stations.
3	Calculation of antenna power budget	B	The higher antenna gain requires more antenna stacks as a result to occupy more space on antenna mast. It is suggested to evaluate the best engineering design approach in selecting transmitter power and antenna gain.

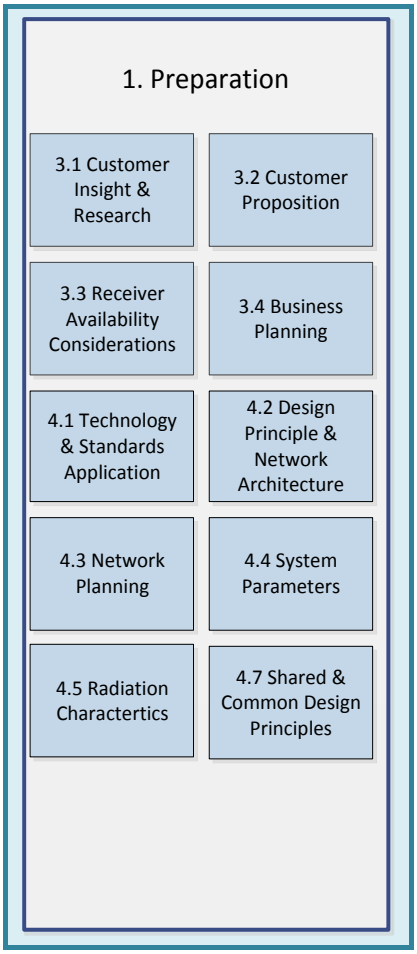
4.7 Deciding shared and common design principles

Brief description	This section consists three parts each containing a sub-part with implementation guidelines, a) application of shared and common design principles; b) Site and antenna sharing; c) multiplex sharing.
Objective	This section provides background information and guidelines on key topics and choices regarding shared and common design principles.

4.7	Main activities	Status code	Observation / Advice
1	Investigate national regulations regarding site sharing	A	
2	Determine in principle shared use of DTTB and MTV networks and which elements (sites, antennas, multiplex)	A	
3	Determine in principle on common design and planning of DTTB and MTV networks	A	
4	Prepare site sharing agreements	B	

Annex 4: Functional building block related to phase 1 of the roadmap for operator (DBNO)

Preparation



The selected functional building blocks related to phase 1 of the roadmap are shown in Figure 11 and are reproduced here.
Section 3.4.6 describes phase 1 of the roadmap for the operator.

This Annex gives an overview in the form of tables of the status of each of the selected functional building blocks related to phase 1 by means of the following codes:

A. the activities on key topics and choices that are **already decided**;

B. the activities on key topics and choices that are **partly decided**;

C. the activities on key topics and choices that are under consideration and are **not decided**;

D. the activities on key topics and choices that **need revision**;

NA. the activities on key topic and choices that are **not considered yet**.

The selected functional building blocks are presented in the order of the number of the block. This number refers to the corresponding chapter in the ITU Guidelines, where more information and implementation guidelines can be found.

Functional building blocks 4.1, 4.2, 4.3, 4.4, 4.5 and 4.7 can be found in phase 3 Licensing policy and regulation for the regulator.

3.1 Investigation of customer insight and carrying out market research

Brief description	Launching a commercial PSB DTTB service, will require the identification of demand drivers (i.e. customer needs), competitive advantages, service uptake projections and possibly market entry barriers in the local market(s).
Objective	The NRT will have to carry out some form of market research for identifying these demand drivers, competitive advantages and service uptake projections.

3.1	Main activities	Status code	Observation / Advice
1	Determine need, timing and scope for market research	C	
2	Analyse competitive offerings, substitutes and technology developments	C	
3	Design and develop preliminary DTTB and MTV service propositions	C	
4	Draft market research plan, staff and budget market research project	C	
5	Carry out market research and analyse results, translate into DTTB/MTV service propositions, if necessary carry out additional market research	C	

3.2 Defining customer proposition

Brief description	This section focuses on determining the PSB DTTB competitive advantage and what the related service attributes could look like.
Objective	Finding the best Customer Proposition in line with the Business Plan objectives (see initial DTTB service planning in the second phase).

3.2	Main activities	Status code	Observation / Advice
1	Analyse earlier DTTB and MTV service launches and compare with customer research results/local market conditions	C	
2	Define DTTB/MTV service propositions and check feasibility/cost levels with key suppliers, i.e. Distributor (broadcast network operator) and Content Aggregators, Content Creators	C	NRT should include the best approach to deliver the subsidized STB to the viewers into account.
3	Possibly redefine DTTB/MTV service propositions and test in market again, i.e. additional market research	C	Suggest taking pilot DTTB services in Northern Province to conduct this activity.

3.3 Carrying out receiver availability considerations

Brief description	The consideration of the many different DTTB receivers commercially available today.
Objective	For a Service Provider it is important to draft the receiver's functional requirements based on the defined Service Proposition(s). Only those requirements supporting the Service Proposition should be incorporated. These 'must have' requirements might prove to be too expensive for the business case and therefore receiver considerations might result in a revised Service Proposition.

3.3	Main activities	Status code	Observation / Advice
1	Analyse earlier DTTB and MTV service launches, assess local substitutes and technology developments	B	
2	Check any prescribed Technologies and Standards, Receiver regulations and analyse market research results	B	
3	Assess and make inventory of availability and roadmaps of various receiver types/attributes	C	
4	Check network compatibility and interoperability (radio interfaces and API/applications)	C	
5	Assess and detail ex-factory and retail pricing for various receivers	C	
6	Decide key receivers and their attributes, draft receiver/service roadmap	C	

3.4 Performing business planning

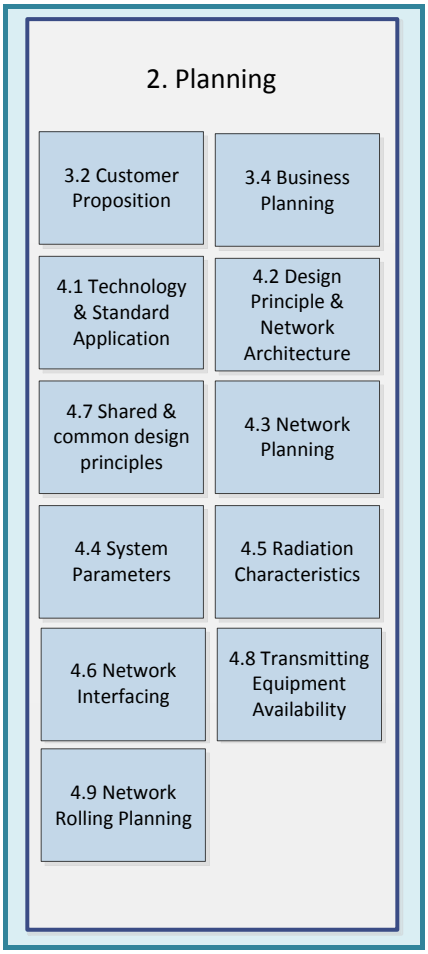
Brief description	This section will focus on agreement on business case (budget) for the ASO Plan.
Objective	To have the ASO Plan successfully passing Cabinet

3.4	Main activities	Status code	Observation / Advice
1	Analyse legal/regulatory framework (may include prescribed Technologies and Standards, Assignment Procedure, License Terms and Conditions, Business Models and Public Financing), determine impact and opportunities	B	

3.4	Main activities	Status code	Observation / Advice
2	Assess market take-up and project revenue streams, based on customer research and proposition	C	
3	Assess and calculate associated costs (considering concepts of 'total cost of ownership'), project costs ahead	C	
4	Carry out profitability and sensitivity analysis, draft business plan scenarios	C	
5	Carry out market research and analyse results, translate into DTTB/MTV service propositions, if necessary carry out additional market research	C	

Annex 5: Functional building block related to phase 2 of the roadmap for operator (DBNO)

Planning



The selected functional building blocks related to phase 2 of the roadmap are shown in Figure 11 and are reproduced here.

Section 3.4.7 describes phase 2 of the roadmap for the operator.

This Annex gives an overview in the form of tables of the status of each of the selected functional building blocks related to phase 2 by means of the following codes:

A. the activities on key topics and choices that are **already decided**;

B. the activities on key topics and choices that are **partly decided**;

C. the activities on key topics and choices that are under consideration and are **not decided**;

D. the activities on key topics and choices that **need revision**;

NA. the activities on key topics and choices are **not considered yet**.

The selected functional building blocks are presented in the order of the number of the block. This number refers to the corresponding Chapter in the ITU Guidelines, where more information and implementation guidelines can be found.

Functional building blocks 3.2, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5 and 4.7 can be found in phase 1 Preparation for the network operator (DBNO).

4.6 Specifying network interfaces

Brief description	Interfaces between parts of the network, the studio and the head-end, the transmitting antenna and the receiver and transmitting equipment and the monitoring centre.
Objective	Defining interfaces with network elements in order to obtain satisfactory service delivery.

4.6	Main activities	Status code	Observation / Advice
1	Drafting interface specifications between studio and multiplex head end	C	
2	Drafting interface specifications between network monitoring system and transmitting equipment	C	
3	Describing the radio interface	C	

4.8 Considering equipment availability

Brief description	This section includes market research and technical specification in relation to activities, a) specification of the transmission equipment in the DTTB implementation plan; b) verifying if the specification can be met on the market, and c) drafting specifications for tending to purchase equipment.
Objective	This section provides background information and guidelines on key topics and choices regarding transmission equipment availability.

4.8	Main activities	Status code	Observation / Advice
1	Drafting interface specifications between studio and multiplex head end	C	
2	Drafting interface specifications between network monitoring system and transmitting equipment	C	Suggest common monitoring system setup by DBNO can be accessed by the regulator
3	Describing the radio interface	C	

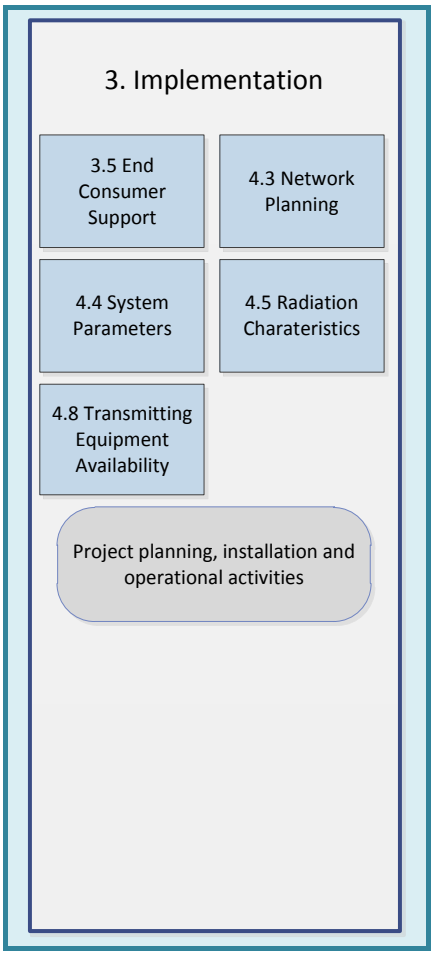
4.9 Network roll out planning

Brief description	Implementation plan taking into account coverage priorities, services priorities, ASO, equipment availability and capacity of the network operator
Objective	To provide implementation schedule for the DTTB services within budget and time constraints

4.9	Main activities	Status code	Observation / Advice
1	Describing pilot tests	B	
2	Roll out planning (e.g. main cities, provincial cities, rural areas), before and after ASO	B	
3	Agreement with receiver manufacturers to deliver receivers in sufficient quantities, in time	C	
4	Coverage assessment at each stage of implementation	C	
5	Setting up communication plan and related provisions (e.g. helpdesk, website)	C	

Annex 6: Functional building block related to phase 3 of the roadmap for the operator (DBNO)

Implementation



The selected functional building blocks related to phase 3 of the roadmap are shown in Figure 11 and are reproduced here.

Section 3.4.8 describes phase 3 of the roadmap for the operator.

This Annex gives an overview in the form of tables of the status of each of the selected functional building blocks related to phase 3 by means of the following codes:

A. the activities on key topics and choices that are **already decided**;

B. the activities on key topics and choices that are **partly decided**;

C. the activities on key topics and choices that are under consideration and are **not decided**;

D. the activities on key topics and choices that **need revision**;

NA. the activities on key topics and choices are **not considered yet**.

The selected functional building blocks are presented in the order of the number of the block. This number refers to the corresponding Chapter in the Guidelines, where more information and implementation guidelines can be found.

Function building blocks 4.3, 4.4, 4.5 and 4.8 can be found in phase 2 Planning for network operator (DBNO).

3.5 Defining end consumer support

Brief description	The end consumer support comprises normally 1) subscription management, 2) order management and fulfilment, 3) catalogue management, 4) marketing campaign management, 5) customer services and support, and 6) service provisioning.
Objective	This section is part of the DTTB/MTV Service Provider's customer relationship management (CRM) process.

3.5	Main activities	Status code	Observation / Advice
1	Describing pilot tests	B	
2	Roll out planning (e.g. main cities, provincial cities, rural areas), before and after ASO	B	
3	Agreement with receiver manufacturers to deliver receivers in sufficient quantities, in time	C	
4	Coverage assessment at each stage of implementation	C	
5	Setting up communication plan and related provisions (e.g. helpdesk, website)	C	

Annex 7: Example of DT SFN coverage probability prediction

In the subcommittee report, section 4.4 location of transmission, the probable locations were identified as Yatiyantota, Karagahatenna, Kokavil, Numunukula, Gongala, Piduruthalagala, Hanthana, and Peliyagoda (replaced by site in Colombo). The recommendation of these optimal locations of transmission sites were also based on the coverage simulation provided by TRCSL, see Appendix 2 of the subcommittee report. The transmission site technical data is shown in Table 26.

Table 26: Transmission site technical data of the proposed eight DTTB principal sites

No	DTTB Site location name	Elevation MSL (m)	TX antenna high (m)	Rated DTTB TX power (kW)	TX Ant System Gain (dB)	DTTB ERP (kW)	Polarizat-ion
DTT-1	Kokavil	60	172	5	10	50	H
DTT-2	Colombo	5	75	2	10	20	H
DTT-3	Yatiyantota	1295	50	5	10	50	H
DTT-4	Pidurutha-lagala	2524	50	5	10	50	H
DTT-5	Karagahatenna	1082	55	5	10	50	H
DTT-6	Numunukula	1497	30	2	10	20	H
DTT-7	Gongala	1089	50	5	10	50	H
DTT-8	Hanthana	1050	70	2	10	20	H

Note: Correct ERP values should be calculated using radio planning software by Project Management Office (PMO).

Source: Author

With reference to implementation scenarios 3a and 3b in the EBU – TECH 3348, Frequency and Network Planning Aspects of DVB-T2, Table 27 below is the DVB-T2 SFN parameter setting for these two scenarios.

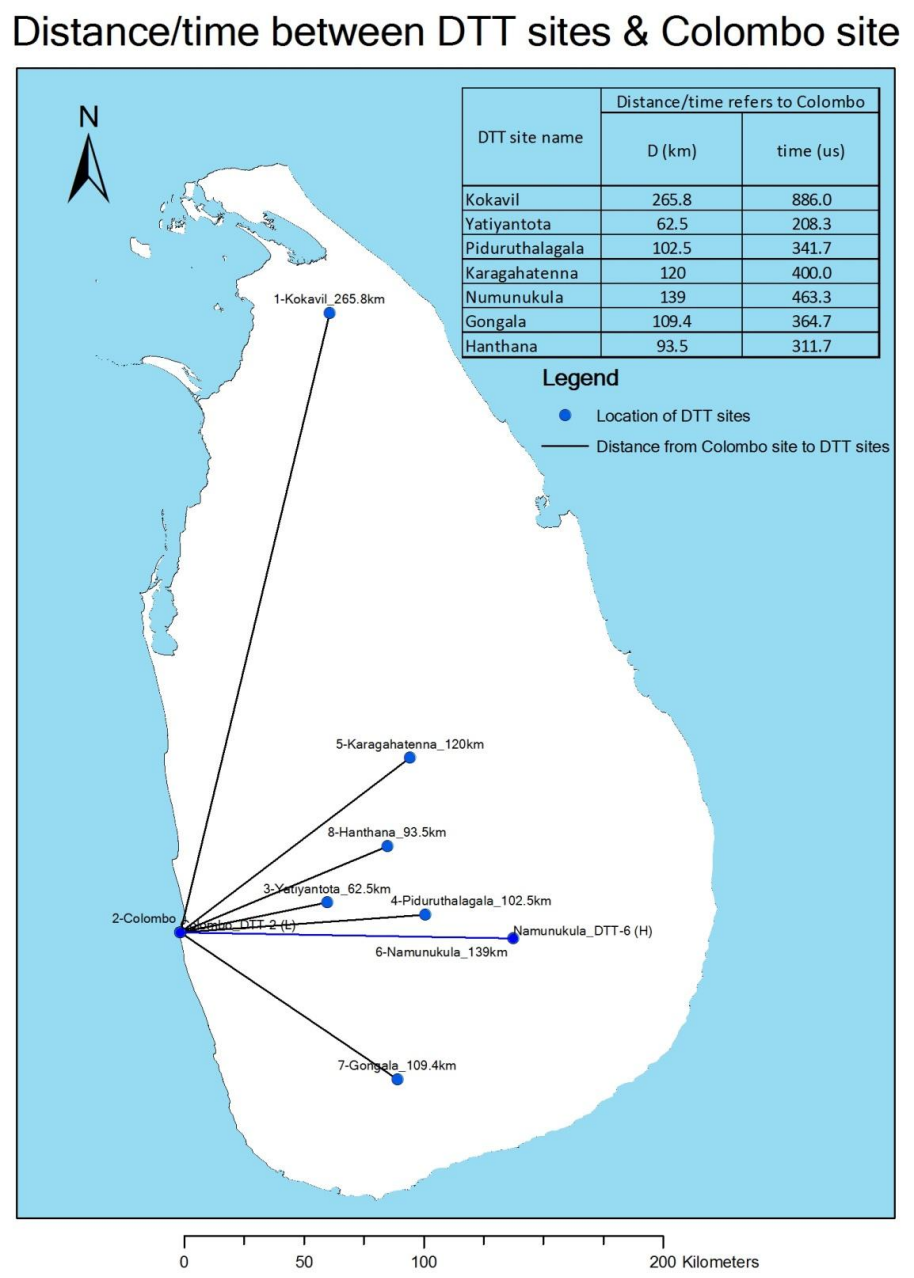
Table 27: Implementation scenarios 3a and 3b for DVB-T2 SFN parameter setting

Scenario 3a: Rooftop reception for limited area SFN	Scenario 3b: Rooftop reception for large area SFNs
Bandwidth: 8 MHz FFT size: 32k Carrier mode: extended Scattered Pilot Pattern: PP4 Guard interval: 1/16 (224 µs) Modulation: 256-QAM Code rate: 2/3 C/N (Rice):19.6 dB Resulting data rate: ~ 37 Mbit/s	Bandwidth: 8 MHz FFT size: 32k Carrier mode: extended Scattered Pilot Pattern: PP2 Guard interval:1/8 (448 µs) Modulation: 256-QAM Code rate: 2/3 C/N (Rice): 20.0 dB Resulting data rate: ~ 35 Mbit/s

Source: EBU - TECH 3348, Frequency and Network Planning Aspects of DVB-T2

The distance and time from proposed DTTB sites to the Colombo DTTB site is in range from 62.5 km to 265.8 km. It is noted that under scenario 3a: guard interval 1/16 (224µs), maximum distance (km) within GI between SFN site is 67.2 km. On the other hand, under scenario 3b: guard interval 1/8 (448µs), maximum distance (km) within GI between SFN site is 134.4 km. See Figure 34.

Figure 34: Measured distance between proposed DTTB sites and test point locates at Colombo DTTB site



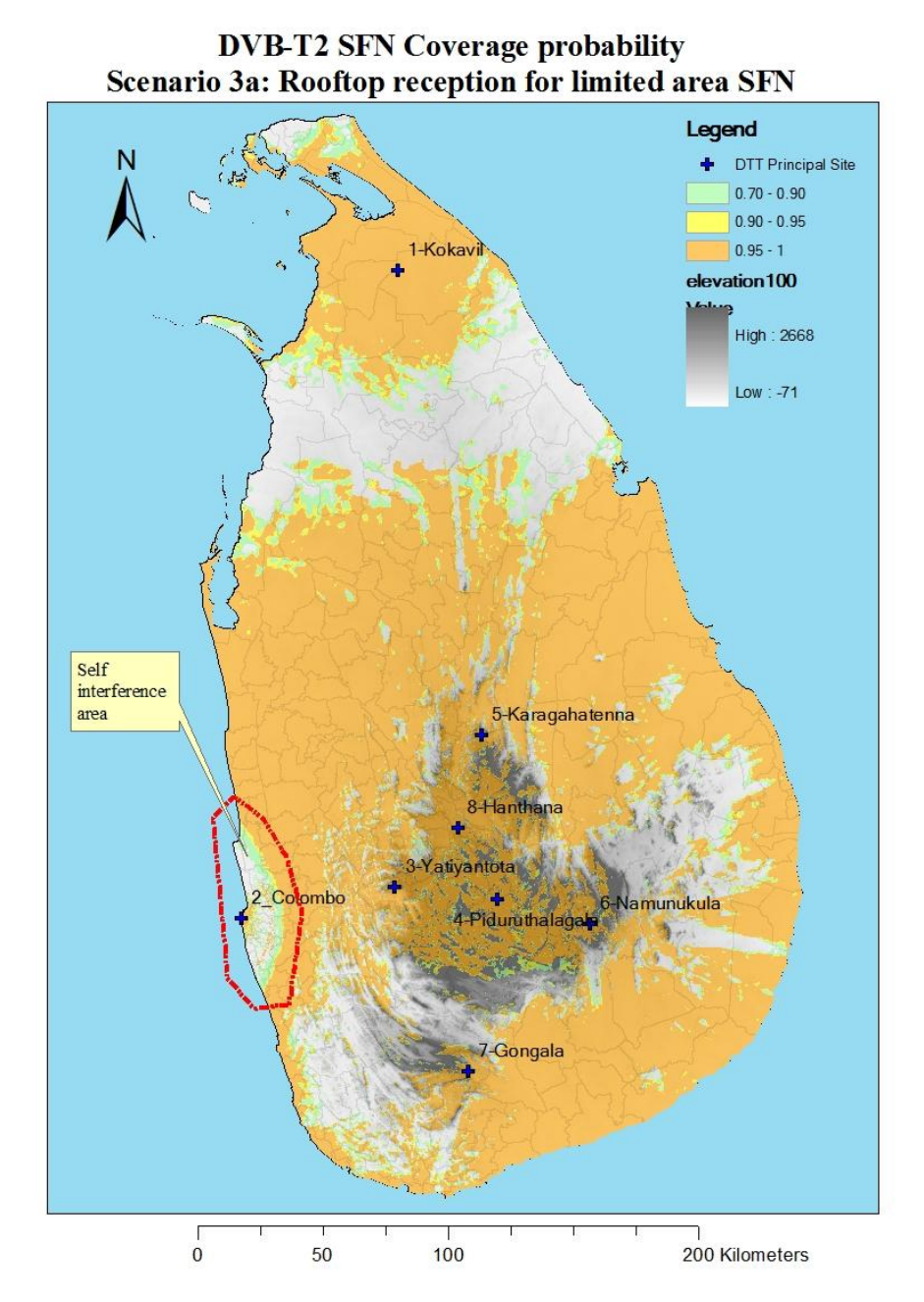
DTT site name	Distance/time refers to Colombo	
	D (km)	time (us)
Kokavil	265.8	886.0
Yatiyantota	62.5	208.3
Piduruthalagala	102.5	341.7
Karagahatenna	120	400.0
Numunukula	139	463.3
Gongala	109.4	364.7
Hanthana	93.5	311.7

Source: NRT

Under scenario 3a: Rooftop reception for limited area SFN, the resulting data rate is ~37 Mbit/s. However, the distance from most of the DTTB sites to Colombo area is in range from 62.5 km to 265.8 km that exceed maximum distance 67.2 km because guard interval 1/16 is 224µs. In order to find out the SFN coverage performance based on scenario 3a and 3b, the DVB-T2 SFN coverage probability simulation was carry out by means of radio planning software (GiraPlan© from Progira Radio Communication®).

Figure 35 is the simulation result of DVB-T2 SFN coverage probability based on the parameter setting suggested in scenario 3a for eight proposed DTTB sites referring to technical data shown in Table 27.

Figure 35: SFN coverage probability under Scenario 3a (self interference occurs in Colombo area)



Source: NRT of Sri Lanka

Figure 36 is simulation result providing with SFN coverage presented in light grey, interference limited area presented in red, etc. Take Colombo area as example, the coverage probability value is 0.572 that is much lower than 0.95 because the impulse response of SFN sites Hanthana and Piduruthalaga exceed the guard interval 1/16 (224 µs) and the level is above the minimum co-channel interference protection ratio, see Figure 37.

Figure 36: SFN coverage interference limited under Scenario 3a (self interference occurs in Colombo area)

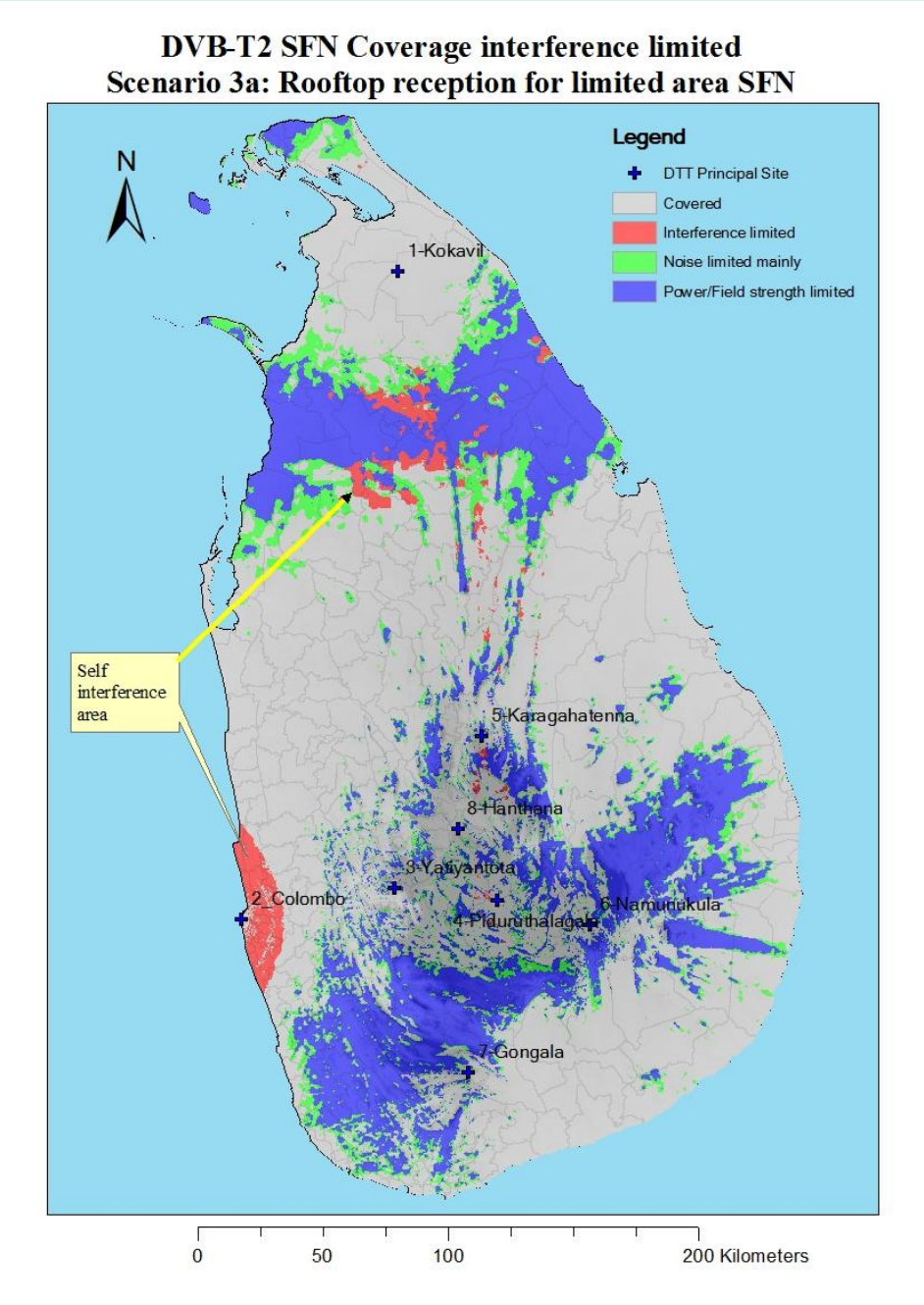
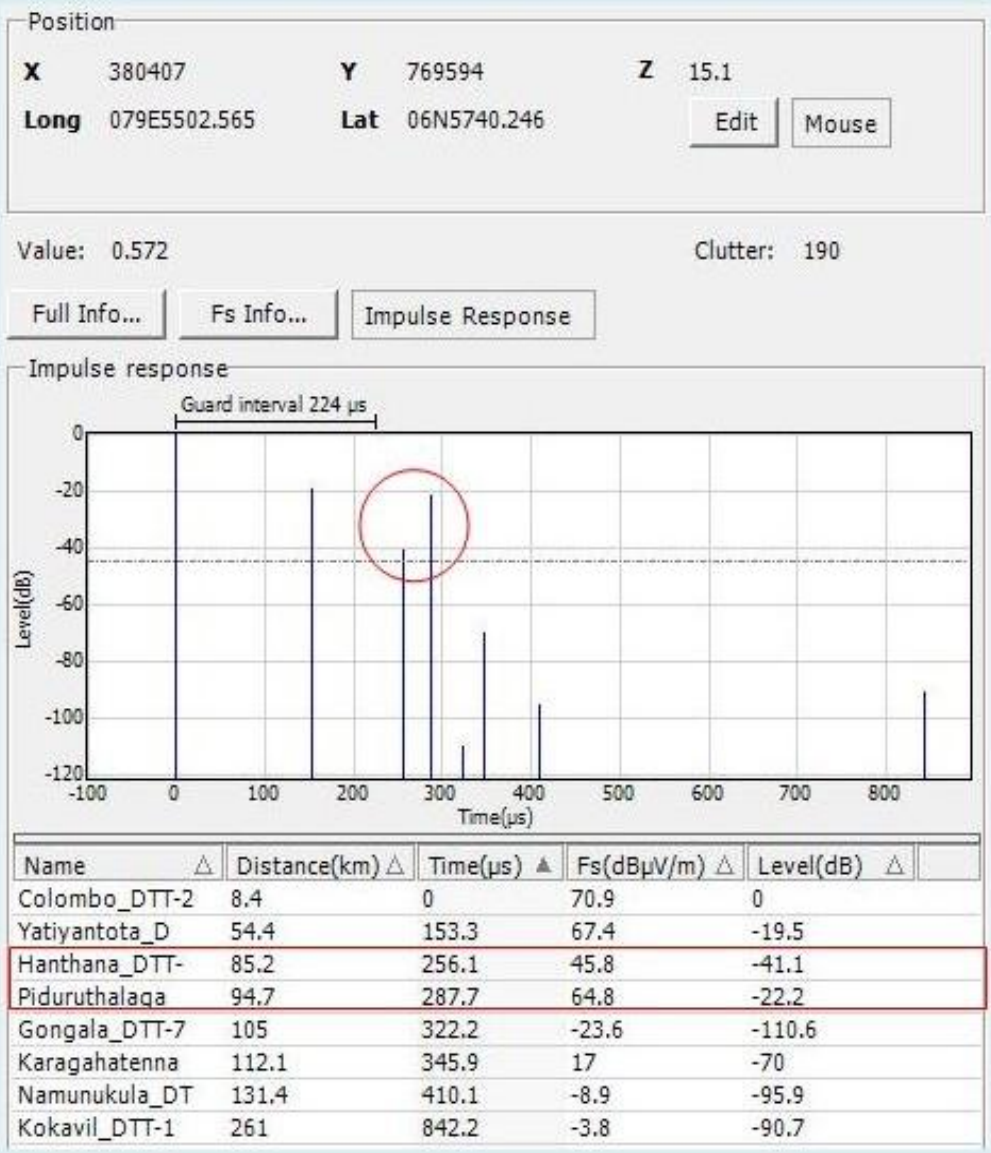


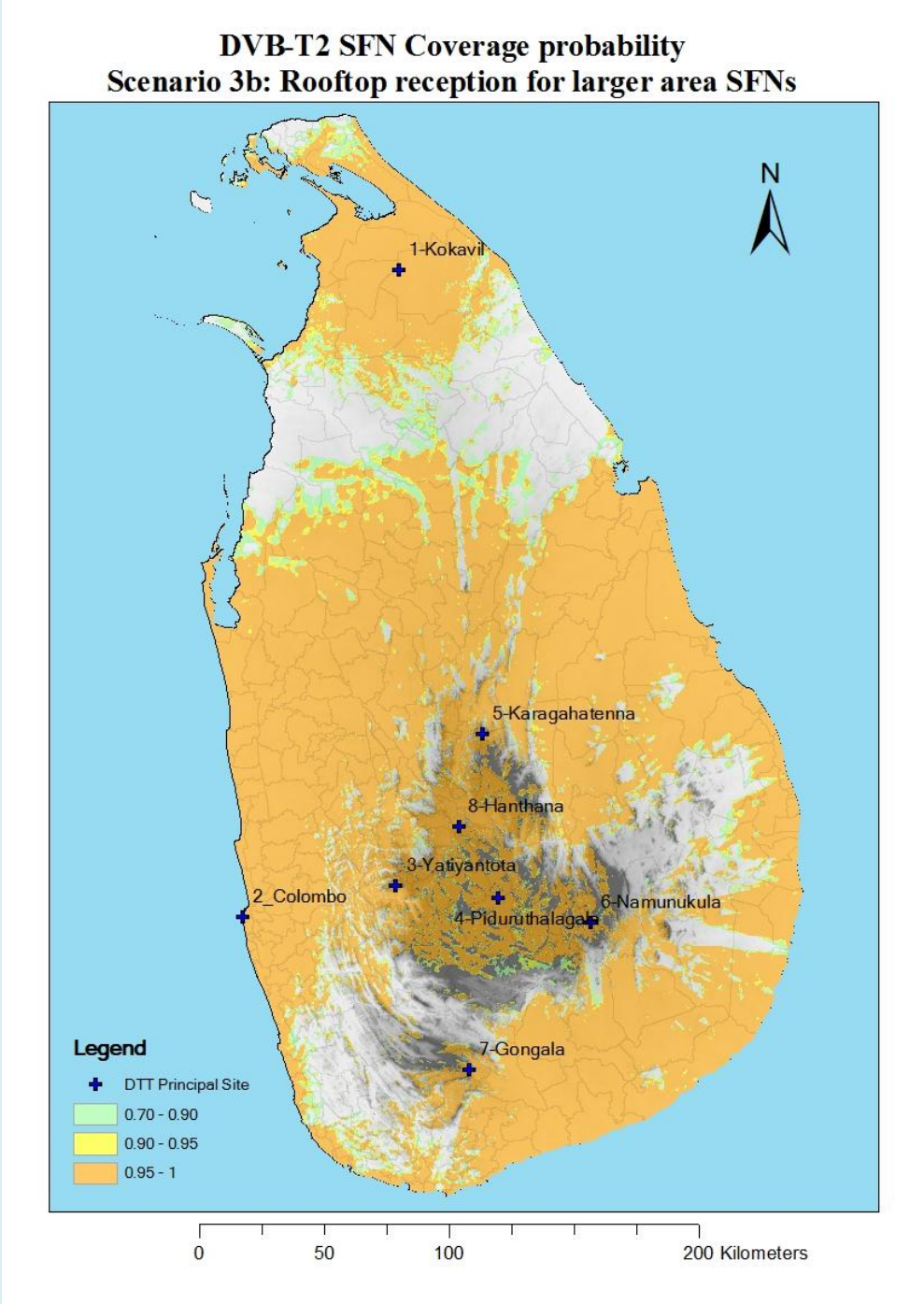
Figure 37: Impulse response at check point in Colombo District with probability value 0.572



Name	Distance(km)	Time(µs)	Fs(dBµV/m)	Level(dB)
Colombo_DTT-2	8.4	0	70.9	0
Yatiyantota_D	54.4	153.3	67.4	-19.5
Hanthana_DTT-	85.2	256.1	45.8	-41.1
Piduruthalaga	94.7	287.7	64.8	-22.2
Gongala_DTT-7	105	322.2	-23.6	-110.6
Karagahatenna	112.1	345.9	17	-70
Namunukula_DT	131.4	410.1	-8.9	-95.9
Kokavil_DTT-1	261	842.2	-3.8	-90.7

Figure 38 is the simulation result of DVB-T2 SFN coverage probability based on the parameter setting suggested in scenario 3b for eight proposed DTTB sites referring to technical data shown in Table 27. Self interference is free in all major DVB-T2 coverage areas.

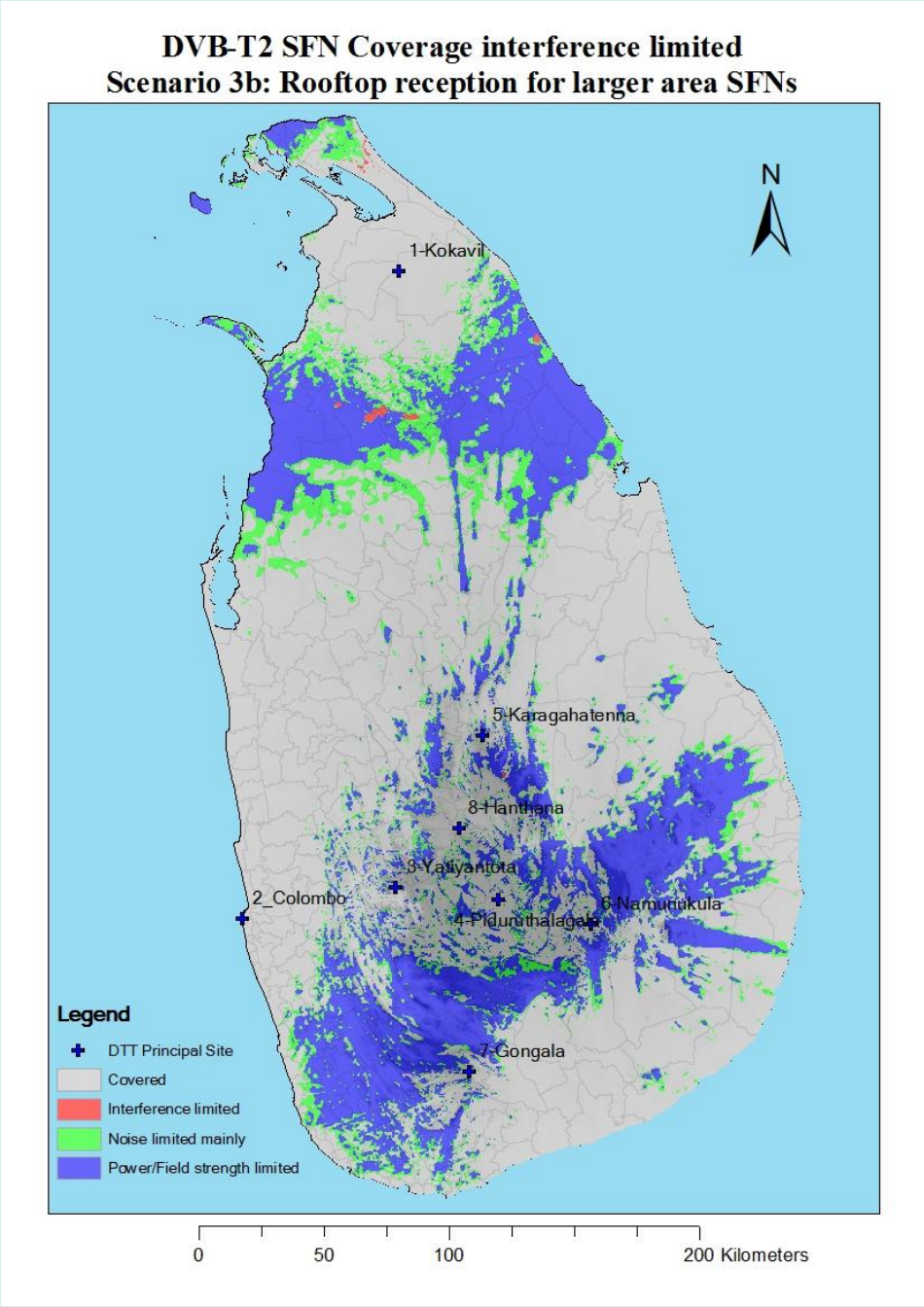
Figure 38: SFN coverage probability under Scenario 3b



Source: NRT of Sri Lanka

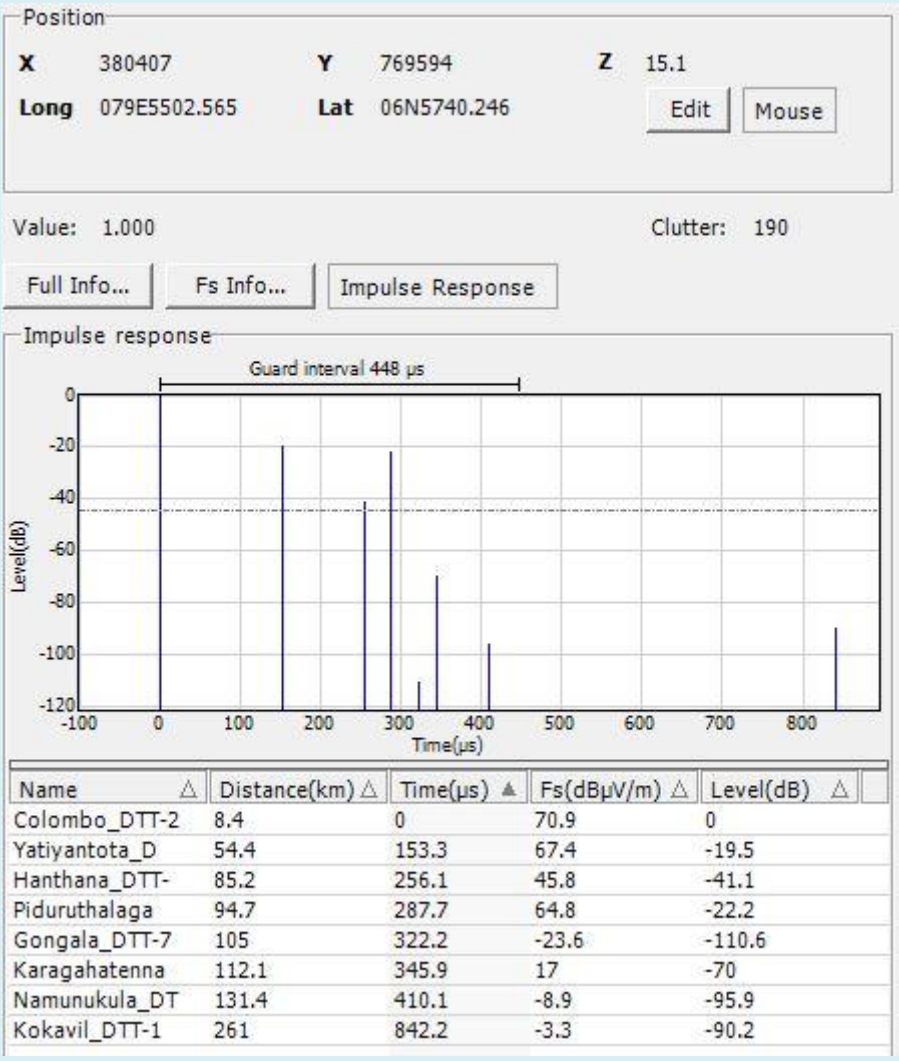
Figure 39 indicates self interference is free from all SFN stations except DTTB station from Kokavil that exceed guard interval 1/8 (448 µs). As shown in Figure 40, the distance between Kokavil and check point locates in Colombo is 261 km (842.2 us) that exceed guard interval (448 us) and cause self interference in overlapping area under power/field strength limited only.

Figure 39: coverage interference limited under Scenario 3b (self interference occurs in power/field strength limited area)



Source: NRT of Sri Lanka

Figure 40: Impulse response at check point in Colombo District with probability value 1



Name	Distance(km)	Time(µs)	Fs(dBµV/m)	Level(dB)
Colombo_DTT-2	8.4	0	70.9	0
Yatiyantota_D	54.4	153.3	67.4	-19.5
Hanthana_DTT-	85.2	256.1	45.8	-41.1
Piduruthalaga	94.7	287.7	64.8	-22.2
Gongala_DTT-7	105	322.2	-23.6	-110.6
Karagahatenna	112.1	345.9	17	-70
Namunukula_DT	131.4	410.1	-8.9	-95.9
Kokavil_DTT-1	261	842.2	-3.3	-90.2

Figure 41 to Figure 48 is DVB-T2 field strength coverage prediction based on scenario 3a parameter setting.

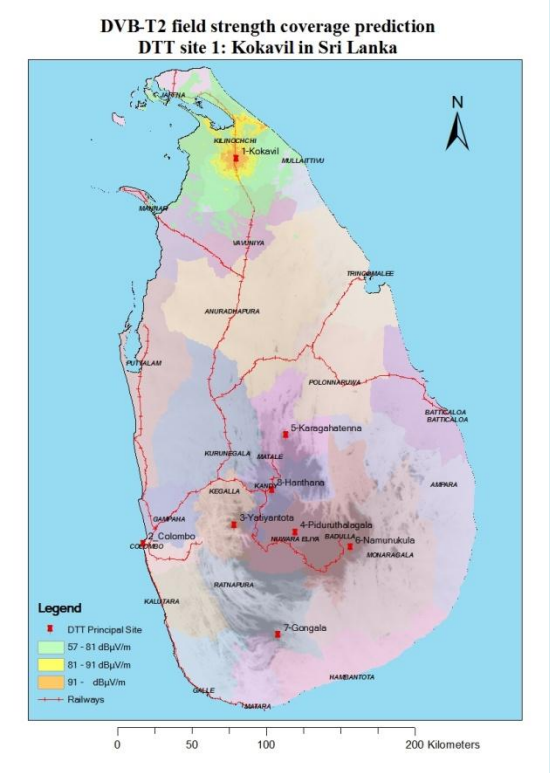
Conclusion

It is noted that using scenario 3b rooftop reception for large SFNs can avoid the SFN self interference problem especially in the geographical environment of Sri Lanka because most of DTTB sites are well within the guard interval as shown in Figure 40. The trade-off using scenario 3b is a reduced data rate, i.e. 33.35 Mbit/s in comparing with approximately 36.83 Mbit/s in scenario 3a.

Recommendation

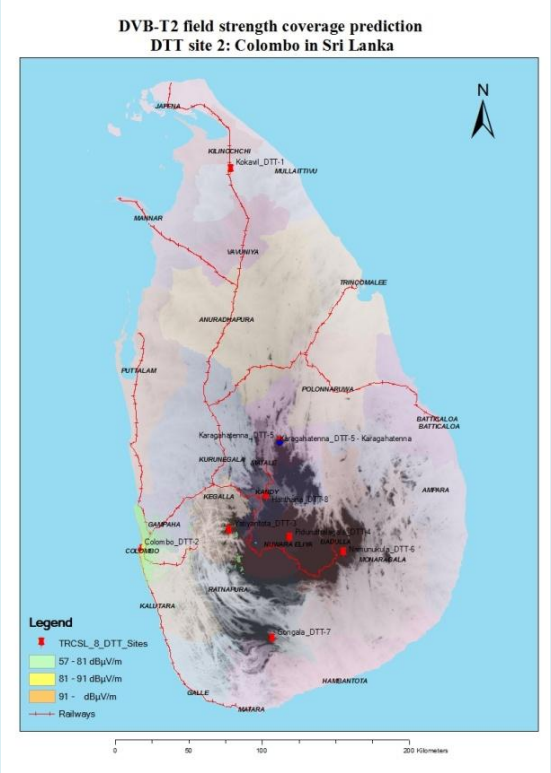
The NRT and TRCSL are recommended taking the above findings into account to further evaluate the DVB-T2 SFN coverage and select the best DVB-T2 transmission parameter setting.

Figure 41: Kokavil DTTB Site FS coverage



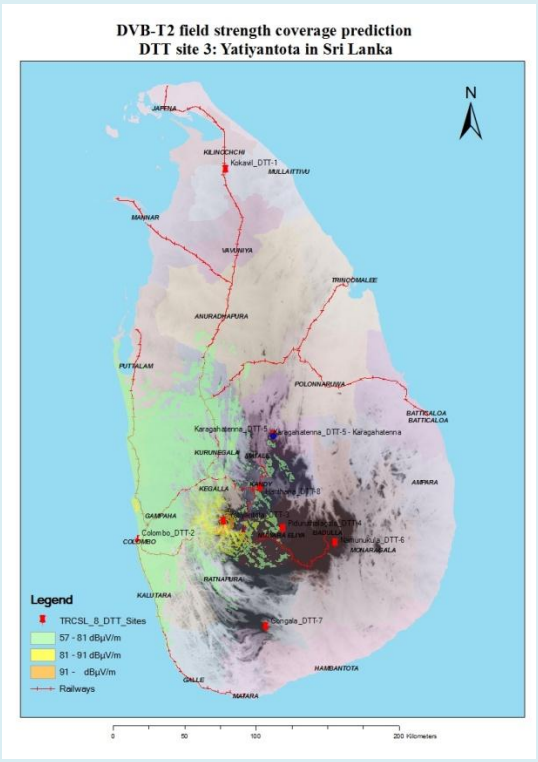
Source: NRT of Sri Lanka

Figure 42: Colombo DTTB Site FS coverage



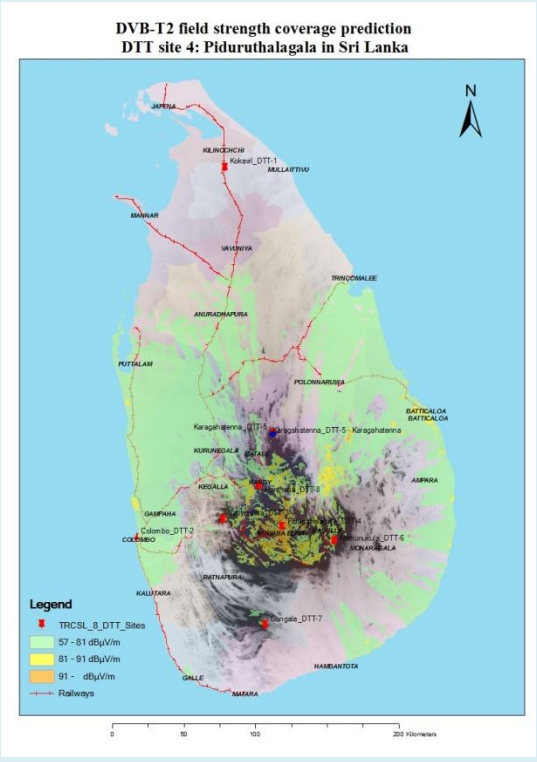
Source: NRT of Sri Lanka

Figure 43: Yatiyantota DTTB Site FS coverage



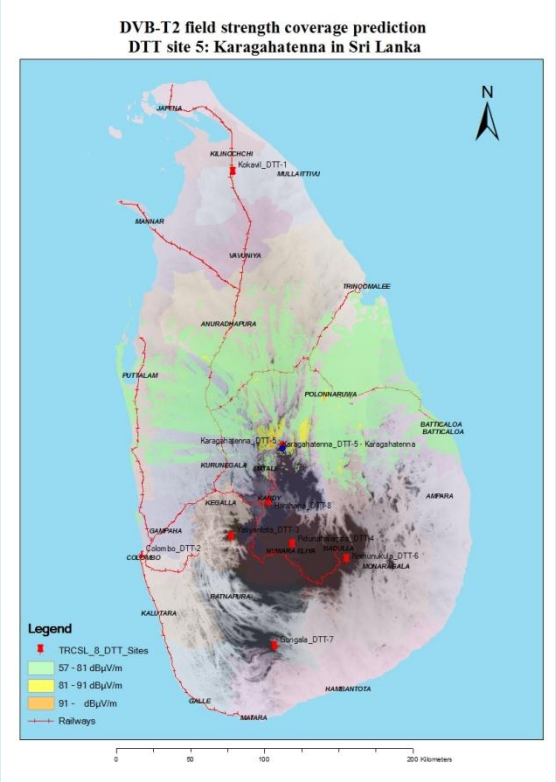
Source: NRT of Sri Lanka

Figure 44: Piduruthalagala DTTB Site FS coverage



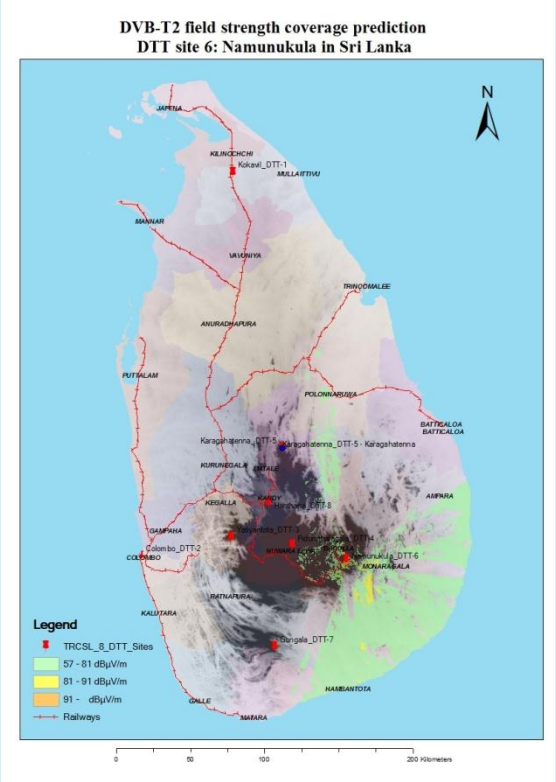
Source: NRT of Sri Lanka

Figure 45: Karagahatenna DTTB Site FS coverage



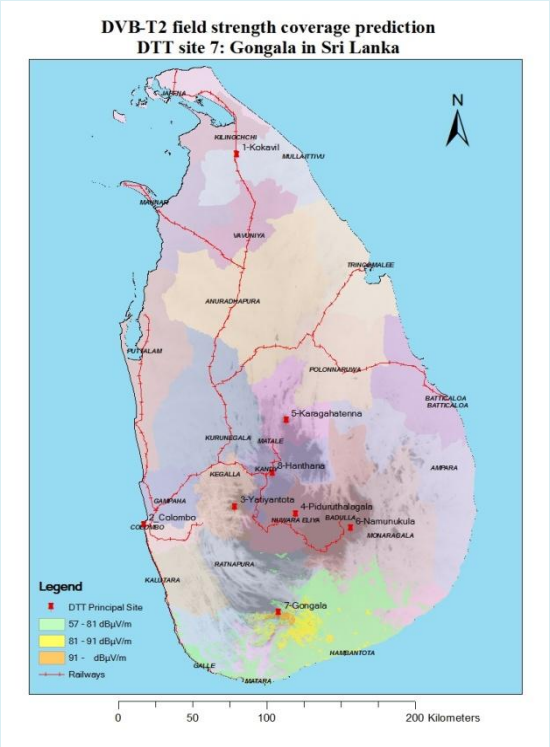
Source: NRT of Sri Lanka

Figure 46: Numunukula DTTB Site FS coverage



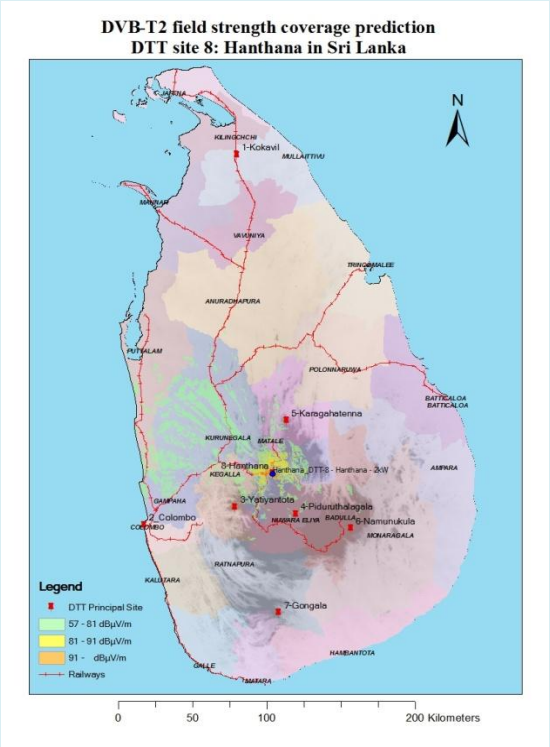
Source: NRT of Sri Lanka

Figure 47: Gongala DTTB Site FS coverage



Source: NRT of Sri Lanka

Figure 48: Hanthana DTTB Site FS coverage



Source: NRT of Sri Lanka

International Telecommunication Union
Telecommunication Development Bureau
Place des Nations
CH-1211 Geneva 20
Switzerland
www.itu.int

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