DVB-T network tender
Information, planning and procedures

Bureau Telecommunicatie en Post

Doc version 1.0
February 2011

DVB T **MEMBER**

Content

1   Introduction

Bureau Telecommunicatie and Post (BTP) is planning the migration from analogue TV to Digital TV. As such Curacao is following the world wide transition to Digital Terrestrial Television (DTT) enabling more programs whilst using less precious frequency space and consuming less energy.

In order to prepare for a seemless transition, BTP has studied the available DTT options. In 2007 an initial study has been performed "Digital TV, initial overview" addressing the issues related to the migration from Analogue terrestrial TV broadcasting to Digital terrestrial TV broadcasting. Also in 2008 the first DVB-T trial deployment in the Netherlands Antilles became reality.

Subsequent studies have been done to determine the locations required to provide good digital TV coverage of most of Curacao's population. In January 2010 LS Telecom has completed a study to verify the locations identified in the initial studies and to recommend the optimal set of locations to cover Curacao cost-efficiently. Based on this study BTP has concluded that a coordinated DVB-T broadcast infrastructure would be required. This standard is future proof and can be easily upgraded to DVB-T2 if more bandwith or High definition (HD) channels are needed.

The mandatory introduction of DTT is set start of 2013. From that date on it will not be allowed to operate according to the analog TV standards. As a regulator BTP is persuing an optimal coverage for almost every inhabited area, low cost of migration and easy to use equipment for the end user accompanied by a large number of both free and pay-tv channels.

In order to achieve this goal BTP is inviting market parties involved to make a proposal for the deliverance of a network infrastructure according to this specification and proposed policies. This infrastructure should support all Free to Air Broadcasters and may include and provide access for pay-TV broadcasters on request. The proposals will be assessed on coverage, cost of operation, access fee and upgradebility.

Two possible operation scenarios are viable:

1. The awarded supplier will have the right to operate and exploit the network not only for their own broadcast but also as a host to other content parties. The revenues for hosting a network will be discussed later on. See paragraph 3.1.

2. After the network infrastructure has been awarded an association will be founded. The members will consist of the free-to-air broadcasters. The initial investor is entiteled to a pre-defined revenue. See paragraph 3.2.

2   DVB-T target broadcast infrastructure

2.1 General considerations

The DVB-T Broadcast Infrastructure should facilitate digital TV by all Free to Air Broadcasters and providing extensive coverage of the population of Curacao.
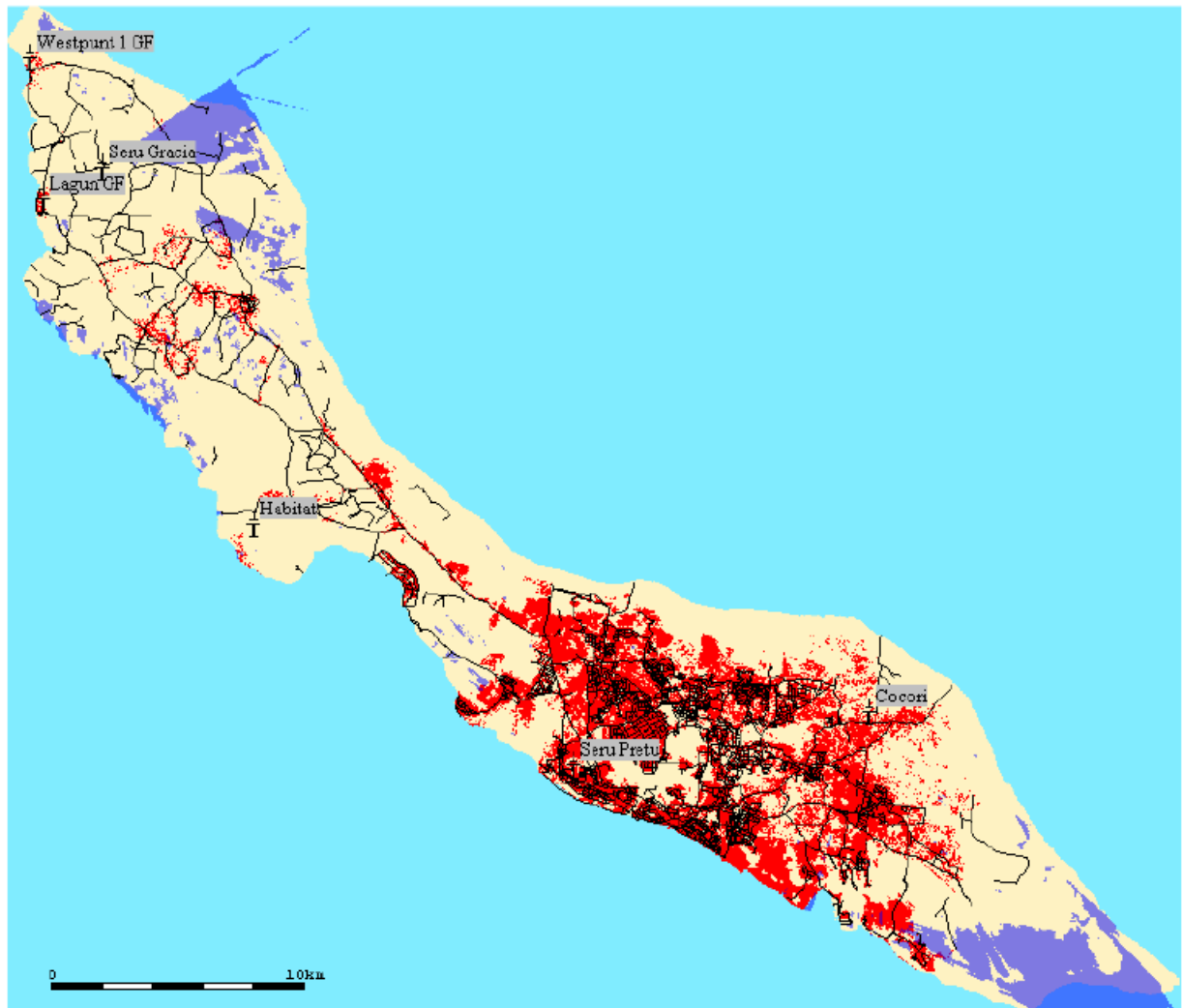
Source: LS Telecom Study

The proposed DVB-T Broadcast Infrastructure consists of 3 main locations (Seru Pretu, Cocori and Seru Gracia) and 3 fill-in locations (Habitat, Lagun and West Punt). These locations will operate in a SFN to provide good quality coverage and to be highly spectrum efficient. Due to the use of SFN, no additional channels will be lost. The Pay-TV parties are obliged to use the same locations for their DVB-T broadcast. Technically they should avoid any power difference between their transmitter and antenna patterns. Ideally the Pay-TV parties share the same DVB-T Broadcast Infrastructure with the Free-to-Air parties.

The standard used will be DVB-T initially with a mandatory upgrade option to DVB-T2. Video coding will be MPEG 2 in the early phase. The upgrade option to MPEG 4 will be necessary due to the future

introduction of DVB-T2 and HD broadcast. It is expected that prices of DVB-T2 settop boxes and DTT ready TV sets will drop rapidly within the next year.

In order to deliver a sufficient RF level for proper receiption, an RF coverage analysis has been done. Using 56 dBμV as minimum design reception level, the ERP power of the main locations should at least be 200W per mux, the secundairy locations should carry 50W per mux.

2.2 Spectrum allocation resulting from market requirements

The market requirement has been formulated as follows:
- Free-to-Air. Currently there are only 3 operational analogue Free-to-Air TV stations but two other licenses have been issued. Several other petitions for analogue television received by BTP were put on hold due to the development of digital television. It is anticipated that more TV stations would be interested if the barrier to entry is reduced and clarity exists with respect to the analogue to digital migration. The total long-term capacity is expected to be less than 5 multiplexes;
- Full package Pay-TV providers. Several market players have expressed their intention to deploy a DVB-T based pay-TV service. However spectrum is a limited resource and the ceiling has been set to maximum 2 Pay-TV licenses up to 10 multiplexes each;
- Specific package Pay-TV channels. 1 multiplex has been reserved for this purpose for a licensed party.

This results in the spectrum allocation as shown in the table below

DVB-T band plan				
Channel	**band_start**	**band_end**	**At this moment**	**Allocation**
21	470,000	478,000		
22	478,000	486,000		
23	486,000	494,000		**Free to air**
24	494,000	502,000		
25	502,000	510,000		
26	510,000	518,000	**TLC - Curacao**	**Test channel**
27	518,000	526,000		
28	526,000	534,000		
29	534,000	542,000		
30	542,000	550,000		
31	550,000	558,000		**Pay TV 10 adjacent channels**
32	558,000	566,000		
33	566,000	574,000		
34	574,000	582,000		
35	582,000	590,000		
36	590,000	598,000		
37	598,000	606,000	**Kanaal Eluisa**	**Single channel pay TV**
38			**Astronomie 608 - 614 MHz**	
39	614,000	622,000		
40	622,000	630,000		
41	630,000	638,000		
42	638,000	646,000		
43	646,000	654,000		**Pay TV 10 adjacent channels**
44	654,000	662,000		
45	662,000	670,000		
46	670,000	678,000		
47	678,000	686,000		
48	686,000	694,000		
49	694,000	702,000	**guard band**	

Note: All channels, except the guard band(channel 49) towards potential mobile broadband use, have been used, including channel 38 which has a radio astronomy allocation. This might have to be reviewed in case radio astronomy in channel 38 becomes an issue on Curacao.

2.3 Description of the multiplex set-up

The multiplexer consists of multiple encoders, a statistical multiplexer per RF channel and a SFN adapter. Remote control and maintenance should be implemented. For the purpose of injecting EPG[1] data into the Transport streams, a general accessible system should be provided. The physical location should be accessible for the interconnection by content providers.
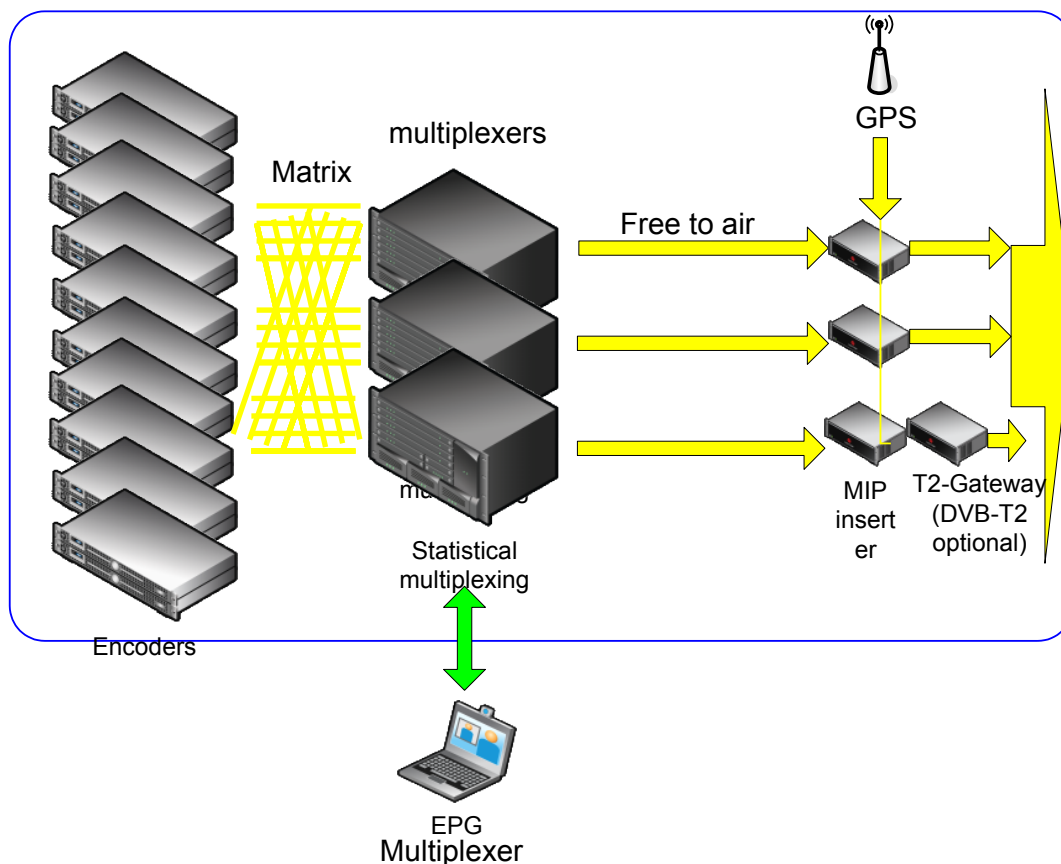
In order to guaranty the minimal allowable video quality no more than 8 SD streams per MUX are allowed in combination with MPEG 2.
In case of MPEG 4 up to 12 program streams per mux are allowed.
Minimal average video program stream 1.8 Mbit/s (VBR preferred).
Additional services to be determent. Use of EPG strongly advised, but not mandatory.
Encoders must be both MPEG 2 and 4 capable, SDI input and Component optional.
Remuxing of already encoded signals for instance when using a satellite source should be provided as well.

2.4 Description of the transmitter network

---

[1] The Electronic Program Guide contains detailed program scheduling information as well as additional content description. The EPG presents an overview of all available channels and is also needed for automatic recording devices like PVR's.

At least one measurement receiver must be installed capable of viewing all transmitter locations. This receiver should be able to monitor the timing of the SFN transmitters in real time. On request measurement data will be delivered to BTP.
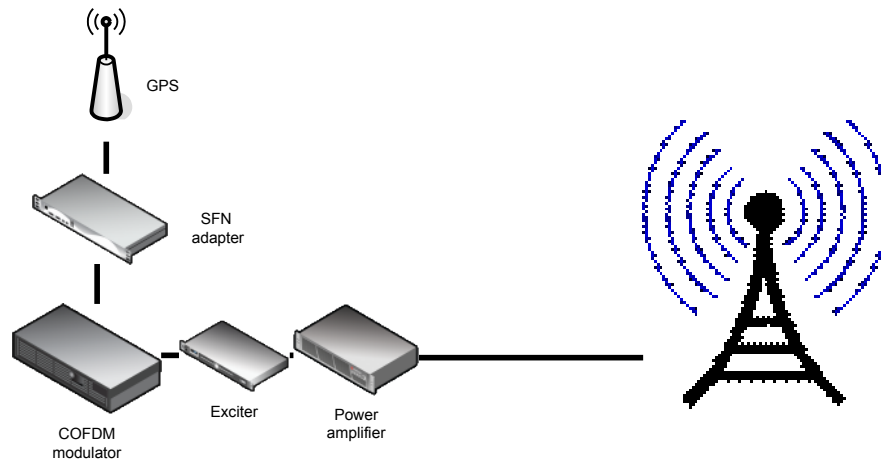
The transmitter setup consists of standardised DVB-T/T2 capable equipment wich features a dedicated GPS receiver for SFN operation.

Care should be taken in the setup when using multiple adjacent RF channels. Either a setup with a single high power lineair amplifier or a setup with multiple parallel digital transmitters is possible. In the latter situation a suitable high pole combiner is obligatory. Spectral purity must be respected at all time. All equipment must be maintained and monitored remotely.

2.5 Description of the transmission network

Due to the nature of SFN operated networks a low latency transmission path is needed from the multiplexer location to the transmitters. Considering future upgrades, dark fiber is preferred over microwave links. The actual required capacity is calculated from the actual ASI streams, some technical overhead and bandwith needed for maintenance and control.

In the event the broadcasters are not able to physically interconnect on to the premises of infrastructure owner, a dedicated distribution network has to be offered.

2.6 Overview of parameters per network segment

2.6.1 Transmitter network

Design min reception level 56 dBµV/m (DVB-T, outdoor-roof top antenna)

Channel allocation

Free to air	21 t/m 26
Pay-TV block 1	27 t/m 36
Single Pay-TV ch	37
Astronomy(no TV)	38
Pay-TV block 2	39 /m 48

Broadcast standard

DVB-T		(DVB-T2 optional)
Modulation	64 QAM	(256 QAM)
Designator	8k	(32K)
Coderate	2/3	(2/5)
Guard interval	¼	(1/16)
Net bitrate	19.9 Mbit/s	(33.3Mbit/s)
SFN	67 km	

Transmitter locations and power

200W ERP per channel/mux
    Seru Pretu
    Cocori
    Seru Gracia

50W ERP per channel/mux
    Habitat
    Lagun
    Westpunt

Mode of operation: SFN
Channel width 8 Mhz
Upgradable to DVB-T2

Antenna diagrams and polarization

The current antenna in the DVB pilot are horizontal polarized with 25 degrees beamwith per sector. When using simple outdoor and portable antenna, vertical polarization could be a better choice. The horizontal diagram and thus coverage could also improve. Field tests will determine the best possible set up.

2.6.2 Distribution network

Transport capacity for 6 free-to–air transport streams

Free to air channels 144 Mbit/s min

Upgradable to min 200 Mbit/s for DVB-T2(only free-to-air transport streams)

Pay-TV (optional)
Block 1(10 ch)   350Mbit
Block 2(10 ch)   350 Mbit
Single channel   35 Mbit
Service and control network 10 Mbit
Total approx. 1 Gbit/s(Pay-TV + Free to air)

Microwave frequencies available in 6 and 10 GHz.
Optical link (Dark fiber) preferred.
Interface specifications will be specified later on.

2.6.3 Encoding and multiplexing

Number of multiplexes(transport streams)   6 (Free to air)
Optional   2 x 10 (pay TV packages)
Optional   1 (specific pay TV package)
In total a maximum of 27 multiplexes
Maximum 8 SD streams/MUX
Encoders both MPEG 2 and 4 capable
Encoder input SDI, Component optional
(audio embedded in SDI)
Minimal average video transportstream 1.8 Mbit/s (VBR preferred)
Additional services tbd.

Video   MPEG 2 MP@ML(main profile at main level) I, P and B frames
Resolution   720 x 480 source NTSC minimal
               720 x 576 souce PAL minimal

Audio   MPEG 1, layer 2
               160kbit/s min

2.6.4 Contribution network

Depending on the physical multiplexer location content suppliers can either connect themselves to the encoders directly or a contribution network has to be installed.

Transport capacity per video stream.
Min 128 kbit for audio
Min. 8 Mbit for component SD
Min. 270 Mbit for SD over SDI
Min 1.5Gbit for HD.

3   Operational structure

Two viable options are available and will be presented here as possible scenarios for implementation of the DVB-T network.

3.1 Legal Entity, option 1 single ownership of infrastructure

Neutrality

The user profile will typically consist of the free-to-air broadcasters. Since these broadcasters do compete in the market for both the consumers watching TV and the advertisers, the technical infrastructure realising the distribution of the digital terrestrial TV signals should be a neutral entity. To avoid potential conflicts of interests that may arise, the DVB-T Broadcast Infrastructure will be neutrally owned and managed with respect to broadcasters. The assets will be fully owned by the DVB-T Broadcast Infrastructure supplier. This supplier is also allowed to act as broadcaster. Neutrality is enforced by license conditions.

Entity

The legal entity of the DVB-T Broadcast Infrastructure needs to ensure that the DVB-T Broadcast Infrastructure neutrality, establish financial security and remain within regulatory constraints. To become a customer at the DVB-T Broadcast Infrastructure interested broadcasters need to apply for a broadcast license. Once the regulator has approved the application, the infrastructure owner has no right to refuse access.

3.1.1 Legal entity roles and responsibilities

Broadcaster 1   Broadcaster 2   Broadcaster 3   Broadcaster 4   Broadcaster 5

Vendor DVB-T equipment

DVB-T Broacast infrastructure supplier

Site/tower rental providers

Tranmission providers

Other 3rd parties

Regulator

The DVB-T Broadcast Infrastructure supplier needs to ensure that the DVB-T Broadcast Infrastructure remains neutrality, establish financial security and remain within regulatory constraints. The assets and operations will be the sole responsibility of the infrastructure supplier.

3.1.2 Right of access

The DVB-T Broadcast Infrastructure is accessible by content parties that have been granted broadcast rights by the regulator. The DVB-T broadcast infrastructure supplier has no right to refuse access to such parties. A fair compensation for the distribution of their content and the use of the installed infrastructure is allowed. The height of this compensation is fixed and can only be adjusted after approval of the BTP.
Should broadcaster be in default or not restrain to rules set by the regulator, distribution of content can be withholded by both the owner as well as the BTP. The capital investment and operational costs will be the sole responsibility of the infrastructure owner.

3.2 Legal Entity, option 2 Association founded by infrastructure investor

After the network infrastructure has been awarded an association will be founded. The initiative will be taken by the supplier/owner. Neutrality, access and regulatory constraints will be enforced by self regulation.
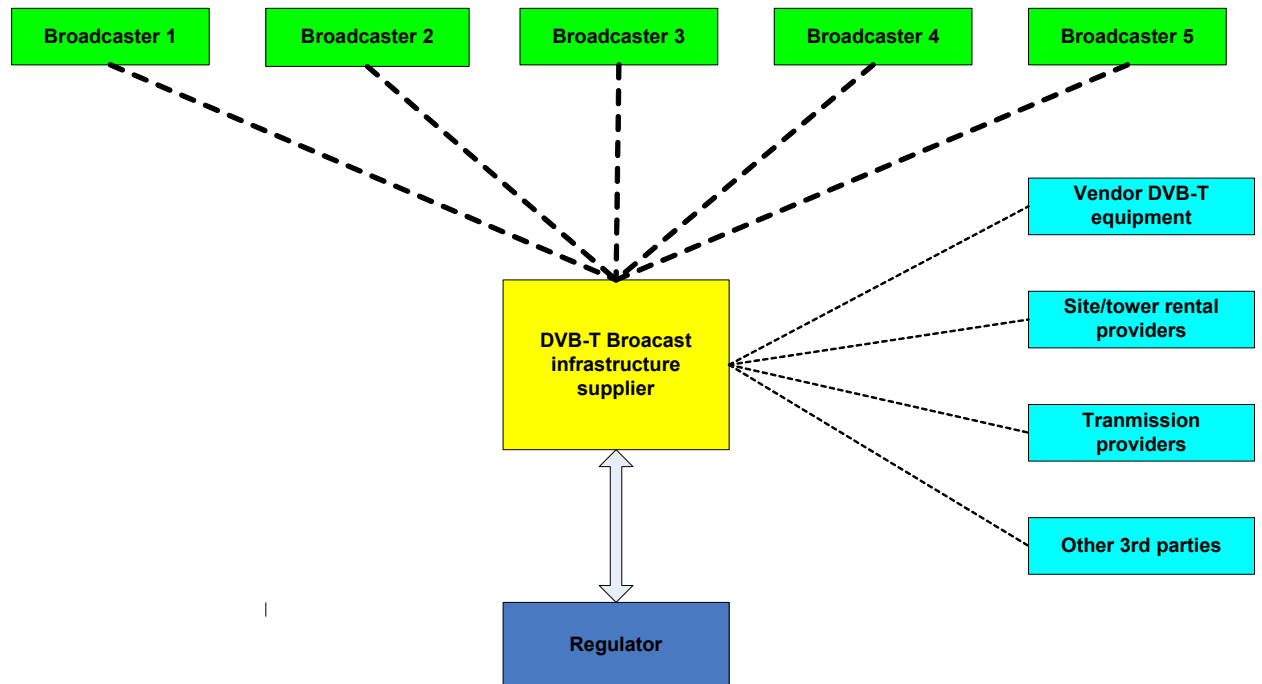
Neutrality
The member profile will typically consist of the free-to-air broadcasters. Since these broadcasters do compete in the market for both the consumers watching TV and the advertisers, the technical infrastructure realising the distribution of the digital terrestrial TV signals should be a neutral entity. To avoid potential conflicts of interests that may arise, the DVB-T Broadcast Infrastructure will be neutrally owned and managed with respect to broadcasters. The assets will be fully owned by the DVB-T Broadcast Infrastructure BV.

Entity
The legal entity of the DVB-T Broadcast Infrastructure needs to ensure that the DVB-T Broadcast Infrastructure neutrality, establish financial security and remain within regulatory constraints. The legal entity will be an Association and a BV. The assets and operations will be part of the BV. The Association will hold 100% shares of the BV. To become a customer at the DVB-T Broadcast Infrastructure interested broadcasters need to become member of the Association. The Association will have its own board, terms and conditions.

(Founding) members
For a successful launch of the DVB-T Broadcast Infrastructure it is important to have the founding members of the Association involved. In this case the potential founding and thus launching members would be initially the existing license holders for television broadcasting:

1. TeleCuracao
2. Flamingo Broadcasting Network (CBA-TV11)
3. HIT-TV
4. Jachmin Pinedo Productions
5. New Song
6. Elouise Terrestrial Network
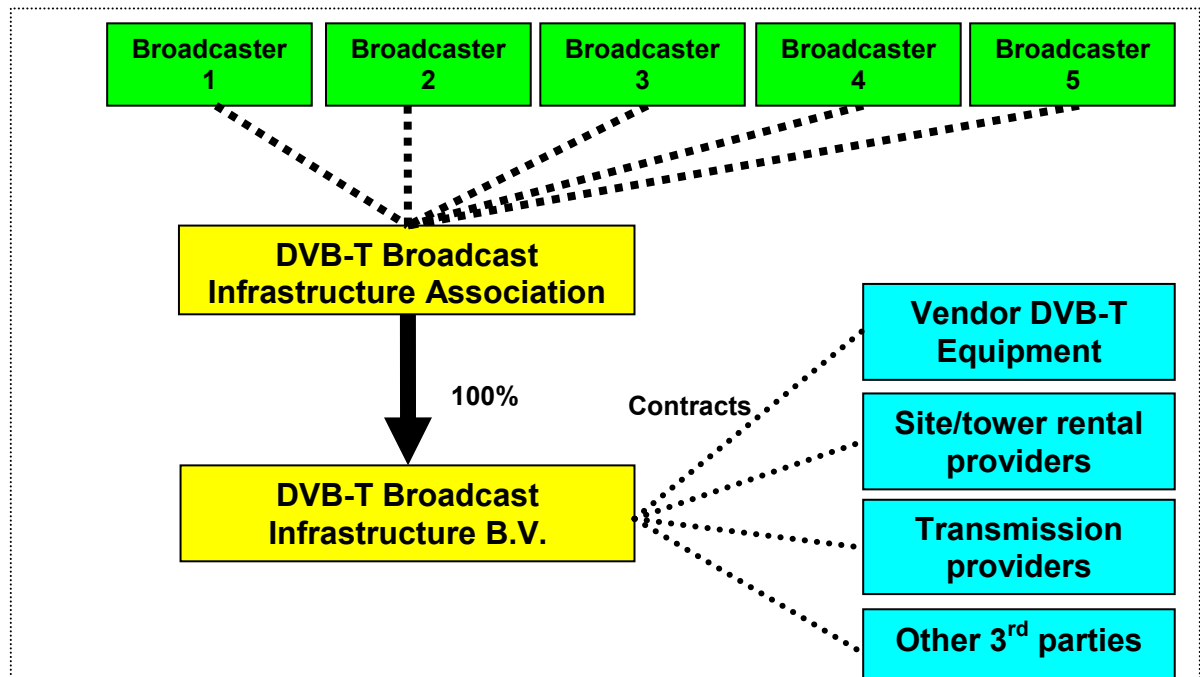
Legal entity roles and responsibilities

The legal entity of the DVB-T Broadcast Infrastructure needs to ensure that the DVB-T Broadcast Infrastructure remains neutrality, establish financial security and remain within regulatory constraints. The legal entities will be an Association and a BV. The assets and operations will be part of the BV. The Association will hold 100% shares of the BV. To become a customer at the DVB-T Broadcast Infrastructure interested parties need to become member of the Association. The Association will have its own board, terms and conditions. The BV will have its own statutory director.

By keeping the operations and the assets in the BV instead of in the association the association members will not be liable for the financial results of the BV. Therefore customers of the DVB-T Broadcast Infrastructure will become a member of the association and not of the BV.

The capital investment and operational costs will be the responsibility of the BV. The BV will enter into third party agreements like purchasing equipment, holding personnel, securing financial loans and guarantees. In this case the BV represented by its statutory director will enter into agreements parties like:

- Vendors of DVB-T transmitters and multiplexers for procurement and installation of the equipment
- Site/tower rental providers for the transmit locations
- Transmission providers to connect the central multiplexing equipment to the transmit locations
- Other third parties like:
    - Local accounting company for invoicing; accounts receivables and basic administration
    - Neutral local professional in the industry for overall representation, coordination of outsourced roles & responsibilities, general management of the DVB-T Broadcast Infrastructure, approaching new members and marketing and promotion of the DVB-T Broadcast Infrastructure.

3.3 Pay-TV parties

The Pay-TV parties are obliged to use the same locations for their DVB-T broadcast. Technically they should avoid any power difference between their transmitter and antenna patterns ⇔ Free-to-Air DVB-T Broadcast Infrastructure. Ideally the Pay-TV parties share the same DVB-T Broadcast Infrastructure with the Free-to-Air parties. Is is never allowed to broadcast the same content on more channels simultaneously

3.4 Regulatory aspects

3.4.1 Transition period

In order to fascilitate a smooth switchover and provide enough time for the retailors to adapt to DTT a transistion period of 1 month is foreseen. During this period broadcasters are allowed to broadcast simultaneously analog and digital on request. In some instances simultaneous broadcast is not possible due to the difference in channel spacing and overlapping frequencies between the analog and digital standard.

3.4.2 Licensing RF channels and program streams

Due to the different and in most instances combined use of spectrum, licensing will take place on RF channel use for the infrastructure owner. Only those RF channels that are actually occupied and in use will be prone to licensing fees. Partially filled transport streams on RF channels will be considerd as fully occupied and charged, thus stimulating an efficient use of spectrum.

In SD quality 8 streams will fit one multiplexer transport stream. Broadcasters that are unable to fill a RF channel will be obligated to share the available transport stream space with other content suppliers. Broadcasters will be granted a license based on program streams. Depending on quality, different fees may apply.

All free-to-air RF channels will receive the same network identity and thus contain a unique, combined EPG in which all station- and program names are included. Within the DVB standard there is no need from the user perspective to know on what RF channels the actual broadcast takes place.

3.4.3 Transitional measures

For those parties already granted a license for analog TV, the following rules will apply.

Channel numbering:
To prevent destruction of established marketing value, broadcasters that are currently holding a license for Analog TV will have the right to migrate their RF channel number to the Logical channel number (LCN) within the DVB standard. In the EPG both the old RF channel number (now as LCN) and the station name will be visible.

4   Deliverables

The following deliverables are requested on application.

4.1 General technical lay-out of the network and physical locations

A technical specification of the network topology including antenna diagrams, multiplexer specification and included future upgrade options.

Specific details are requested on the proposed mechanism for connecting broadcasters to the network

4.2 Overview of services that can be delivered

An overview of all specified additional services included according to the DVB standard.

4.3 Craftsmanship

To ensure stable and reliable operation of DTT an overview of involved 3rd parties including their qualifications is requested.

4.4 Financials

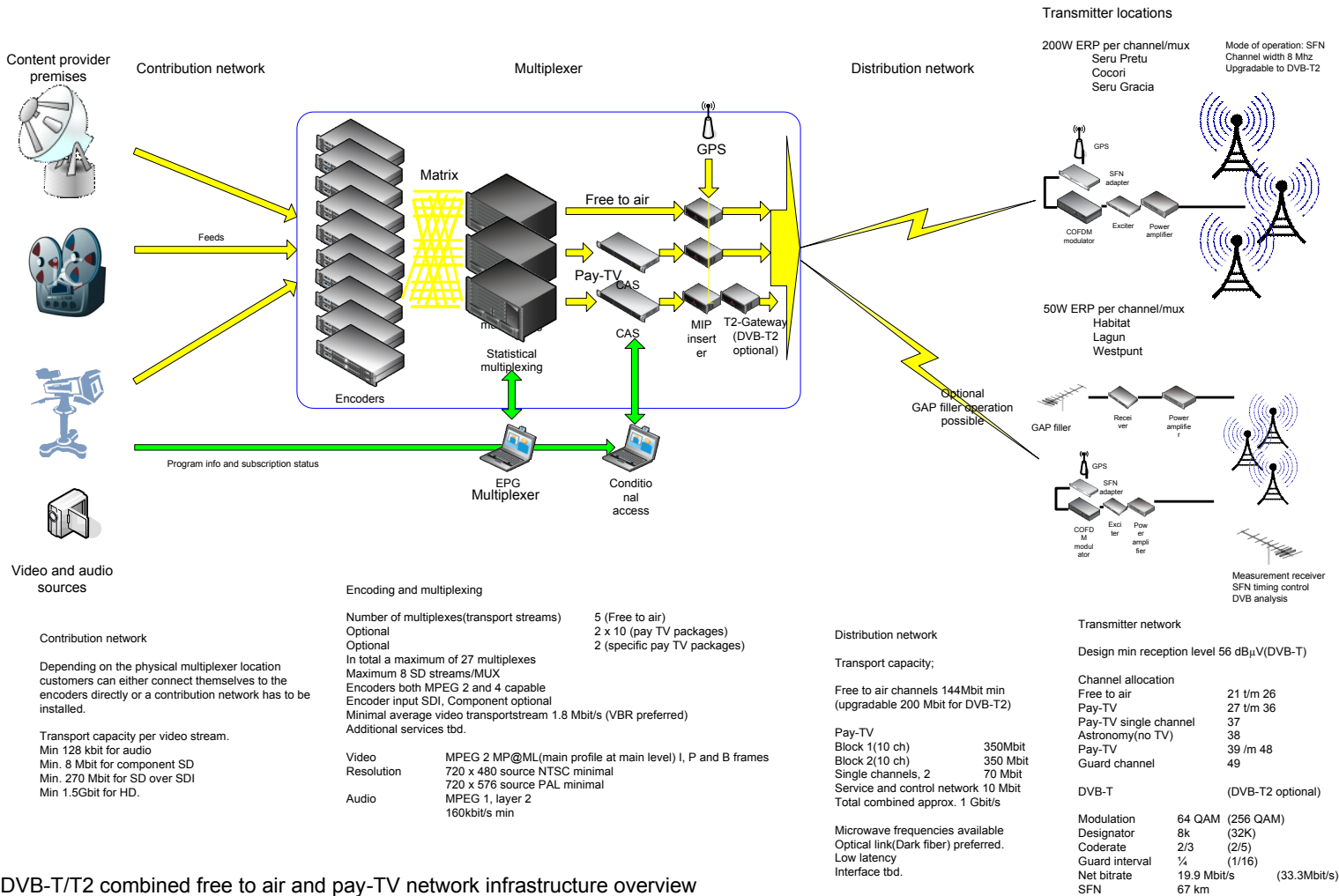In order to judge the financial security the following key cost components are requested

- Estimated investment in the DVB-T Broadcast Infrastructure for Free-to-Air

- Estimated OPEX for the DVB-T Broadcast Infrastructure for Free-to-Air

- Estimated access fee for the DVB-T Broadcast Infrastructure for Free-to-Air

4.5 Planning

A preliminary planning for the network rollout is requested.

5. Addendum, combined network overview

Transmitter locations

200W ERP per channel/mux
Seru Pretu
Cocori
Seru Gracia

Mode of operation: SFN
Channel width 8 Mhz
Upgradable to DVB-T2

Content provider premises

Contribution network

Multiplexer

Distribution network

GPS

Matrix

Free to air

Pay-TV

CAS

MIP insert er

T2-Gateway (DVB-T2 optional)

GPS

SFN adapter

COFDM modulator

Exciter

Power amplifier

Feeds

Statistical multiplexing

Encoders

50W ERP per channel/mux
Habitat
Lagun
Westpunt

Optional GAP filler operation possible

GAP filler

Recei ver

Power amplifie r

GPS

SFN adapter

COFD M modul ator

Exci ter

Pow er ampli fier

Program info and subscription status

EPG Multiplexer

Conditio nal access

Measurement receiver
SFN timing control
DVB analysis

Video and audio sources

Encoding and multiplexing

Number of multiplexes(transport streams)   5 (Free to air)
Optional   2 x 10 (pay TV packages)
Optional   2 (specific pay TV packages)

Contribution network

Depending on the physical multiplexer location customers can either connect themselves to the encoders directly or a contribution network has to be installed.

Transport capacity per video stream.
Min 128 kbit for audio
Min. 8 Mbit for component SD
Min. 270 Mbit for SD over SDI
Min 1.5Gbit for HD.

In total a maximum of 27 multiplexes
Maximum 8 SD streams/MUX
Encoders both MPEG 2 and 4 capable
Encoder input SDI, Component optional
Minimal average video transportstream 1.8 Mbit/s (VBR preferred)
Additional services tbd.

Video   MPEG 2 MP@ML(main profile at main level) I, P and B frames
Resolution 720 x 480 source NTSC minimal
            720 x 576 source PAL minimal
Audio   MPEG 1, layer 2
            160kbit/s min

Distribution network

Transport capacity;

Free to air channels 144Mbit min
(upgradable 200 Mbit for DVB-T2)

Pay-TV
Block 1(10 ch)   350Mbit
Block 2(10 ch)   350 Mbit
Single channels, 2   70 Mbit
Service and control network   10 Mbit
Total combined approx. 1 Gbit/s

Microwave frequencies available
Optical link(Dark fiber) preferred.
Low latency
Interface tbd.

Transmitter network

Design min reception level 56 dBµV(DVB-T)

Channel allocation
Free to air   21 t/m 26
Pay-TV   27 t/m 36
Pay-TV single channel   37
Astronomy(no TV)   38
Pay-TV   39 /m 48
Guard channel   49

DVB-T   (DVB-T2 optional)

Modulation   64 QAM   (256 QAM)
Designator   8k   (32K)
Coderate   2/3   (2/5)
Guard interval ¼   (1/16)
Net bitrate   19.9 Mbit/s   (33.3Mbit/s)
SFN   67 km

DVB-T/T2 combined free to air and pay-TV network infrastructure overview
Main technical requirements and specifications

Eric Moerman
Feb 2011