This document responds to stakeholder comments on the MOC’s consultation on the cost of wholesale services on Hot’s network and the accompanying documentation. Specifically, it focuses on the comments made by TASC Consulting & Capital and a Technical Opinion prepared for HOT and Analysys Mason’s report prepared for Partner Communications Company Limited and Cellcom Israel, Ltd. and comments from the respective companies.

This document summarises the responses received in relation to the MOC’s consultation on the HOT LRIC model (hereinafter the "HFC model"). In particular comments from TASC Consulting & Capital and the Engineering Opinion submitted on behalf of HOT Telecom Network, subsequently referred to as submissions made by HOT and Partner, Cellcom and the Analysys Mason report submitted on their behalf, subsequently referred to as submissions made by other respondents (OR).

The document is structured in the following way:

- Section 1 summarises responses in relation to HOT’s passive infrastructure network and technical assumptions made in the model;
- Section 2 summarises responses in relation to demand assumptions and forecasts in the model;
- Section 3 summarises responses in relation to financial and costing assumptions made in the model;
- Section 4 summarises any other comments received.

Annex 1 sets out the approximate impact of the changes discussed in this document on the results from the model. Annex 2 sets out in summary the final breakdown of service costs and outputs from the model after the changes discussed in this document have been applied. This document is submitted together with a revised version of the model. This final cost estimates derived from that model for the year 2017 (at 2015 prices) are NIS 40.35 per subscriber per month and NIS 17.63 per Mbps per month for access and transport respectively.

In this document, we also refer to the following documents:

- Consultation Recommendation - letter written by Prof. Grunau and Mr, Levaot, dated 14.1.2016.²
- Final Recommendation – letter written by Mr. Levaot, , January 2017; and

1. Response to technical assumptions and dimensioning of HOT Telecom’s Network

This chapter addresses relevant comments made by respondents to the consultation and draft cost model by the MOC regarding the dimensioning of the network and technical network assumptions made in the model.

Length and dimensioning of the infrastructure network

Respondents submit a number of comments with regards to the length of the passive infrastructure network. A detailed discussion of these comments is provided by the SoI under separate cover. In this section we briefly summarise the comments and present the updated network lengths of the different segments as provided by SoI. We also respond to comments regarding the growth of the network, the need to account for network sharing, and the number of ducts deployed in the modelled trenches. Other comments relating to dimensioning of the cable network are discussed later in this document:

HOT

HOT’s structural inefficiency: HOT submits that the model does not account for inherent inefficiencies in network infrastructure deployment. A 100% structural efficiency is unrealistic and inconsistent with the scorched-node approach used in the model.

Network’s length between the street and the courtyard-boundary: HOT submits that the information used to calculate the length of the infrastructure indicate that the length of the network is underestimated. In particular, flaws in assessing road width and sidewalk width underestimate the road-to-courtyard boundary by between 1,000km and 3,000km. Corrections should address the fact that parking lanes are not accounted for in the model, as well as gardens by the road and sidewalk, broad sidewalks on main roads, lane separation and cycling routes.

Network length within-courtyards (or private grounds): HOT submits that the costs of deployment within the courtyards (up to the year 2000) were not accounted for even though HOT Telecom incurred all trenching costs in houses and maintenance expenses. These costs were not factored in the model since the MOC considers HOT’s investments in the segment recouped through cable TV subscribers. HOT submits that wholesale costs model cannot make the assumption
that TV subscribers cover costs of Broadband subscribers. Following the logic that
wiring costs are recognized, if trenching costs are also recognized, the additional
trench length required amounts to 7,314km.

**Growth of network:** HOT submits that increase in the road network, which is used
as a basis of estimating the increase in HOT’s trench network is calculated
incorrectly. Instead of using a simple average of the annual growth in the network
length, a geometric average should be used.

**Other respondents**

**Efficiency of the modelled trench network:** OR submit that the network deployed
in the model excludes the final drop trench from the edge of the pavement to the
edge of the building and that this is in line with the approach used in other
jurisdictions (New Zealand, Denmark). Moreover, OR submit that the model should
not include real world inefficiencies even though they may be unavoidable and again
refer to models in New Zealand and Denmark that have made similar assumptions.

**Dataset used for trench length calculations:** Based on the geographic datasets
provided in the consultation, OR observe that there are significant volumes of
trenches which add to the measurement of HOT’s access network despite not having
optical nodes or core network routes in proximity and should therefore not be
included in the modelled network as they are not reflective of HOT infrastructure.

OR also note that input calculations in the model were erroneous, and that trench
metres in the model were “overstated by at least 453km (363km on the access
network and 90km on the core network)”.

**Cost recovery for resilience in the core network:** OR submit that the model
assigns a significant length of trenching to the provision of resilient routes and that
the modelled routes should be reviewed compared to the actual network routes, to
ensure that trench length requirements are not overestimated.

**Infrastructure and trench sharing:** OR submit that the treatment of network
infrastructure rented from Bezeq in the model is inconsistent with their treatment in
the Bezeq model. OR submit that the model should consider this infrastructure as
rented and not as owned by Hot, and therefore should only take into account the
annual rental price and exclude the capital cost of investing in trenches which HOT
has not incurred. In addition, OR submit that other network sharing agreements,
e.g. with other utilities, and other rented infrastructure similar to that
rented from Bezeq should also be taken into account.

**Number of ducts deployed:** OR submit that modelling two ducts in core and
access networks and therefore four ducts in segments shared between access and
core is over-dimensioning the infrastructure actually required. In addition, OR
submit that coaxial infrastructure does not require ducts and can instead be buried
directly.

**RESPONSE AND CONCLUSION**

Responses to some of the comments outlined above are provided by the MOC under
separate cover. The corresponding inputs into to the model based on the analysis
carried out by MAPI have changed accordingly:

- Primary core network: 1,252km
• Secondary core network: 5,123km
• Access network on private ground: 6,947 km, of which HOT Telecom incurred trenching costs for 78.2%, i.e. 5,434km in 2016
• Access network on public ground: 15,832km

For the purpose of the model, the length of the core network is further split into the distance between municipalities (3,711km) and the remaining distance of the secondary network. Using the updated figures above, results in a remaining secondary network core length of 2,664km.

When determining the length of the access network within courtyards (on private grounds), we take into account that according to HOT’s submission, HOT does not bear the cost of those excavations for buildings built after 2000 (though it does bear the costs for the coaxial cables deployed in private grounds). According to the data provided in HOT’s submission, these represent 22% of the total stock of buildings. This estimate is adjusted annually to take account of the number of new buildings erected.

For the access trench on private ground we note that the corresponding costs for the excavations are considered not to be same as on public ground. This is because substantial works of deeper excavations or resurfacing are not incurred on private grounds. The infrastructure costs (excluding the cable) considered for this part of the access network is therefore based on digging and filling costs alone representing a total of NIS [...] per meter in 2013 prices. This is based on the total costs provided by HOT for the year 2013 and the share of the relevant components (digging and filling) provided by HOT for the year 2011. (HOT was unable to provide the corresponding split for its 2014 trenching cost.)

We accept HOT's comment regarding the calculation of the increase in the road network length. However we have reconsidered that the total length of new roads is likely to be independent of the length of the existing road network and therefore use an average of the absolute annual increase in road network lengths as a basis for the forecast.

With regards to the trench sharing we accept that the treatment of trench rented from Bezeq is inconsistent with the model developed for the Bezeq network and that the assumptions in the model have been adjusted correspondingly. This is because it is reasonable to assume that an operator newly deploying an efficient network would seek similar opportunities of efficient roll-out. The corresponding capital costs (Capex) for the deployment of trench associated with the lengths actually deployed on Bezeq’s network have correspondingly been reduced while the operating expenses (Opex) have been increased to match those payments HOT makes to Bezeq for the usage of their infrastructure. We do not accept claims for additional sharing with other operators/utilities for OR has not presented supporting evidence for such claims.

We accept that the deployment of two ducts in the access network is unjustified and 4

4 The model takes all costs of coaxial cables on private ground into account even though, according to MOC, since 2010 HOT does no longer bear these costs for new buildings due to an amendment of building regulations in that year. We note that this aspect is not reflected in the model due to the relatively small number of buildings affected since 2010, and is therefore treated as a lenient assumption.

5 Frontier data request - 09-09-2014, NIS [...]/m for digging, refilling and resurfacing

6 Ibid., NIS [...]/m and [...]/m for digging and refilling out of a total of NIS [...]/m
unlikely to be necessary given passive infrastructure being available on other networks and the possibility for shared access to single ducts. We do not agree with the suggestion that the coaxial network does generally not require the deployment of duct. While we do agree that ducts are not required for the coaxial segment from the curb to the building, we do consider that the deployment of duct in trenches on public grounds significantly improves the maintenance of the cable network and also ensures that future upgrades to the network can be implemented efficiently, even though we recognize that HOT’s network consists, at least in part, of segments where the coaxial cable was buried and not deployed in ducts, even on public grounds. During the consultation HOT has also agreed that it is reasonable to assume only one duct in its access network. The model has been changed accordingly in relation to the assumptions of the number of ducts in the access network and the ratio of operating expenses applied to access duct and trench. i.e. given the lower capital cost after adjusting the number of ducts, this ratio needs to be increased to arrive at the level of operating expenses we previously considered reasonable for the passive access network infrastructure.

Technical modelling

Further comments are made in relation to a number of conceptual and computational issues in relation to network engineering aspects of the model. Due to the number of points raised in this section, we respond to each point individually.

HOT

DOCSIS standard: HOT submits that the modelling is not reflective of HOT’s network. Instead of using Euro-DOCSIS, HOT’s network uses the (US) DOCSIS standard. It argues that this causes the model to significantly underestimate the number of units of the following equipment: CMTS chassis (27 rather than […]), Nexus chassis (18 rather than […] and RFGW chassis (18 rather than […]). HOT concludes that changing to the Euro-DOCSIS standard would result in considerable economic impact on the network, with “81.5%” of all equipment in need of replacement. In this context, reference is made to appendix 3 of TASC’s submission which lists a range of equipment and compares the modelled equipment volumes and the volumes in HOT’s network.

RESPONSE AND CONCLUSION

We accept HOT’s submission that the DOCSIS standard used in the model should be that which is actually deployed by HOT. The use of the DOCSIS standard is at least partly a result of frequency bandwidth plans in cable TV systems consistent with private equipment (e.g. TV sets) used in Israel which also an efficient entrant would apply to ensure backward compatibility of its services with the equipment consumers use. It is therefore reasonable to dimension HOT’s modelled network according to US DOCSIS. Given that all information in relation to technical dimensions provided by HOT refers to US DOCSIS equipment also suggests that this standard should be used. We note, however, that the use of a different DOCSIS standard as such does not result in a significant underestimation of network
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equipment. the standards, while technically different do not result in significant differences in the number of units of equipment being used. it is true that the technical standards use different channel widths (6MHz for US-DOCSIS and 8MHz for Euro-DOCSIS) which in turn result in different capacities (36Mbps and 50Mbps respectively) per channel. however, corresponding equipment which is driven by the number of channels (e.g. the CMTS) allow for a higher number of channels to be carried under US-DOCSIS then Euro-DOCSIS resulting in the maximum capacity carried by one unit of equipment to be approximately the same under either standard. however we note that the previous model incorrectly considered the Euro-DOCSIS channel bandwidth while using the number of ports per port cards based on hot’s equipment (i.e. US-DOCSIS). correcting for this inconsistency by applying the US-DOCSIS channel bandwidth implies that the modelled number of CMTS units increase, all else equal.

the differences between modelled and actual equipment units can rather be explained by the type of equipment being modelled. while hot has deployed several generations of network equipment (some of which carry significantly fewer channels and less capacity), the model uses (in line with the bottom-up LRIC principles set out in the model documentation) the most recent type of equipment and their costs (which hot has also partly rolled out) as a basis for estimating the dimensions and costs of the network. this results in a lower number of equipment units at the current level of demand. in fact, as demand increases, so do the modelled equipment units. again using the example of the CMTS, hot seems to ignore the fact that the number of equipment units in fact increase over the modelled period to over 90, close to hot’s current number of CMTS units. hot’s higher number of equipment unit is therefore likely to be the result of its transition from older to newer equipment. in fact, hot confirmed during the MOC hearing that the number of CMTS used in its network has not changed over recent years and that it does not expect the number to significantly change in the future.

differences between equipment units for other types of equipment are the result of similar issues except for the number of Nexus equipment units which, due to an inconsistency in the model were not included in the costing section of the model. correcting for this, results in modelled number of equipment units of 36 in 2016. however, these consist of primary and secondary chassis while hot only refers to one type of chassis and the extent to which the units are comparable is unclear.

other equipment covered in appendix 3 of TASC’s submission referred to in this context:

- Branching points: the dimensioning of branching points has been updated to reflect their use in the part of the access network on public land as well as inside of buildings. the corresponding number of branching points is 325,000, similar to the number hot submitted.
- Amplifiers: hot submits that around [...] amplifiers are used in the network. the final model estimates around 42,000 amplifiers which is the result of modelling a shorter network length.
- Optical nodes/optical cabinets: see subsequent section on optical nodes and cabinets.
- DTI: hot confirms that the number of equipment is broadly similar.
- Aggregator/Nexus: see earlier response in this section.
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- RFGW/CMTS: see subsequent section in response to HOT’s comments regarding the number of upstream and downstream segments.
- CWDM: the model estimates around 3,000 units of CWDM equipment. This is approximately twice the number of units in the draft version of the model and the result of an increase of the number of optical nodes to around 10,000.
- DWDM: see subsequent section in response to HOT’s comments regarding missing network components.

**Length of COAX cable:** HOT submits that the coax cable considered in the model (18,500km) excluding home-wiring, is not sufficient to cover the trench length in the access network (20,700km) given the current assumptions of the HFC model, where the whole access infrastructure is treated as coax network. The submission provided illustrative examples that aim to demonstrate that the ratio of the length of coaxial cable to trench (the part of the access network on public ground) is 1 to approximately 2, although further qualitative arguments are made to suggest that the true ratio is 2.5 (e.g. restrictions in the way the trench is designed). In addition, HOT’s position on home-wiring is that the model underestimates the length of wiring in the house courtyards. It estimates that a total of 16,000km from the edge of the courtyard to the subscriber’s home (including upwards in apartment buildings) instead of the modelled 7,800km needs to be added. This is based on estimates of the wiring length for infrastructure in courtyards (9,300km), the upward length in buildings with joint boxes on every floor (1,000km) and the upward wiring length in buildings with a single joint box (5,700km).

**RESPONSE AND CONCLUSION**

We accept that the length of the coax cable in the model, though based on one of HOT’s earlier submissions, is inappropriate, for as HOT has stated the ratio between the coax length and the modelled access trenches is unreasonably low. With regards to Hot’s suggestion for the coax length the model should account for, we note first that HOT does not provide an actual measurement of the length of coax cable in its network now but an estimate of the coaxial cable in the various segments of the access network. With regards to the estimates HOT submits, we note that:

- HOT’s estimate of the ratio of coaxial cable in the access trench on public ground is inflated. The explanations submitted justify a ratio of approximately 2 but do not provide quantifiable justification of the ratio of 2.5 which HOT submits should be applied in the model. The arguments provided do not allow the conclusion that the ratio between coax and trench length would increase as a result of a more complex routing of the trench network. Instead, the length of the coaxial cable would increase in proportion with the increase in the trench network hence not result in an increase of the ratio of coaxial cable to trench length.

Another reason the ratio may be inflated is that the illustration provided by HOT is not representative of HOT’s modern hybrid fibre coax network. The total length of the trench considered in the example is 5.4km which is assumed to be connected to a single optical node. However, in HOT’s
network, the average trench length per optical node is approximately 1.5km. This means that the degree of overlap of coaxial cables that HOT suggests is the reason for the ratio of 2 is unlikely to be required. Instead, a configuration with a significantly larger number of optical nodes, efficiently deployed is likely to require less coaxial cables. However, we accept that optical nodes are likely to be deployed in the same cabinets as a result of splitting locations where previously a single node was operating. This would still require some additional coaxial cable to reach from the optical node to the area of premises the node serves. For that reason we consider that a ratio of 2 is reasonable. We note that this is consistent with the model developed in Denmark in 2011 which also shows a ratio of coaxial cable length to trench length of approximately 2, although the most recent model shows a ratio of 1.76. However, it is unclear from the documentation of the recent model if the access network is fully optimised (with optical nodes being re-sited) or based on the legacy location of nodes. Again, this suggests that the ratio of 2, i.e. weighing the evidence provided by HOT more highly, is reasonable.

Given the increased number of optical nodes compared to the example provided by HOT, we also assume that the type of cable (860) considered for the connection to the first amplifier is no longer required. Instead, the cable considered by HOT for the 2nd layer of cabling (540) is used. This is because a decreased distance and number of drops per optical node connected through one coaxial cable has decreased and reduces the extent to which the transmission through the cable is reliant on cables with lower electrical resistance. The same rationale applies to the use of amplifiers in the coaxial network. HOT submits that two different types are used which we understand to be the result of the legacy structure of the network. However, given the increased level of power on the coaxial segments due to fewer drops being served per optical node, we assume that the amplifier with the lowest cost would be used.

- With regards to coaxial cable in trenches on private ground we determine the length of the cable based on the length of that trench (i.e. 6,947km in 2016), subject to typical wastage assumption.
- With regards to the coaxial cable inside of buildings we accept HOT’s submission regarding their data previously submitted being unsuitable. We note that the calculation HOT provides in replacement of the previously submitted data is based on assumptions of the types of houses and number of floors and types of coaxial cable installations. Except for the assumptions with regards to the types of indoor installations, we consider these assumptions reasonable. HOT considers two types of indoor coaxial cable installations: (i) installations with individual cables deployed from the ground to the premise; and (ii) installations with a single cable throughout the house and individual cables being deployed on each floor. However, considering

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7 HOT submits that the number of optical nodes in its network is currently around 10,000. If 5.4km trench per optical node was representative of the nodes in HOT’s network, only approximately 3,000 nodes would have been deployed.
10 We made only one minor adjustment and assume floor height of 3 m where HOT suggested 3.5 m.
that the cost of installing one shared upward coax is the same as installing several individual upward coax (except for the costs of the additional material) we conclude that installing individual cables is the more cost effective way of deployment. Given the purpose of the model of estimating efficient costs, the model estimates the costs of deploying individual cables exclusively.

**Number of upstream and downstream segments:** HOT disagrees with the determination of the number of upstream and downstream network segments in the model based on the number of subscribers. It submits that the number of households passed should be used instead. It further submits that as a result of its segmentation process the number of households per upstream and downstream segment is 300 and 900 respectively. The final number of downstream segments according to HOT is 2,250 rather than 700 as estimated in the model.

**RESPONSE AND CONCLUSION**

The numbers of upstream and downstream segments are a function of the capacity required by broadband customers. The amount of capacity is not a function of the number of households HOT’s network passes but a function of the number of subscribers on HOT’s network and the maximum concurrent traffic they generate. We therefore maintain that the functionality in the model (i.e. determining the amount of capacity on the basis of the number of subscribers) is justified. HOT submits that its segmentation process aims for 300 and 900 households per upstream and downstream segment respectively. We note that this statement was not supported by evidence as neither the current status of the segmentation process, the time when the process is meant to be finalised nor the underlying assumptions of HOT’s channel dimensioning has been provided.

Given the inconclusive evidence provided by HOT, we reviewed other sources as points of reference for the dimensioning of the access network. A study by Analysis Mason suggests that the capacity on the access network per cable TV network subscriber in Western European countries is around 640 kbps per subscriber. This is equivalent to approximately 950 subscribers per downstream segment considering 16 downstream channels as submitted by HOT.

We further reviewed the Core network model published by the Danish Business Authority in that regard. While this model does not provide the level of detail to directly compare the inputs that drive the number of subscribers per downstream segments, it does provide the number of CMTS which is directly driven by the number of downstream segment.

In particular, the Danish model calculates 45 CMTS for a total of approximately 1.1m subscribers. This is based on the dimensioning of port cards being based on 5,000 subscribers on every card. For comparison, the number of subscribers per CMTS port card based on the HFC model using a per subscriber capacity on the

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12 [https://erhvervsstyrelsen.dk/gaeldende-prisafgoerelse-2016](https://erhvervsstyrelsen.dk/gaeldende-prisafgoerelse-2016), accessed on 03/11/2016
access network of 640kbps is approximately 3,900, lower but broadly consistent with the dimensioning in the Danish model.

Using HOT’s assumption of 900 homes passed per downstream segment (not subscribers) would result in fewer than 500 subscriber per port card, i.e. only 10% of the utilisation in the Danish model. This appears to be unrealistically low compared to other evidence available and we therefore estimate the equipment on the basis of 640kbps capacity per subscriber on the access network in 2016. This represents a factor of 1.2 to the core capacity in 2016 and the access network capacity calculation in years after 2016 is based on applying this factor to the core capacity forecast in the model.

We note in this context that HOT also submits that the current number of CMTS port cards in its network is […] This is significantly higher compared to the number of modelled port cards. However, given the arguments set out above, we believe that these equipment volumes are currently unjustified by demand. Such a high number of port cards is also inconsistent with the number of RFGW chassis and cards deployed in HOT’s network – as submitted by HOT. I.e. the number of RFGW port cards in HOT’s network (which are driven by the number of CMTS port cards in use) is […] The modelled number of RFGW port cards for 2016 is 180, broadly similar to HOT’s number. We would expect the number of RFGW port cards and chassis to be significantly higher if […] CMTS port cards were in use in HOT’s network.

The number of optical nodes: HOT submits that the number of optical nodes (transceivers) considered in the model is too low. It clarifies that information previously provided in these procedures referred to locations in which optical nodes are placed, not the optical nodes as such. It submits that the number of optical nodes currently deployed is around 10,800 with the final number of nodes expected to be around 12,600.

RESPONSE AND CONCLUSION

We note that though the network can operate at the number of optical nodes previously provided and reliably satisfy the traffic generated by HOT’s subscribers during the period covered in the model, a forward looking approach would have to take into account the build ahead for later years as well. We have undertaken an exercise to approximately estimate the number of optical nodes after 2018 as a result of the currently projected growth in broadband traffic. This has shown that a significant increase in the number of optical nodes would be required soon after the modelled period ends. Having considered that it is not practical for a Cable TV operator to instantly roll-out a large number of optical nodes we conclude that it is reasonable to take account of HOT’s current number of optical nodes, as part of HOT’s upgrade project when efficiently rolled out. This implies that future increases in the number of optical nodes are significantly reduced and more realistic to achieve. The assumptions in the model have therefore been changed to approximately 10,800 optical nodes in 2016. As in the previous version of the model the final model also takes into account the requirements for additional optical nodes as a result of access network expansion.
**Modelled upstream and downstream bandwidth:** HOT argues that the model overstates the capacity of upstream channel capacity by 18.5 Mbps. According to HOT, the source of the error is the usage of 64 QAM and 6.4 Mhz rather than 16 QAM and 3.2 Mhz. HOT submits a number of reasons why such operating modes cannot be achieved in HOT’s network. For example, HOT submits that a mix of legacy networks from merging different operators into a single entity prevents the current network from operating more effectively. In another argument HOT submits that the types of amplifiers used in the access network are not compatible with operating the upstream segment more efficiently. HOT further submits that the number of downstream channels per segment is 16 rather than 8.

**RESPONSE AND CONCLUSION**

The explanations provided by HOT in relation to the operating mode of upstream channels are not relevant given the purpose of the model. The model estimates the costs of a current network, not that of legacy networks or old equipment. The reason for estimating costs of current equipment at current prices is precisely to estimate the cost a modern network to satisfy the current level of demand would incur. This is consistent with the approach applied in the Bezeq model and consistent with best practice in other jurisdictions (including the EU and other jurisdictions).

A cable network rolled out today using current cable TV technologies would be able to arrange the frequency bands it uses in ways that allow for the efficient provision of all types of services. For example, the network would not suffer from:

- the impact of the network’s legacy focus on TV services – i.e. instead, TV channels would be deployed in frequency bands that allow for the efficient use of lower spectrum bands for upstream traffic; or
- historic negligence of technical aspects of the network that are important for the provision of services today but were of limited or no importance when HOT’s network was originally rolled out.

Again, this is also why the model takes account of the current cost of equipment and infrastructure rather than the costs HOT originally incurred.

We therefore conclude that the assumptions made in the model are justified.

**Missing network components:** HOT submits that the dimension of the model omits necessary network equipment, such as distant hubs and 5GE card. It states that there are 16 hubs in cities far from HOT’s headends, which represent unaccounted costs in terms of maintenance operations. Moreover, almost […] 5GS card are missing from the calculations of the cost of the network. HOT further submits that DWDM equipment is missing from the model.

Finally, HOT clarifies that the number of licences HOT purchases from Cisco for CMTS and RFGW equipment are based on the number of channels, not ports as considered in the model. It further states that licence costs should not be classified as hardware costs, but rather as a separate accounting cost.
RESPONSE AND CONCLUSION

We accept that HOT’s network is one that in the past has relied on a larger number of headends than those currently considered in the model. However, this larger number of headends is the result of the legacy structure of the network prior to the roll-out of HOT’s current hybrid fibre coaxial network. We understand that the topic of the number of headends was subject of discussions between the Ministry and HOT and that HOT confirmed the number of 18 headends now considered in the model whereas around 50 sub-headends were considered to be redundant once the restructuring of the network is completed. Taking account of the size of Israel, this implies an average of around 1200km² per headend. Assuming the area of a circle results in a radius of approximately 20km, a distance that is easily manageable by modern transmission systems.

The fact that the model does not calculate cards with 5Gbps does not imply that it omits corresponding costs. The model relies on 1Gbps and 10Gbps cards most commonly deployed in modern networks according to the capacity requirements on the network. We note that HOT does not provide a comparison for those cards, which suggests that the overall number of cards considered in the model is not disputed.

With regards to DWDM equipment, we note that the model uses CWDM equipment and dimensions sufficient numbers of fibres in the network to operate without the use of DWDM. We note that HOT does not comment on the dimensioning of the fibre cables used in the network and therefore assume that this aspect of the model is undisputed.

We accept that the cost of licenses is incurred on a per channel basis rather than port basis and the adjustments in the model have been made accordingly. We note however that the costs modelled are investment and do not distinguish between hardware, software of licence or otherwise. As part of headend equipment, the costs of the licences are considered as a share of that investment which is treated in the model in the same way as other types of parts thereof (such as hardware or civil engineering).

Division between access and core network: HOT submits that allocation of the network segment between headends and optical nodes to the core part of the network is unjustified because the coaxial network ends at the optical nodes and from there the connection continues on optical fibre. It notes that that the outgoing signal from the headend does not undergo other changes before its arrival at the customer’s home. HOT submits on that basis, that the cost of network between optical nodes and headends should be attributed on a per subscriber basis and form part of the wholesale access charge.

RESPONSE AND CONCLUSION

We accept that the allocation of the different cost elements to the different services should be based on the actual cost drivers of each element, and this implies that the...
trench and duct network between the optical node and headend should be treated in the way HOT suggests. I.e. the segment of the network now used for the roll-out of fibre cable has previously been used for coaxial cable and is invariant with the amount of capacity provided to subscribers but necessary for the provision of any form of connectivity. However, the fibre cable rolled out in this segment of the network is precisely rolled out for the purpose of providing more services and increased broadband capacities to consumers. It is therefore reasonable to allocate the cost of that roll-out based on the capacity carried over that part of the network; i.e. in the way set out in the draft version of the model submitted to stakeholders.

**Homogeneous pricing for different speeds:** The MOC set a fixed access price for 12, 30 and 100 Mbps lines, disregarding HOT Telecom’s network structure and characteristics. TASC maintains that access pricing should be composed of a flat (fixed) tariff plus a variable component to make the pricing differentiated. TASC advocates that this practice is in line with an efficiency argument. Since HOT Telecom is a shared network that works on a “best-effort” basis, subscribers share the total available bandwidth. Setting a fixed access price incentivizes the operators to sell 100 Mbps lines only, which is expected to increase the load on the network and create congestion.

**RESPONSE AND CONCLUSION**

This aspect of the consultation response is considered under separate cover by the Ministry of Communication.  

Other respondents

Other respondents make the following comments with regards to the technical aspects of the model.

**Size of coaxial cables:** OR submit that coaxial cables should be smaller in size as they reach closer to the customer. This is based on ORs observation that only a single cost is used in the model while other models use several types and costs of cable.

**Computational errors in dimensioning of upstream/downstream channels:** OR submit that the function used to calculate the total number of upstream and downstream channels at the CMTS taking account of the number of service groups is too complicated, results in too many channels being calculated and suggest an alternative approach, using a simpler Ceiling function for the determination of the number of channels.

**Modern equivalent asset approach and use of HOT’s equipment:** OR submit that the model should not rely on HOT’s equipment as this is often outdated and inefficient and use a modern equivalent asset approach instead.

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14 Final recommendation by Mr. Levaot p. 19.
RESPONSE AND CONCLUSION

With regards to the size of the coaxial cables used in the model we confirm that the cost considered in the draft model is an average of the different types of cables used in HOT’s network. As already set out in the earlier discussion with regards to the number of optical nodes and types of coaxial cables, this has since been simplified to only refer to one type of coaxial cable deployed in infrastructure on public ground and another (thinner) type in infrastructure on private ground and in-building.

Comments made in relation to the determination of CMTS upstream and downstream channels in the model conclude that a simpler Ceiling function should be used for the determination of the number of channels. However, this function would result in an incorrect number of channels. In fact, if implemented in the way suggested by OR, it would result in a higher number of upstream and downstream channels than currently modelled. The approach considered in the model ensures that only an integral number of channels are being transmitted to an integral number of optical nodes. We therefore consider the approach applied in the model as justified.

We think that OR’s comment regarding the use of modern equivalent assets is unjustified because the model already implements that approach. We note that HOT uses a range of equipment of which some is old but also includes more recent equipment an entrant would use to roll-out its network today. The model only considers the latter type of equipment when estimating network cost.

2. Demand assumptions and projections

This chapter addresses relevant comments made by respondents in relation to demand assumptions and forecasts.

**Forecasts for broadband and TV subscribers:** HOT submits that due to changes in the market in recent years, the future demands for TV and broadband should be assessed using a 3 year trend rather than longer time spans, to ensure that the most recent developments in the market are given a higher weight. HOT also comments on the market share assumption for broadband customers which does not reflect the recent trend.

**Average capacity per broadband subscriber:** HOT submits that the broadband capacity considered in the model does not reflect HOT’s actual capacity but that of the market, covering HOT’s and Bezeq’s subscriber capacities. HOT submits that this is unreasonable because (i) Unlike HOT’s VOD, YES’ VOD service (who’s subscribers are predominantly Bezeq customers) is provided over broadband and (ii) Bezeq’s client base includes more heavy users, i.e. business subscribers and non-TV subscribers.

**Number of TV channels:** HOT submits that the number of TV channels assumed for 2016-18 in the draft model is the same as in 2014, which is higher than in 2015. The 2015 number of channels should be used instead.

**Number of HOT subscribers:** HOT submits that the number of subscribers in 2015 is incorrect due to number of access lines being counted rather than the
number of customers (i.e. these numbers are different due to some customers having two accesses).

**Annual update of demand assumptions:** OR submit that demand assumptions in the model of HOT’s network should be updated annually in line with the practice applied in the Bezeq model and similar to those in other jurisdictions (e.g. Denmark).

**Population forecast:** HOT submits that the population forecast should be based on official CBS data rather than the internal forecasts developed in the model.

**Overstated demand for VOD:** HOT submits that the assumption of VOD usage is too high and clarifies that […]% rather than 25% of its subscribers use VOD services during the network peak.

**RESPONSE AND CONCLUSION**

We clarify with regards to HOT submission regarding the approach chosen for forecasting different demand parameters in the model that the assumptions made are by no means arbitrary but tailored to each parameter considered in the model. We note that an approach that considers the last three years as a basis of all forecasts in the model is unlikely to be more robust precisely because it doesn’t take into account the specific circumstances of the respective parameters. HOT specifically comments on the forecast of its market share of broadband customers. While the data of the last three years would suggest a downward trend, the model assumes a constant market share at the level of the 2015 data. We consider it is reasonable to assume that HOT’s retail operations will focus on reversing the negative trend of recent years. In fact, recent news suggest that HOT has implemented certain changes in its customer facing operations that are aimed at improving the quality of the customer experience which is eventually aimed at ensuring a greater retention of existing customers and acquisition of new customers. We also note that considering a forecast based on the trend suggested by HOT would result in a market share of under 20% by 2020. We do not expect HOT to blindly accept that faith without efforts to improve its position in the market.

However, we note the MOC’s intention to implement an annual update procedure of the demand assumptions made in the model, consistent with its procedures in relation to the model of Bezeq’s network. This should adequately address HOT’s concerns in that regard, as well as OR suggestions.

Regarding the issue of capacity of the average broadband subscriber, we note that OTT TV subscribers generate substantially higher traffic during the busy hour than ‘Yes’ VOD subscribers. An effective wholesale market over HOT’s network will allow operators to offer competitive service packages that include OTT TV services to subscribers over HOT’s network as well, and correspondingly the demand for capacity on HOT’s network is likely to increase. Secondly, Hot explains that because most of its subscribers are also TV subscribers, they generate less traffic than subscribers over Bezeq’s network. However, this difference is a result of Hot’s own marketing and pricing strategy that mainly targets multi-channel TV subscribers rather than the general public. Instead, in a more competitive environment which the wholesale market is likely to generate, users who do not subscribe to multi-channel TV services and therefore tend to generate more broadband traffic are likely to change that average traffic profile of subscribers on HOT’s network. We also note that this principle is consistent with MOC’s pervious modelling decision.
Estimating the cost of A Wholesale Access Service on HOT’s network

Regarding Bezeq's FTTC model.

Finally, we note that the traffic generated by business subscribers does not affect the overall capacity required, because such subscribers are usually inactive during the network busy hours.

We conclude, therefore, that MOC's decision to regard the average Israeli subscriber and not specific subscribers currently targeted by Hot's marketing strategy is reasonable.\textsuperscript{15}

We accept HOT's comments regarding the number of TV channels considered in the model and this aspect has been updated accordingly and is therefore also reflected in the network dimensioning part of the model.

The dimensioning of the network depends on the number of accesses and a subscriber having two lines can utilise the network twice as much as a customer with a single line. We therefore conclude that the use of the number of accesses is correct.

In relation to the population forecast and assumptions regarding the share of VOD users we confirm that the changes proposed by HOT have been implemented in the model.

3. Financial and costing assumptions

This chapter addresses relevant comments in relation to the financial assumptions made in the model.

\textbf{HOT}

\textbf{OPEX of optical cables:} HOT submits that the Opex for optical fibre is almost zero because of the build ahead function in the model.

\textbf{WACC:} HOT submits that applying the same WACC to HOT as to Bezeq is incorrect because (i) the main focus of the business (fixed telephony for Bezeq, cable TV for HOT) should be taken into account in the estimation of the WACC; (ii) the impact of different technologies should be taken into account; and (iii) incumbent’s advantage should be accounted for in the estimation.

\textbf{USD/NIS exchange rate:} HOT submits that the exchange rate used in the model is not based on the “replacement-cost” principle and needs to be updated based on recent exchange rate levels.

\textbf{Allocation of costs to TV:} HOT submits that TV channels are transmitted on the basis of 1,400 access segments while the model assumes that all channels pass through the all optical nodes. HOT submits that as a result, too much cost is allocated to TV and that the allocation should be changed based on the number of segments it submits.

\textsuperscript{15} This is more extensively discussed in MOC's final recommendation by Mr. Levaot.
RESPONSE AND CONCLUSION

With regards to optical fibre cables, we note that the operating expenses for fibre cables are around NIS 23m per year in every year covered in the model, not “almost zero” as HOT seems to suggest. We further note that HOT did not submit any concern regarding the overall level of operating expenses and we therefore assume that this is undisputed. We therefore consider the concerns raised by HOT in that regard unjustified.

The response to the WACC is provided by the MOC under separate cover. The corresponding level of the WACC remains at 6.68%, as was set in the Bezeq model.

We partly accept HOT’s comment regarding the exchange rate used in the model but consider a reasonable exchange rate to be based on the average rates in 2013, 14 and 15, during this period the current equipment has been purchased. This results in an exchange rate of 3.69 NIS/USD.

Regarding the allocation of costs between TV and broadband we note that HOT does not submit by what technical means the TV signal reaches the households. We accept that HOT may achieve this through a network (with somewhat redundant infrastructure) that is the result of the way in which HOT has historically rolled out the network. However, the network modelled is one where customers are connected through one coaxial cable that is linked to the core network through one optical node and fibre cable as the most cost effective way to provide all services HOT is providing to its customers. Coaxial cable, optical node and fibre cables are therefore shared between different services and we therefore consider that the cost allocation implemented in the model is accurate.

Other respondents

Benchmarked inputs into the model: OR submit that the HFC model uses the 2014 Danish cost model of cable networks as a benchmark for cable-specific inputs. They submit that the benchmark no longer adequately reflects the latest assumptions on the unit cost of an efficient cable operator, also in view of the fact that the Danish regulator released a new model for wholesale pricing in 2016. OR submit that using inputs from the 2016 Danish model indicates that the current cost assumptions for assets including cabling and electronics are not efficient (i.e. overestimated) and need to be reviewed.

Common site costs: OR submit that common site costs based on HOT’s information may be inappropriate for ensuring that the model calculates efficient costs. They further criticise that site costs are considered to be the same for different types of equipment.

Operating expenses: OR submit that operating expenses should not be applied to build ahead units may need to be bought ahead of usage but don’t require actual operations and therefore do not incur additional operating costs.

The cost of duct: OR submit that there are differences in the cost of duct between the model for Bezeq’s network and HOT’s. In particular, OR submit that the assumption in the model is NIS 7,500 per duct and km while the HFC model assumes NIS 12,100.
RESPONSE AND CONCLUSION

With regards to the reference of relevant benchmarks of the cost of network equipment we note that the costs considered in the model are those incurred in Israel. While these inputs have been compared against other models, they have not been found inadequate. As OR are likely to be aware, also equipment prices in the 2016 Danish model (while lower compared to prices in the 2014 model) are still above those considered in the HFC model.

Common site costs are determined using information from HOT and considered against similar estimates in the model of Bezeq’s network. We found that such costs are typically lower in HOT’s network. Where they were not, equivalent costs from the model of Bezeq network had been used (and documented in the model).

With regards to operating expenses, we understand that OR consider the build ahead function to reflect the timing of the acquisition of the equipment while the actual installation of that equipment occurs in the year when demand requires it to be installed. However, this is not the rationale of the build-ahead considered in the model. While the acquisition does play a role, the primary reason for the roll-out of network equipment ahead of demand requiring it is the installation, testing and integration of that equipment in the existing network. Such equipment is therefore operational prior to actually being required. This also implies that costs for operating equipment are incurred at an earlier stage. We therefore consider the assumptions made in the model regarding the determination of operating expenses reasonable and note that this approach is also consistent with the approach applied in the Bezeq model.

We note that OR’s comment regarding the cost of duct seems to refer to the draft version of the Bezeq model submitted for consultation in January 2014. We confirm that the cost considered in the HFC model is consistent with that in the final Bezeq model.

4. Comments on other areas of the model

This final section sets out comments in relation to the modelled services.

**Multicast service dimensioning and costing:** HOT submits a number of comments in relation to the multicast service considered in the draft model.

**Passive infrastructure access service:** HOT submits a number of comments in relation to the pricing of passive infrastructure access pricing.

RESPONSE AND CONCLUSION

Responses to both aspects set out above are provided by the MOC under separate covers. The multi-cast service has been removed from the model in line with those responses.
Annex 1: Impact of changes applied in the model

The following table describes the changes applied in the model and their impact on costs. The changes are set out in the order of appearance in the model.

<table>
<thead>
<tr>
<th>Description</th>
<th>Reference</th>
<th>Access costs</th>
<th>Transport costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange rate increased to 3.69 NIS/USD</td>
<td>Assumption summary D9</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Indoor cabling added</td>
<td>Assumption summary D24:D27</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Type of coaxial cable changed</td>
<td>Equipment D35</td>
<td>-2%</td>
<td></td>
</tr>
<tr>
<td>Trenching on private ground added</td>
<td>Assumption summary D37</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>Network sharing with Bezeq taken into account</td>
<td>Assumption summary D39</td>
<td>-7%</td>
<td></td>
</tr>
<tr>
<td>Network length on public grounds decreased</td>
<td>Assumption summary D36</td>
<td>-7%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Number of optical nodes increased</td>
<td>Assumption summary D51</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Number of bores in access trench reduced to 1</td>
<td>Assumption summary D63</td>
<td>-7%</td>
<td></td>
</tr>
<tr>
<td>Increase coax to trench length ratio to 2</td>
<td>Assumption summary D68</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Capacity per downstream channel reduced to 38Mbps</td>
<td>Assumption summary D120</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Busy hour VOD usage reduced to 10%</td>
<td>Assumption summary D189</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Downstream capacity per subscriber on the access network set to 640kbps</td>
<td>Assumption summary D170</td>
<td>-4%</td>
<td></td>
</tr>
<tr>
<td>Revised number of households</td>
<td>Demographic D30:P30</td>
<td>-1%</td>
<td>&gt;-1%</td>
</tr>
<tr>
<td>Revised broadband penetration</td>
<td>Demographic D57:P57</td>
<td>&gt;-1%</td>
<td>&gt;-1%</td>
</tr>
<tr>
<td>Revised number of TV channels</td>
<td>TV &amp; VoD I19:M23</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Dimensioning of CMTS and RFGW licences changed from physical ports to RF channels</td>
<td>CMTS K4:L4</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>Excess redundancy of CMTS port cards removed</td>
<td>CMTS AC9:AD9</td>
<td>&gt;-1%</td>
<td></td>
</tr>
<tr>
<td>Cost of trench/duct infrastructure between optical node and headend recovered from access costs</td>
<td></td>
<td>19%</td>
<td>-28%</td>
</tr>
<tr>
<td>Updated demand assumptions</td>
<td></td>
<td>13%</td>
<td></td>
</tr>
</tbody>
</table>

Note: The measurement of the impact is indicative and not cumulative.
Annex 2: Summary of model results

The following tables set out a number of key results from the model; intermediate outputs and final cost estimates.

### CMTS and associated headend equipment (units of equipment)

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMTS</td>
<td>50</td>
<td>66</td>
<td>95</td>
</tr>
<tr>
<td>RFGW</td>
<td>19</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>Aggregator</td>
<td>64</td>
<td>78</td>
<td>109</td>
</tr>
<tr>
<td>DTI</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
</tbody>
</table>

### IP edge and IP core router equipment (units of equipment)

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP edge</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>IP edge - port cards</td>
<td>28</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>IP core</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>IP core - port cards</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

### Infrastructure and cable network (km)

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure: Access trench on public ground*</td>
<td>15,619</td>
<td>15,809</td>
<td>15,999</td>
</tr>
<tr>
<td>Infrastructure: Access trench on private ground</td>
<td>5,434</td>
<td>5,434</td>
<td>5,434</td>
</tr>
<tr>
<td>Infrastructure: Access duct</td>
<td>24,114</td>
<td>24,327</td>
<td>24,540</td>
</tr>
<tr>
<td>Infrastructure: Core trench</td>
<td>514</td>
<td>514</td>
<td>513</td>
</tr>
<tr>
<td>Infrastructure: Core duct</td>
<td>1,054</td>
<td>1,053</td>
<td>1,052</td>
</tr>
<tr>
<td>Cables: Coax cable on public ground</td>
<td>38,447</td>
<td>38,784</td>
<td>39,120</td>
</tr>
<tr>
<td>Cables: Coax cable on private ground</td>
<td>7,199</td>
<td>7,315</td>
<td>7,432</td>
</tr>
<tr>
<td>Cables: Coax cable in-building</td>
<td>19,573</td>
<td>19,886</td>
<td>20,205</td>
</tr>
<tr>
<td>Cables: Fibre cable</td>
<td>8,742</td>
<td>10,063</td>
<td>10,105</td>
</tr>
<tr>
<td>Optical nodes: locations</td>
<td>4,593</td>
<td>4,633</td>
<td>4,674</td>
</tr>
<tr>
<td>Optical nodes: equipment</td>
<td>10,858</td>
<td>10,898</td>
<td>10,939</td>
</tr>
</tbody>
</table>

Note: Infrastructure measures are in effective km after taking account of sharing between access and core. *Includes trench between optical nodes and headends.
### Wholesale access and transport cost stack and results (2017)*

<table>
<thead>
<tr>
<th>Network element</th>
<th>Total annual cost</th>
<th>Total network volume</th>
<th>Network unit cost</th>
<th>Volumes attributed to Broadband</th>
<th>Access cost (NIS / access)</th>
<th>Transport cost (NIS / Mbps)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical node</td>
<td>15,944,371</td>
<td>377,352 (Channels)</td>
<td>42</td>
<td>129,534</td>
<td></td>
<td>12.35</td>
</tr>
<tr>
<td>DTI</td>
<td>1,284,140</td>
<td>829,943 (Mbps)</td>
<td>2</td>
<td>826,446</td>
<td></td>
<td>2.88</td>
</tr>
<tr>
<td>Aggregator</td>
<td>3,588,206</td>
<td>829,943 (Mbps)</td>
<td>4</td>
<td>826,446</td>
<td></td>
<td>8.06</td>
</tr>
<tr>
<td>RFGW</td>
<td>11,797,045</td>
<td>829,943 (Mbps)</td>
<td>14</td>
<td>826,446</td>
<td></td>
<td>26.50</td>
</tr>
<tr>
<td>CMTS: Downlink</td>
<td>15,120,867</td>
<td>830,212 (Mbps)</td>
<td>18</td>
<td>826,446</td>
<td></td>
<td>33.96</td>
</tr>
<tr>
<td>CMTS: Processor</td>
<td>8,432,756</td>
<td>830,212 (Mbps)</td>
<td>10</td>
<td>826,446</td>
<td></td>
<td>18.94</td>
</tr>
<tr>
<td>CMTS: Uplink</td>
<td>2,857,987</td>
<td>444,938 (Mbps)</td>
<td>6</td>
<td>443,264</td>
<td></td>
<td>6.42</td>
</tr>
<tr>
<td>Edge router: Downlink</td>
<td>6,714,749</td>
<td>444,901 (Mbps)</td>
<td>15</td>
<td>443,264</td>
<td></td>
<td>15.09</td>
</tr>
<tr>
<td>Edge Router: Processor</td>
<td>2,919,272</td>
<td>444,901 (Mbps)</td>
<td>7</td>
<td>443,264</td>
<td></td>
<td>6.56</td>
</tr>
<tr>
<td>Edge Router: Uplink</td>
<td>4,883,454</td>
<td>444,901 (Mbps)</td>
<td>11</td>
<td>443,264</td>
<td></td>
<td>10.98</td>
</tr>
<tr>
<td>Core Router: Processor</td>
<td>455,408</td>
<td>444,875 (Mbps)</td>
<td>1</td>
<td>443,264</td>
<td></td>
<td>1.02</td>
</tr>
<tr>
<td>Core Router: Core Router</td>
<td>2,414,082</td>
<td>444,875 (Mbps)</td>
<td>5</td>
<td>443,264</td>
<td></td>
<td>5.43</td>
</tr>
<tr>
<td>Transmission - Coax+Trench &amp; ON to HE Trench</td>
<td>462,741,426</td>
<td>982,346 (Accesses)</td>
<td>471</td>
<td>982,346</td>
<td>471.06</td>
<td>0.00</td>
</tr>
<tr>
<td>Transmission - ON to HE - Fibre</td>
<td>35,560,121</td>
<td>377,352 (Channels)</td>
<td>94</td>
<td>129,534</td>
<td>27.54</td>
<td></td>
</tr>
<tr>
<td>Transmission - HE to MHE - Fibre+Trench</td>
<td>11,767,884</td>
<td>613,781 (Mbps)</td>
<td>19</td>
<td>443,264</td>
<td>19.17</td>
<td></td>
</tr>
<tr>
<td>Transmission - MHE to MHE - Fibre+Trench</td>
<td>3,691,786</td>
<td>613,683 (Mbps)</td>
<td>6</td>
<td>443,264</td>
<td>6.02</td>
<td></td>
</tr>
</tbody>
</table>

Total annual unit cost (excluding wholesale markup) 471.06 200.92

Total annual unit cost (including wholesale mark-up) 484.25 211.57

* real value (2015 prices)

** Transport costs are derived by multiplying network unit costs with the number of broadband related units divided by the total broadband capacity in 2017 (443Gbps)