Draft Report for Methodology for cost based model for broadcasting free to air services on the DTT platform and associated WACC

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1 Introduction

ONE Telecommunication Services DOOEL Skopje (ONE) was designated by the Agency for Electronic Communications of the Republic of Macedonia (AEC) as having significant market power (SMP) in the commercial free-to-air (FTA) DTT market,[1] after it was awarded the licence for two multiplexes (MUXs) in 2012 through a tender procedure.[2]

As a consequence, AEC has imposed price control and cost accounting obligations on ONE and now wants prices for national and regional access to the digital terrestrial broadcasting system offered by ONE to be set on a cost-oriented basis.

In January 2015 the two operators ONE and Vip merged to form a new player called One.Vip, which is the legal successor of ONE (and Vip). As such, all of the obligations and remedies originally imposed on ONE have been transferred to One.Vip.

Analysys Mason Limited (Analysys Mason) and Grant Thornton LLP (Grant Thornton) have been commissioned by AEC to develop a cost model for broadcasting commercial FTA services on the digital terrestrial platform (commercial FTA DTT) and to calculate the weighted average cost of capital (WACC) to be applied in the cost model.

This report provides documentation to accompany that cost model, and should be read in conjunction with the inception report previously shared with AEC.

The model calculates the cost of the commercial FTA DTT service at both national and regional level. Parts of One.Vip's FTA broadcasting network is shared with One.Vip's mobile and pay DTT terrestrial network; therefore, the calculation process takes into account also the mobile and pay DTT operations of One.Vip, so that the total network costs are allocated to the three different operations: mobile, pay DTT and FTA DTT.

The remainder of this document is laid out as follows:

- Section 2 describes the model methodology, explaining all the main conceptual steps
- Section 3 summarises the results of both the commercial FTA DTT model and the WACC estimation
- Annex A explains the structure of the Microsoft Excel model, describing each of the sheets and the relationships between them and provides a list of the abbreviations used in this document.

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[1] See http://www.aek.mk/mk/analiza/pregled-na-analizi/golemoprodazhba?start=10.

[2] AEC procedure no. 02-2954 of 15 October 2012; DVB-T broadcasting licence no. 107976/1 issued by AEC to ONE on 17 May 2013.

2 Methodology

2.1 Key assumptions

2.1.1 WACC

The formula for the post-tax WACC is:[3]

$$WACC_{post-tax} = C_d \times \frac{D}{D+E} + C_e \times \frac{E}{D+E}$$

where:

- C_d is the cost of debt
- C_e is the pre-tax cost of equity
- D is the value of the operator's debt
- E is the value of the operator's equity.

The pre-tax cost of equity C_e is calculated with the Capital Asset Pricing Model, i.e. $C_e = R_f + \beta \times R_e$, where:

- R_f is the risk-free rate of return
- R_e is the equity risk premium
- β is a measure of how risky a particular company or sector is relative to the national economy as a whole.

The cost of debt (C_d) is calculated to reflect the typical corporate bond yields, i.e. $C_d = (1 - t) \times (R_f + R_d)$, where:

- R_f is the risk-free rate
- R_d is the company's debt premium
- t is the corporate tax rate.

However, the model works in pre-tax terms, therefore the calculated post-tax WACC must be translated into the homologue pre-tax one according to the formula:

$$WACC_{pre-tax} = \frac{WACC_{post-tax}}{(1-t)}$$

Since the corporate tax rate in Macedonia is 10%, the pre-tax value is 11.05%.

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[3]   See Section 4 of the inception report.

2.1.2 Commercial FTA DTT

The commercial FTA DTT cost model follows the methodology proposed in the inception report;[4] the key operating principles are reported in the following sections, broken down by area.

Cost inputs

- The model considers One.Vip's actual DTT network in terms of asset count and characteristics of the assets (e.g. same transmitter power

- The model considers the costs effectively incurred by One.Vip to broadcast the FTA DTT channels (both national and regional), including the distribution and multiplexing costs

- No further efficiencies have been factored in, as One.Vip's network was built recently in the context of a competitive market, i.e. One.Vip had no incentives to deploy the network inefficiently and its objective when deploying the network was to maximise shareholder value

- Following recent European best practices in regulatory costing and cost accounting, the model uses the current cost accounting (CCA) approach, rather than the historical cost accounting (HCA) one. By default, the tilted annuity depreciation method is used (although annuity and linear depreciation are also implemented in the model and can be tested by the user)

- The gross book value (GBV) figures from 2014 provided by One.Vip are considered to be a good proxy for the capex incurred at the time when each network asset was deployed, i.e. it is assumed that each asset is deployed in one single year.

Demand

- The network dimensioning assumes full occupancy of the two FTA MUXs; this demand level is higher than the current market one but appears reasonable in light of the overall market dynamics described to us by AEC, whereby there is strong interest by broadcasters in the FTA DTT platform at sustainable prices. Assuming full occupancy of both MUX 6 and 7 needs however to consider that additional network elements (and investments) will be needed compared to the *as is* network (e.g. one additional transmitter[5] but no additional multiplex equipment[6]).

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4   See Section 3 of the inception report.

5   We understand that today One.Vip's DTT broadcasting sites have five transmitters installed for DTT, of which three are for pay TV, one is for FTA and one is for redundancy purposes. If MUX 7 needs to be transmitted at a given site, then One.Vip would adopt a N+1 redundancy configuration, whereby five transmitters would be operational and one would be for redundancy purposes. We believe this is an efficient resiliency strategy and have included the same in the model. However the cost of the redundant transmitter has been pro-rata allocated also to the pay-DTT MUXs as well as to the FTA MUXs

6   We understand that One.Vip uses today multiplex equipment with 5 outputs. Considering that Macedonia has 9 regions (for 8 allotment zones), today two (redundant) pieces of multiplex equipment is needed. If MUX 7 is launched, then the 10 multiplex outputs available today would be sufficient as one output MPTS could be dedicated to national channels and there 9 could carry different regional MPTS

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Implementation

- The model is a single-year model, since the network size does not scale significantly with the demand and because the overall capacity is constrained by the number of MUXs

- The model is capable of calculating the service cost for any year in the future, taking into account One.Vip's accounting data by asset and the assumed cost trends

- The WACC used in the model is the one calculated by Analysys Mason using the CAPM model and international benchmarks and economic information from Macedonia in order to calibrate the various parameters (see Section 2.1.1 for details).

Cost actualisation

- For the network assets shared with mobile operations, capex values are actualised from the year when the tower of the site was built. This option is used for assets such as the site, the building, the tower, the air conditioning, etc.

- For the network assets which do not share operations with the mobile business, capex values are actualised from the year One.Vip started broadcasting pay DTT channels (as pay-DTT MUXs were launched by One.Vip before FTA MUXs). This option is used for the transmitters, combiners, DTT antennas, etc.

- Finally, for the network assets dedicated to the FTA DTT operations, i.e. the multiplexers, capex values are actualised from the year One.Vip started broadcasting FTA channels, i.e. 2013.

Figure 2.1 shows the actualisation method for each network asset.

Figure 2.1: Asset capex actualisation [Source: Analysys Mason, 2016]

Network asset	Value chain segment	Actualisation option	Reasoning
• Site • Building • Electric substation • Emergency plant • UPS (uninterruptible power supply) • Air conditioning • Transmitter • DTT antenna • Combiner • Feeder • Tower	Broadcasting	Year of construction of the tower. Assumed year of the launch of mobile operations in the site	
• Microwave links	Distribution	Date of launch of the pay DTT business (these links are dedicated to the DTT	

Network asset	Value chain segment	Actualisation option	Reasoning
		operations and are not shared with the mobile business)	
• Site • Building • Electric substation • Emergency plant • UPS • Air conditioning	Multiplexing	Date of launch of the pay DTT business	These assets relate to the head-end site. Although the assets are also used for mobile purposes, the year of construction of the site was not available. These assets share operations between pay DTT and FTA businesses
Multiplexer	Multiplexing	Date of launch of the FTA operations	The multiplexer only relates to FTA MUXs

Although the user can change these parameters in the Control sheet, we do not recommend changing them; indeed, these parameters have been set following the specific rationale explained above.

2.2 Inputs

2.2.1 WACC

The values for each input of the WACC formula are obtained from different sources, as set out in Figure 2.2 below.

Input	Source of values	Value used in the base case WACC formula
R_f	Three different values inputted: • 10-year bond in MKD issued by the Macedonian authorities in December 2015 (3.5%) • Average of the 10-year bonds issued by the Macedonian authorities since November 2005 (4.11%) • 7-year Eurobond in EUR issued by the Macedonian authorities in July 2014 (3.975%)	The first option (3.5%) is used by default in the formula, but the user can select one of the other two options
R_e	Three different values inputted: • Market premium of Macedonia in 2014 (10.2%)[7]	The first option (10.2%) is used by default in the

Figure 2.2: WACC formula input sources [Source: Analysys Mason, 2016]

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[7]   Source: Pablo Fernandez, Pablo Linares and Isabel Fdez. Acín. IESE Business School (2014), accessible at http://www.valuewalk.com/wp-content/uploads/2015/07/SSRN-id2450452.pdf

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|	Average of the market premiums of other comparable countries (Croatia, Bulgaria, Slovenia, Albania, Serbia) in 2014 (8.98%)[8] • Average of broadcasting tower companies (Arqiva (2015), TDF (2015), Abertis (2014) and the average of three Italian companies in 2015, i.e. EI Towers, Inwit and Rai Way (5.58%)	formula, but the user can select one of the other two options
R_d	Average of other tower broadcasting companies: Arqiva (2015), TDF (2015), Abertis (2014) and three Italian companies, i.e. EI Towers, Inwit and Rai Way (2015)	1%
T	Tax rate applied in Macedonia	10%
β	Average of other tower broadcasting companies: Arqiva (2015), TDF (2015), Abertis (2014) and the average of three Italian companies, i.e. EI Towers, Inwit and Rai Way (2015)	0.85
D	Calculation from previous inputs	1.22%
E	Calculation from previous inputs	9.19%
WACC post-tax	D + E	10.41%
WACC pre-tax	Calculation from WACC post-tax and tax rate	11.05%

2.2.2 Commercial FTA DTT

The model is based on the data received from One.Vip in response to our data request. A number of interactions (calls, e-mails, etc.) took place between Analysys Mason and One.Vip after the first data submission, supervised by AEC, in order to clarify points of uncertainty and request further details.

As discussed in the inception report, a typical TV production and broadcasting value chain can be modelled as shown in Figure 2.3. It should be noted that One.Vip's regulated service only includes multiplexing, distribution and broadcasting building blocks, and only the assets required for provision of these sub-services have been accounted for in the cost model.

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[8]   Source: Pablo Fernandez, Pablo Linares and Isabel Fdez. Acín. IESE Business School (2014), , accessible at
http://www.valuewalk.com/wp-content/uploads/2015/07/SSRN-id2450452.pdf

Figure 2.3: DTT value chain [Source: Analysys Mason, 2016]
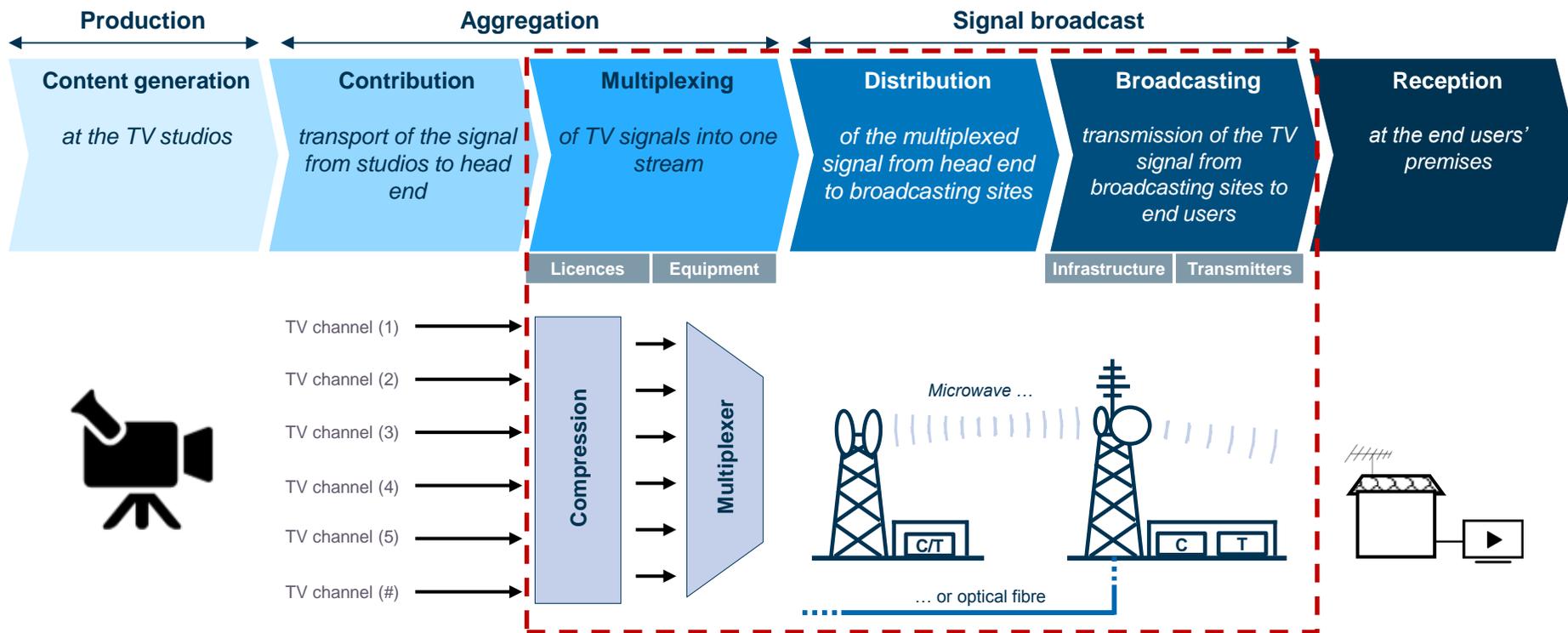
Included in One.Vip's FTA value chain and in the model

Relevant assets have been split and grouped according to the different segments of the value chain to which they belong, as reported in Figure 2.4 below.

Broadcasting	Multiplexing	Distribution
• Site	• Site	• Microwave links
• Building	• Building	• Fibre links
• Shelter	• Electric substation	
• Electric substation	• Emergency plant	
• Emergency plant	• UPS	
• UPS	• Air conditioning	
• DC power supply and battery back-up	• Multiplexers	
• Air conditioning		
• Transmitter		
• Combiner		
• Feeder		
• Tower		
• Antenna		

Figure 2.4: Assets by value-chain segment [Source: Analysys Mason, 2016]

For each network asset present in the relevant network segments (multiplexing, distribution and broadcasting), One.Vip has provided the required technical data (e.g. site and building area, transmitter power, etc.), the GBV at 2014 (latest audited financial year) and the operating expenditure (opex) incurred in 2014. Figure 2.5 below reports the key technical parameters for each involved asset type.

Asset	Value-chain segment	Technical input	Unit
Site	• Broadcasting • Multiplexing	• Area	• Square metres
Building	• Broadcasting • Multiplexing	• Area	• Square metres
Shelter	• Broadcasting	• Area	• Square metres
Electric substation	• Broadcasting • Multiplexing	• Power • Ownership	• kVA • Owned/rented
Emergency plant	• Broadcasting • Multiplexing	• Power • Assets	• kVA • Number of assets
UPS	• Broadcasting • Multiplexing	• Power • Assets	• kVA • Number of assets
Air Conditioning	• Broadcasting • Multiplexing	• Available capacity • Utilised capacity	• kW
Transmitter	• Broadcasting	• Power	• kVA
Combiner	• Broadcasting	• Power • Transmission channel	• kVA • Frequency band
Feeder	• Broadcasting	• Diameter • Length	• Inches • metres
Tower	• Broadcasting	• Height • Section • Construction year	• Metres • Square metre • Year
Antenna	• Broadcasting	• Span • Height in tower • Power • Supported band	• metres • metres • W • Frequency band
Multiplexer	• Multiplexing	• N/A	• N/A
Microwave and fibre links	• Distribution	• Capacity	• Mbps

Figure 2.5: Asset key technical inputs [Source: Analysys Mason, 2016]

The other key inputs to the model are the unit cost trends (for both capex and opex) and the lifetimes for all asset categories (as shown in Figure 2.6), which were sourced from international benchmarks available to Analysys Mason from previous similar assignments.

Figure 2.6: Asset unit cost trends and lifetimes [Source: Analysys Mason, 2016]

Asset list	Price trend		Asset lifetime
	Capex	Opex	
	%	%	years
Site	-%	2%	80
Building	2%	2%	20
Electric substation	-%	2%	10
Emergency plant	-%	2%	15
UPS	-%	2%	10
Air conditioning	-%	2%	6
Transmitter + Combiner + Feeder + Antenna	-%	1%	10
Combiner filter	-%	1%	8
Feeder	-%	1%	20
Tower	2%	2%	30
Antenna	-%	1%	20
Microwave link	-%	1%	15
Multiplexers	-%	1%	10
MUXs licenses	4%		10

Note: The capex trend used for the MUX licence corresponds to the risk-free rate used in the WACC formula.

2.3 Calculation flow

The model follows a simple and clear structure, moving from the inputs received from One.Vip to the final calculation of the cost per Mbit/s at both regional and national level. Figure 2.7 illustrates the calculation flow in the cost model.

Figure 2.7: Illustration of the calculation flow in the cost model [Source: Analysys Mason, 2016]
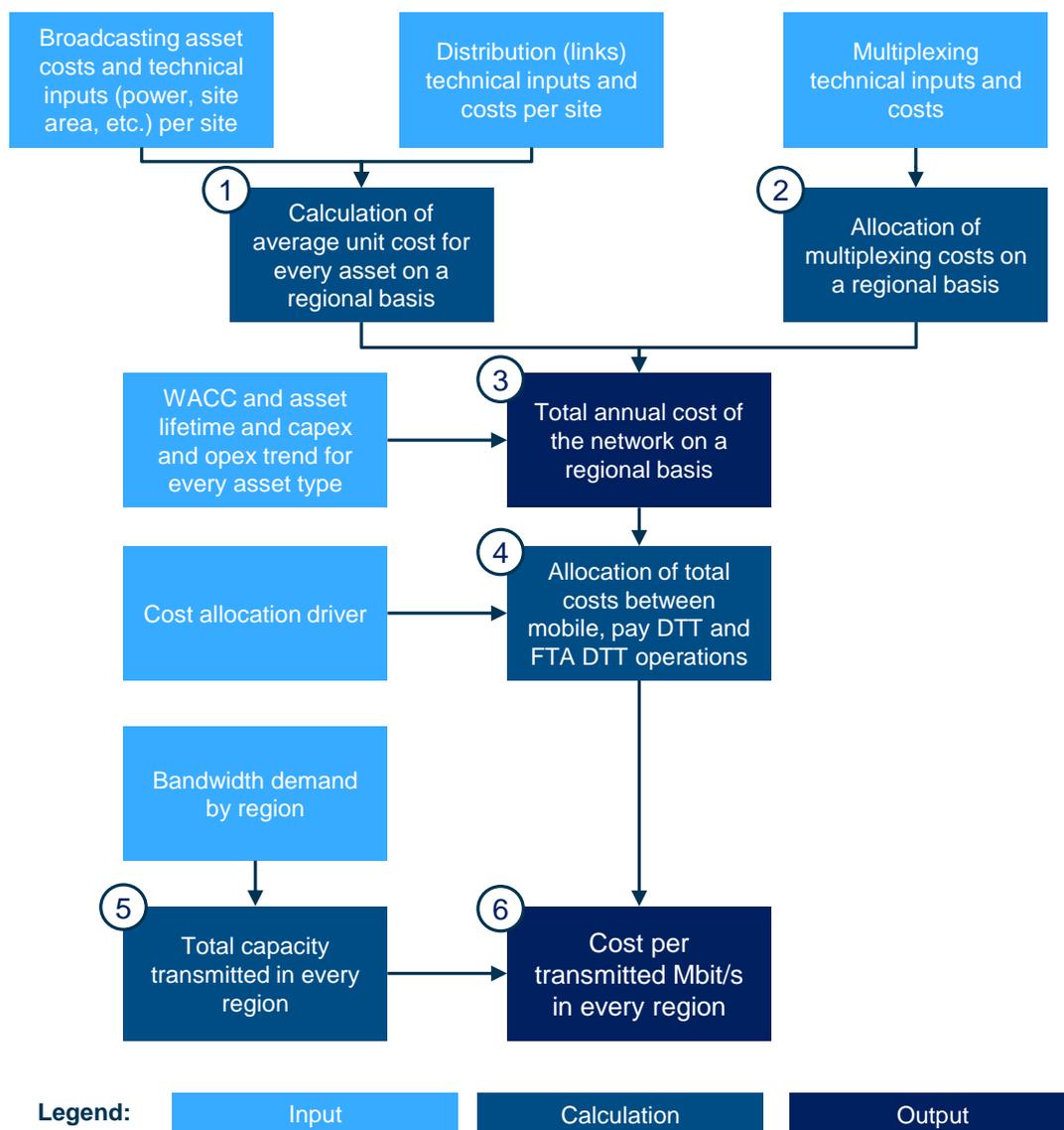
In the remainder of this section we explain each of the six steps outlined in the flow chart above.

1.   Unit capex and opex per region for the broadcasting and distribution network assets

This first calculation step relates only to the broadcasting and the distribution part of the value chain (see Figure 2.4). All data was provided on a per-site basis. This first step of the process involves calculating the average unit capex and opex per region for both broadcasting and distribution network assets.

Most sites in One.Vip's network are used for mobile operations only. These mobile-only sites have been completely disregarded for the purpose of calculating the average unit costs of the broadcasting network. We have only considered the sites (and related costs) which are used for broadcasting operations (all of which are also mobile sites).

In this step the model calculates two intermediate results at both regional and national level for each category of asset:

- The total 'physical quantity' of the technical parameter (e.g. square metres of building, used power, etc.) by asset category, by region. Then, for instance, the total square metres of building in a region; the total used power in a region, etc.

- An average unit cost (both capex and opex) by asset category, by region, i.e.:

$$Unit\ cost_{r,a} = \frac{\sum_{s=1}^{S} Cost_s}{\sum_{s=1}^{S} Physical\ quantity_s} \forall r \in Regions, a \in Assets$$

2.   Multiplexing costs

In the case of the multiplexing assets the process is slightly different from that for the broadcasting and distribution network segments, since multiplexing assets are not assigned to a specific site and region but rather shared by the whole network. The multiplexing asset costs (both capex and opex) are allocated across the nine regions according to the same proportion of the broadcasting segment assets' costs calculated in the first step.[9] This proportion is applied to all the multiplexing assets.

3.   Total cost of the network

The objective of the third step is to calculate the total cost of the network for a given year in the future. To calculate the share of capex to be recovered in a single year, the model uses the tilted-annuity recovery option, calculated as:

$$Tilted\ Annuity = \frac{GRC \times (WACC - tilt)}{1 - \left(\frac{1 + tilt}{1 + WACC} \right)^{lifetime}}$$

Notes:

GRC: Gross Replacement Cost.

As stated in the inception report,[10] simple annuity and linear depreciation are also included in the model for comparison purposes.

This calculation gives the total cost of the network for a given year in the future. Finally, in order to consider common costs which cannot be allocated to a specific business unit such as mobile or DTT, an overhead mark-up is applied to the calculated annual network costs. Overhead mark-ups are based on international experience and are set at 6%.

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[9]   Another viable option would be to calculate the costs based on the number of broadcasting sites per region, but the output does not vary significantly since there is a close correlation between the number of sites and the associated costs.

[10]   See Section 3 of the inception report.

4.   Network cost allocation to the services

As stated earlier, many assets in the broadcasting network, mainly passive infrastructure (e.g. land, tower, power and air conditioning), are shared between FTA DTT (the service of interest), pay DTT and mobile. The model allocates the costs to these three services in two sub-steps:

- allocation of costs between mobile and DTT (FTA and pay)
- allocation of DTT costs to FTA and pay.

► *Cost split between mobile and DTT services*

One.Vip also uses its DTT sites for mobile operations. For this reason, some of the calculated costs need to be allocated to its mobile operations. Indeed, while some assets are used solely for DTT purposes (e.g. the dedicated microwave links, the transmitters, the DTT antenna systems), others are shared between the two services, and so their costs have to be allocated according to specific drivers; Figure 2.8 below sets out the allocation driver, the rationale for its choice and the share of the asset cost allocated to DTT.

Figure 2.8: Cost allocation driver to DTT [Source: Analysys Mason, 2016]

Asset	Value-chain segment	Allocation driver	Rationale	Share of cost allocated to DTT
• Site	Broadcasting, multiplexing	Floor-space occupancy	As for the building (see below)	53%
• Building	Broadcasting, multiplexing	Floor-space occupancy	Cost allocated according to the surface of mobile and DTT shelters	53%
• Tower	Broadcasting	Occupied metres in the tower, the location where the mobile and the DTT antennas are located, and the value of each spot	The tower is occupied by both mobile and DTT antennas. Typically, there are more mobile antennas than DTT antennas, but DTT antennas are typically located at the top of the tower (a more valuable position)	50%
• Electric substation • Emergency plant • Air conditioning	Broadcasting, multiplexing	Used power	Difference between the power used for DTT and that for mobile operations	92%
• UPS (included in the transmitter costs) – DC supply	Broadcasting, multiplexing	Power used	The DC supply is a mobile asset, but it is also used for DTT transmission. The allocation is driven by the proportion of total power that relates to DTT	51%

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Asset	Value-chain segment	Allocation driver	Rationale	Share of cost allocated to DTT
• Microwave links • Transmitter • DTT antenna • Feeder • Combiner • Multiplexer	Multiplexing	-	Only DTT assets	100%

Although the user can change these parameters in the Control sheet, we do not recommend changing them; indeed, these parameters have been set following the specific rationale explained above.

► *DTT cost split between FTA and pay DTT services*

Once the total network costs have been split between the mobile and the DTT businesses, a further split is required. One.Vip holds two FTA DTT MUXs, but also manages three pay DTT MUXs by sharing the same passive infrastructure. Since the costed service is only commercial FTA DTT, the cost per Mbit/s must be calculated by taking into account only the proportion of costs generated by the FTA DTT service, not by the pay DTT service. In this case, the driver used to split the costs is the capacity in Mbit/s of the used MUXs. Since all MUXs have the same capacity (as reported by One.Vip) and share the whole broadcasting, and distribution network assets, the share of DTT costs allocated to FTA equals the proportion of FTA MUXs out of the total number of MUXs, i.e. 40% (two MUXs out of five).

We understand that One.Vip transmits all MUXs by all broadcasting sites. Therefore there are five active transmitters at each site, although all five transmitters share the same antenna systems (combiner, feeder and antenna). One.Vip has provided us with a lump sum cost for transmitters, combiner, feeder and antenna (per site), so the share of these costs allocated to FTA is also 40%.

There are two exceptions to the allocation rule explained above:

• Microwave links – The cost allocation is made according to the current usage of the links made by the two services according to the data provided by AEC (i.e. 48% to pay DTT and 52% to FTA DTT)

• Multiplexers – The cost of the multiplexing equipment provided by One.Vip refers only to the FTA operations: therefore, all of their costs are allocated to the FTA DTT service.

5. *Total capacity transmitted in every region*

The service demand corresponds to the MUX bandwidth used by One.Vip to broadcast all of the TV channels requiring access to the service.

The used bandwidth depends on two main technical parameters:

- The maximum available MUX capacity, i.e. $2 \times 22.5 = 45 \ Mbit/s$, which constitutes a cap

- The bandwidth per channel type, i.e. standard definition ('SD') or high definition ('HD'). In this model the bandwidth per channel type is calculated according to the maximum number of channels per type that can be hosted by one MUX[11], as reported in below:

Channel type	Maximum number of channels in one MUX	Bandwidth per channel[12]
SD	10	2.25
HD	4	5.63

Figure 2.9: Maximum number of channels by type per MUX and bandwidth per channel type [Source: Analysys Mason based on One.Vip, 2016]

There is an infinite number of combinations of channel type (SD/HD) and number of channels by type with which the total available bandwidth can be filled; in addition, it is reasonable to expect that both drivers will change in the future, i.e. new channels could join the platform in the future and some of the existing / new channels might also simulcast in HD.

In order to improve ease of use, we have implemented, in addition to the approach described above (i.e. demand as product of number of channels and bandwidth per channel, by channel type), the possibility for the user to input a percentage of occupancy of the total available bandwidth at regional level, to reflect a given expected level of service take-up[13].

Therefore, the demand is calculated as

$$Demand_r = \% \ of \ occupancy_r \times MUX \ capacity \ \forall r \in Regions$$

where $MUX \ capacity = 2 \times 22.5 = 45 \ Mbit/s$.

The inputted percentage of occupancy is 100% in all of the country regions, as reported by Figure 2.10, i.e. we assume that both MUX 6 and 7 are fully occupied in all regions.

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[11]   In practice, it depends on a number of technical parameters, mainly the transmission technology (e.g. DVB-T, DVB-T2) and the compression coding (e.g. MPEG-2, MPEG-4, etc.)

[12]   The bandwidth per channel is calculated as $Bandwidth \ per \ channel_i = \dfrac{MUX \ capacity}{Maximum \ number \ of \ channels_i} \ \forall i \in Channel \ type,$ where the MUX capacity is 22.5 Mbit/s

[13]   As a first cross-check, the user can calculate the occupancy of a suitable channel mix to assess the appropriateness of the inputted occupancy percentage

Service demand	Bandwidth	%occupancy	
	Mbit/s	calculated	inputted
Total	14.8	33%	100%
D1-Crn Vrv (Veles)	15.8	35%	100%
D1-Crn Vrv (Skopje)	22.5	50%	100%
D2-Stracin	15.8	35%	100%
D3-Turtel	13.5	30%	100%
D4-Boskija	11.3	25%	100%
D5-Pelister	13.5	30%	100%
D6-Mali Vlaj	13.5	30%	100%
D7-Stogovo	13.5	30%	100%
D8-Popova Sapka	20.3	45%	100%

Figure 2.10: Service demand in terms of percentage of occupancy by region[14] [Source: Analysys Mason, 2016]

These percentages are significantly higher than the current ones; however, they reflect the expected long-term service take-up, in turn backed up by some relevant evidence:

- **Market context** – According to AEC's market intelligence and analysis, a number of TV broadcasters is willing to get (back) on the DTT platform if there were reasonable access conditions.

- **Network uniqueness** – The One.Vip's FTA DTT platform is the only platform available at regulated conditions; indeed, access is not mandated on the two other DTT platforms (namely One.Vip's pay and the public service broadcaster's ones) and so far the public service broadcaster has not given access to its platform to third-party channels.

- **Network footprint** – The only alternative commercially viable option for TV broadcasters seem to be cable networks; however, all of them have at most coverage of the major 10-12 urban areas, while DTT is the only relevant FTA platform giving virtually ubiquitous coverage.

- **HD channel take-up** – Take-up of HD channels can be expected, as experienced in other countries. Furthermore, HD channels are usually broadcasted in simulcast with their SD versions, i.e. a TV channel cannot be broadcasted only in HD since it would be only visible only by HD TV sets, the take-up of which will take many years given the typically long replacement cycles of TV sets (6-10 years depending on the market); therefore, HD transmission would not decrease the demand of SD bandwidth on the platform in the short and medium term.

Figure 2.11 below reports for each benchmark country the number of DTT MUXs[15] and the number of FTA HD channels, both in absolute terms and as a percentage of total FTA channels.

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14   The column labelled as 'calculated' reports the current actual percentage of occupancy in light of the current service demand

15   Includes both pay and FTA commercial DTT MUXs

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Figure 2.11: Percentage of FTA HD channels out of total FTA channels in benchmark countries [Source: Analysys Mason, 2016]

Country	Number of MUXs	Number of FTA HD channels	% of FTA HD channels out total FTA channels
France	7	4	13%
Latvia	7	-	-%
Sweden	7	3	33%
Austria	6	1	5%
Spain	6	5	17%
Greece	5	1	2%
Malta	5	-	-%
Norway	5	1	10%
Romania	5	1	11%
Czech Republic	4	5	12%
Lithuania	4	1	7%
Poland	4	6	21%
Slovak Republic	4	3	18%
Average			
• Countries with 6 or 7 MUXs	6.4	5.7	15%
• All countries	5.4	3.9	12%

Figure 2.12 below reports a benchmark of the estimated occupancy ratio in some selected countries: while a forecast for Macedonia at 100% occupancy would rank at the top of the benchmark the benchmark shows that even today there are a number of countries with occupancy ratio near 100% or significantly above 80%. It should be noted that the occupancy of benchmark countries refers to today and therefore is also expected to increase due to HD and the launch of new channels.

Figure 2.12: Occupancy ratio benchmark [Source: Analysys Mason, 2016]
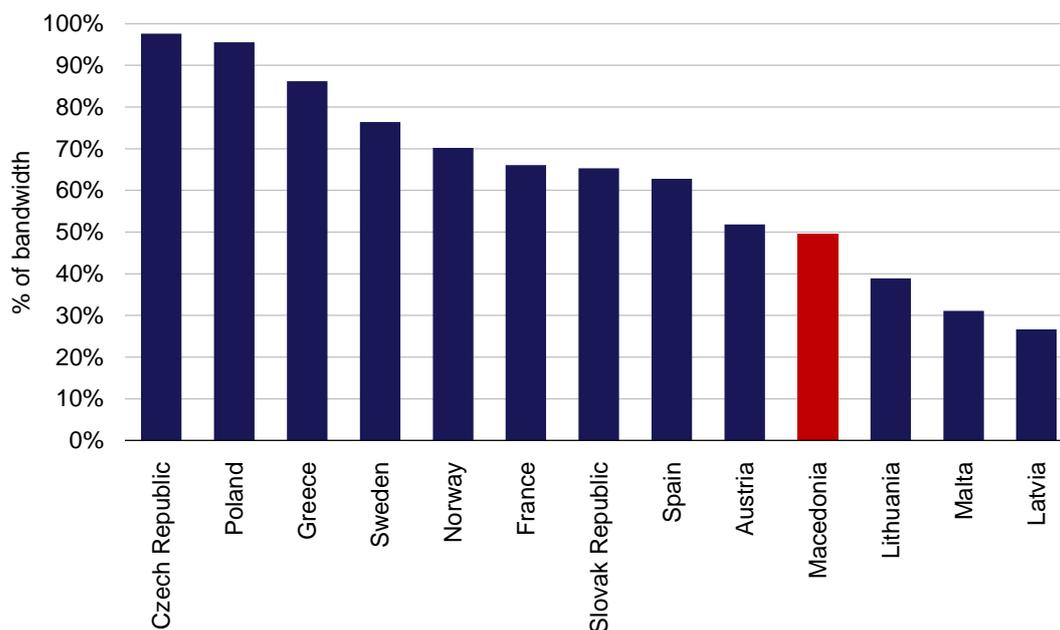
6. Unit cost calculation

In order to derive a unit cost for the commercial FTA DTT service, the network costs allocated to the FTA DTT service is divided by the service demand at regional level, i.e.:

$$FTA\ DTT\ unit\ cost_r = \frac{FTA\ DTT\ costs_r}{Demand_r} \forall r \in Regions$$

The FTA DTT service unit cost at national level is equal to the sum of the costs calculated at regional level, i.e.

$$FTA\ DTT\ unit\ cost_{national} = \sum_{r=1}^{9} FTA\ DTT\ unit\ cost_r$$

3 Results and usage

3.1 Results

3.1.1 WACC

The pre-tax WACC used in the commercial FTA DTT service cost model is 11.05%.

3.1.2 Commercial FTA DTT service cost

Figure 3.1 below summarises the commercial FTA DTT service cost calculated by the model.

Region	Unit Cost	
	MKD / Mbit/s	EUR / Mbit/s
National	**2,372,810**	**38,667**
Regional average	263,646	4,296

Figure 3.1: Commercial FTA DTT service cost [Source: Analysys Mason, 2016]

The value calculated is in line with the available benchmarks, calculated as price per Mbit/s per pop. to keep into account the country size factor, as reported in Figure 3.2.

Figure 3.2: Price per Mbit/s per pop. benchmark[16] [Source: Analysys Mason, 2016]

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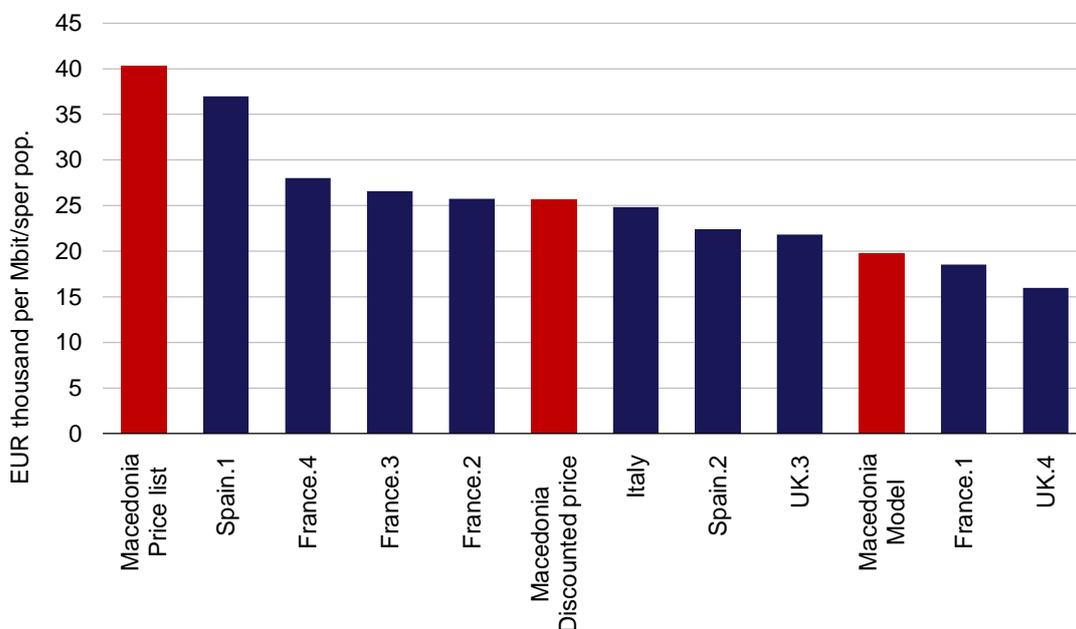
[16]   There are multiple prices per countries due to different terms and conditions (e.g. length of the contract)

3.2 Control sheet

The Control sheet summarises the model results and is used as the control panel for the model. The model user can calibrate a series of parameters to be used in the model.

Figure 3.3 below shows the first set of parameters the model user can select.

Figure 3.3: Model year and dimensioning and costing parameters to be chosen on the Control sheet [Source: Analysys Mason, 2016]

- **Model year** – The first parameter the user can select is the "Model year". By default, the model calculates the costs for 2016, but any year in the 2016–2022 period can be selected. The cell for "number of years on which to actualise unit cost" varies depending on the selected year. Since the accounting costs received from One.Vip refer to 2014, they are by default actualised by $2016 - 2014 = 2$ years.

- **WACC** – The WACC is used in the model to consider the value of money over time on the capex recovery. The higher the WACC inputted, the higher the cost recovery of One.Vip and consequently the higher the cost of the transmitted Mbit/s. The WACC value can be calibrated by selecting:

  — three different risk-free figures: 3.975% (7-year Eurobond in EUR, 2014), 3.5% (10-year bond in MKD, 2015) and the average of the 10-year bond issued by the Macedonian Government since 2005 (4.11%)

— three different market premium figures: the market premium of Macedonia in 2014 (10.2%); the average of the market premiums of other comparable countries (Croatia, Bulgaria, Slovenia, Albania, Serbia) in 2014 (8.98%); the average of a series of broadcasting tower companies (5.58%), namely Arqiva (UK, 2015); TDF (France, 2015); Abertis (Spain, 2014); EI Towers, Inwit and Wai Way (Italy, 2015)

By default, the model uses the calculated WACC based on the risk-free 7-year Eurobond of July 2014 and the market premium calculated for Macedonia in 2014.[17] The cell 'WACC inputted' (see Figure 3.3) shows the final figure used for WACC, which has been estimated at 11.05% with the default parameters.

- **Depreciation method** – Another parameter the user can select is the depreciation method in the control sheet. As mentioned earlier, the model uses the tilted annuity depreciation methodology by default, but the annuity and the linear depreciation methodology can be selected instead.

- **Multiplexing cost allocation** – The user can also choose the multiplexing cost allocation. As explained in Section 2.3, multiplexing costs are not associated with a single site or region as the multiplexing activity is carried out at the head end and the multiplexed signal is then distributed to every site by the distribution network. In order to allocate the multiplexing costs at regional level, the model offers a choice of two different methods:

  — using the same cost proportion of the broadcasting segment assets' of costs per region (i.e. the rest of the costs apart from the distribution/transmission costs).

  — using the proportion of number of sites per region.

By default the model uses the first option, but it should be noted that the result does not vary significantly if the second approach is used instead

- **Microwave link unit opex** – The user can select between two values, coming from two sources, i.e.:

  — the value provided by One.Vip, approx. EUR571 per link, including: (i) the frequency fee to be paid to AEC, (ii) the technical support and (iii) the maintenance costs

  — the value provided by AEC, EUR70 per link, including only the frequency fee.

Finally, the user may decide how the asset financial parameters are to be calibrated. All assets considered in the model have capex and opex trends, which have been set using international benchmarks. The lifetimes of assets have been also inputted on the basis of benchmarks. The percentages of total cost allocated to mobile operations reflect the rationale explained in Figure 2.8.

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[17] Source: Pablo Fernandez, Pablo Linares and Isabel Fernandez Acín, IESE Business School, 2014.

Figure 3.4 shows a series of parameters that can be chosen on the Control sheet, on a per-network asset basis.

Figure 3.4: Asset parameters to be chosen on the Control sheet [Source: Analysys Mason, 2016]

Asset list	Price trend		Asset lifetime
	Capex	Opex	
	%	%	years
Site	-%	2%	80
Building	2%	2%	20
Electric substation	-%	2%	10
Emergency plant	-%	2%	15
UPS	-%	2%	10
Air conditioning	-%	2%	6
Transmitter + Combiner + Feeder + Antenna	-%	1%	10
Combiner filter	-%	1%	8
Feeder	-%	1%	20
Tower	2%	2%	30
Antenna	-%	1%	20
Microwave link	-%	1%	15
Multiplexers	-%	1%	10
MUXs licenses	4%		10

Annex A Model structure and abbreviations

A.1 Model structure

The cost model consists of two linked workbooks. The first one, "Inputs", contains the information received from One.Vip regarding the driver inputs and costs of every asset on a site-by-site basis. All of the worksheets in the "Inputs" Workbook have an identical linked sheet in the "Model" workbook.

Figure A.1: Summary of the "Inputs" workbook [Source: Analysys Mason, 2016]

Sheet	Description	Use in the model structure
Broadcasting – Information	Broadcasting asset technical inputs (e.g. transmitter power, tower height, etc.)	Linked to the sheet with the same name in the "Model" workbook
Broadcasting – Costs	Broadcasting asset GBV and opex	Linked to the sheet with the same name in the "Model" workbook
Distribution	Capacity, GBV and opex of the microwave and fibre links within One.Vip's network	Linked to the sheet with the same name in the "Model" workbook
Multiplexing	Technical and economic inputs, multiplexing assets	Linked to the sheet with the same name in the "Model" workbook
WACC	WACC figure and inputs used by One.Vip	Information linked to the *WACC calculation* sheet of the "Model" workbook.
One.Vip Accounts	One.Vip accounts used as a cross check within the model	Not directly used in the model
Data provided by AEC -->	The sheets which follow the *Data provided by AEC➔* sheet contain additional information provided by AEC	Not directly used in the model

Figure A.2: Summary of the "Model" workbook [Source: Analysys Mason, 2016]

Sheet	Description	Use in the model structure
Control	Summary of the model results and control panel of the model.	The user can change a series of parameters used to calculate the cost of a transmitted Mbit/s
Sites to region	This sheet calculates the unit capex and opex of all the network assets of an average site on a regional basis for the Broadcasting and Distribution network assets	Receives inputs from the *Broadcasting – Information* and *Costing Information* sheet and provides its output to the *Costing* sheet
Multiplexing allocation	This sheet distributes the GBV and opex of the multiplexing assets into the nine different regions	Receives inputs from the *Broadcasting – Information* and *Costing Information* sheet and provides its output to the *Costing* sheet
Costing	This sheet calculates the annual capex and opex for every asset on a regional basis for any given year considering the value of time	Receives inputs from the *Sites to region* and *Multiplexing allocation* sheets and provides its output to the *Total Cost summary* sheet

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Sheet	Description	Use in the model structure
Cost allocation to services	This sheet first calculates the distribution of the total costs calculated in the *Costing* sheet into mobile and DTT operations. It then splits the DTT costs between pay TV and FTA	Provides its output to the *Control* sheet
Total Cost Summary	This sheet is a simple summary of the total annual expenditure, capex and opex for all assets in the network, including the overall costs as well as the mobile, total DTT and FTA costs	Receives information from the *Costing* and *Control* sheets and provides output to the *Demand* & *Unit Cost* sheet
Demand	Calculates the required bandwidth at regional level as described in the paragraph 5 of section 2.3	Receives inputs from the *Total Cost summary* and *Control* sheets
Unit cost	Calculates the service unit cost at both regional and national level by dividing the total network costs pertaining to the FTA DTT service (coming from the *Total cost summary* sheet) by the demand (coming from the *Demand* sheet)	Output sheet, receiving inputs from the *Total Cost summary* and *Control* sheets
Inputs →	The sheets which follow the *Inputs →* sheet are linked sheets from the "Inputs" Workbook	The sheets which follow the *Inputs →* sheet are identical to those the same name in the "Inputs" workbook. These sheets feed into the *Sites to region* and *Multiplexing allocation* sheets
WACC →	The sheets which follow the *WACC →* sheet calculate the proposed WACC for the model. The *WACC calculation* sheet summarises the WACC calculation and also shows the WACC received from One.Vip	The sheets which follow the *WACC →* sheet are used to calculate the WACC proposed by Analysys Mason. The *WACC calculation* sheet receives information from the *WACC sheet* of the "Inputs" workbook. The WACC is used in the *Costing sheet*

A.2 List of abbreviations

Figure A.3 below shows the abbreviations used in the document.

Figure A.3: List of acronyms and abbreviations [Source: Analysys Mason, 2016]

Acronym	Meaning
AEC	Agency for Electronic Communications of the Republic of Macedonia
DTT	Digital terrestrial television
DVB-T	Digital video broadcasting – terrestrial
FTA	Free to air
GBV	Gross book value
GRC	Gross replacement cost
HD	High-definition channel
KVA	Kilo-volt-ampere
MUX	Multiplex

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Acronym	Meaning
SD	Standard definition channel
SMP	Significant market power
UK	United Kingdom
UPS	Uninterruptible power supply
WACC	Weighted average cost of capital