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December 18, 2018

VIA ECFS

Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, DC 20554

REDACTED – FOR PUBLIC INSPECTION

Re: Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations; WT Docket No. 18-197

Dear Ms. Dortch:

Pursuant to Section 1.1206(b) of the Commission's Rules, 47 C.F.R. § 1.1206(b), notice is hereby provided of a written *ex parte* presentation in the above-referenced docket. Attached please find additional information regarding (a) the role of memory in T-Mobile's Network Build Model, (b) the congestion objective of the Network Build Model, and (c) documentary support for unit costs applied in the analysis reported in the Israel, Katz, and Keating declaration.[1]

This filing contains information that is "Highly Confidential" pursuant to the Protective Order filed in WT Docket No. 18-197.[2] Accordingly, pursuant to the procedures set forth in the Protective Order, a copy of the filing is being provided to the Secretary's Office. In addition, two copies of the Highly Confidential Filing are being delivered to Kathy Harris, Wireless Telecommunications Bureau.[3] A copy of the Redacted Highly Confidential Filing is being filed electronically through the Commission's Electronic Comment Filing System.

[1] Mark Israel, Michael Katz, and Bryan Keating, "Reply Declaration of Mark Israel, Michael Katz, and Bryan Keating," WT Docket No. 18-197 (Sept. 17, 2018).

[2] Applications of T-Mobile US, Inc., and Sprint Corporation for Consent to Assign Licenses, Protective Order, WT Docket No. 18-197 (June 15, 2018).

[3] For administrative efficiency, please note that the exhibits to the attached discussion on unit costs are being submitted on a disk containing other materials being submitted by T-Mobile today in the above-captioned proceeding.

Please direct any questions regarding the foregoing to the undersigned counsel for T-Mobile US, Inc.

Respectfully submitted,

DLA Piper LLP (US)

/s/ Nancy Victory

Nancy Victory
Partner

cc: David Lawrence
Kathy Harris
Linda Ray
Kate Matraves
Jim Bird
David Krech

Attachment A

ADDITIONAL INFORMATION REGARDING THE ROLE OF MEMORY IN THE NETWORK BUILD MODEL

The economic analysis reported in the Israel, Katz, and Keating declaration generates marginal cost predictions by applying dollar valuations to the incremental solutions identified by T-Mobile's Network Build Model.[1] This model is "memoryless" in that the baseline network in year *t* is not required to be equal to the baseline network in year *t*–1 plus the incremental builds from year *t*–1. This note explains that T-Mobile has found the memoryless model to be a reasonable and reliable means of predicting the network investment that it will have to make to serve the forecasted traffic level. It follows that the model is also a reasonable and reliable means of predicting how network costs vary with vary with traffic volume.

T-Mobile's Network Build Model takes as inputs a baseline network, a traffic forecast, and a set of solutions available to augment network capacity.[2] Given these inputs, the model identifies the incremental capacity solutions needed to supplement the baseline network in order to satisfy the network performance planning criteria at the forecasted traffic level. Following T-Mobile's ordinary course practice, the Network Build Model does not keep track of incremental builds that the model identified in previous years and does not require that the solutions of a given type in effect in year *t* include all of the solutions of that type that were implemented as of the end of year *t*–1.[3]

T-Mobile has found the memoryless model to be a reasonable and reliable means of predicting the network investment needed to satisfy future capacity needs. T-Mobile has based billions of

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1 Mark Israel, Michael Katz, and Bryan Keating, "Reply Declaration of Mark Israel, Michael Katz, and Bryan Keating," September 17, 2018, WT Docket No. 18-197 (hereinafter *IKK Declaration*), § III.A.2.

In performing this analysis, IKK conservatively used the plan-of-record networks for each year in the case of the standalone Sprint and T-Mobile networks and the 2021 network in each subsequent year for New T-Mobile. (Id., § III.A.1.)

2 *IKK Declaration,* § III.A.1.

3 Although there are instances where a given solution generated by the Network Build Model for year *t*–1 is not retained in year *t*, deployments in the baseline, plan-of-record networks never decrease from year to year. (Table 7 of Reply Declaration of Neville R. Ray, September 17, 2018, WT Docket No. 18-197.)

dollars of investment on output of the Network Build Model.[4] T-Mobile has found that the model provides accurate predictions of its actual network expenditures.[5]

Use of the Network Build Model in this way is equivalent to assuming when calculating marginal costs in year *t* that T-Mobile had perfect foresight in all preceding years leading up to year *t*. Although this assumption does not literally hold, it is a means of capturing forces that are not otherwise incorporated into the Network Build Model—namely, that T-Mobile has predictions regarding future network needs and investments that it takes into account when making current network investment decisions.

Lastly, while the model lacks memory, it does not double count the costs of incremental builds. It is widely agreed that mobile data traffic will continue to increase over time.[6] This fact means that, if the marginal unit of capital is not installed in the current period, then it will be necessary to install one more unit of capital in the next period (and all other periods for the remaining operating life of that equipment) than otherwise would have been the case. For this reason, the marginal cost is the increase in the net present value of capital expenditures associated with making the capital expenditure one period earlier.[7] Because marginal cost is based entirely on the incremental builds specifically needed to meet *the current-period traffic increase,* the costs of any given build are counted as marginal costs only once—that is, only in the period in which the initial capital outlay occurs.[8] There is no double counting.

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4 Reply Declaration of Neville R. Ray, WT Docket No. 18-197, September 17, 2018, ¶ 13 ("We have relied on the model to direct approximately $2B in annual expenditures for our network ($10B total in the past 5 years).").

5 See Table 1 of "Additional Information Regarding the Congestion Objective of the Network Build Model," December 17, 2018. See Attachment B.

6 *IKK Declaration,* § III.B.3.(c).

7 Both Sprint and T-Mobile similarly amortize capital expenditures to a monthly values. See, *e.g.*, TMUS-FCC-03510143 at TMUS-FCC-03510144 ("Amortized network cost per unit, used for various pricing, marketing and business case evaluations."), TMUS-FCC-00093887 at TMUS-FCC-00093888, and TMUS-FCC-00708893 at TMUS-FCC-00708902; SPR-FCC-08634678 and SPR-FCC-10534164.

8 *IKK Declaration,* § IV.A.2.

Attachment B

ADDITIONAL INFORMATION REGARDING THE CONGESTION OBJECTIVE OF THE NETWORK BUILD MODEL

The economic analysis reported in the Israel, Katz, and Keating declaration generates marginal cost predictions based on the results of the Network Build Model.[1] Although T-Mobile seeks to have no more than two percent of all sectors congested,[2] the Network Build Model attempts to solve to for zero-percent busy-hour congested sectors.[3] This note explains that calculating T-Mobile's and New T-Mobile's marginal costs based on the Network Build Model's zero-percent congestion target is fully consistent with T-Mobile's ultimate objective of having no more than two percent of sectors congested in practice. The reason is that network investment plans based on the solutions proposed by the Network Build Model run with a zero-percent target lead in practice to congestion levels closer to two percent.

T-Mobile's ordinary-course practice is to allocate network funding through a multi-stage process:[4]

- The first stage forecasts future traffic on the network.[5]
- The second stage determines the optimal capacity solutions (e.g., cell splits and spectrum overlays) based on the output of the Network Build Model.[6] The model seeks to identify solutions (or "builds") sufficient to have all sectors satisfy T-Mobile's congestion criteria

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1 Mark Israel, Michael Katz, and Bryan Keating, "Reply Declaration of Mark Israel, Michael Katz, and Bryan Keating," September 17, 2018, WT Docket No. 18-197 (hereinafter *IKK Declaration*).

2 Document 30 and Declaration of Neville R. Ray, WT Docket No. 18-197, June 18, 2018, ¶ 62. The numbered documents referenced throughout this submission were provided to the Commission along with the network engineering model.

3 *See* Reply Declaration of Neville R. Ray, WT Docket No. 18-197, September 17, 2018, ¶ 10 ("Our company goal is to fund and mitigate congestion in the network completely…").

4 Document 22 describes T-Mobile's ordinary-course planning process.

5 Document 6 describes T-Mobile's ordinary course demand forecast methodology.

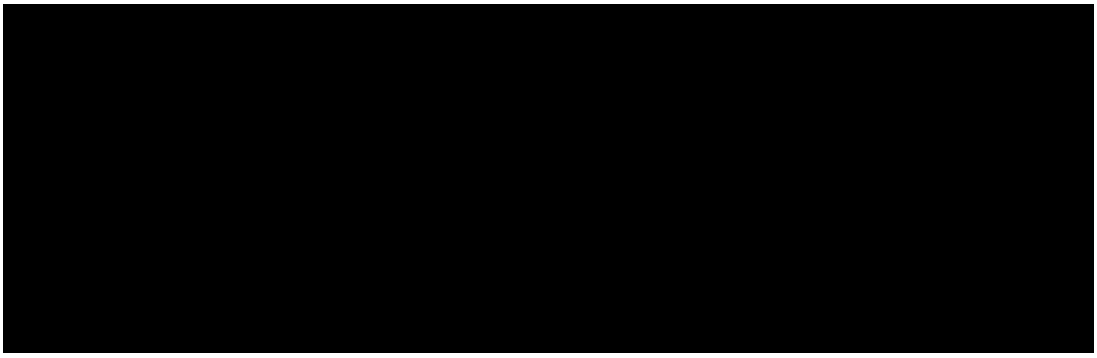
6 Document 21 describes the capacity solutions available to T-Mobile.

while serving the forecasted demand (i.e., to have zero percent of the sectors congested in the busy hour).[7, 8] These builds serve as the basis for the Network Capacity Plan (NCP).[9]

- In the third stage, local and regional teams assess the feasibility of implementing the solutions identified in the NCP and release a final implementation plan, called the Capacity Mitigation Plan (CMP), which becomes the plan of record.[10]

T-Mobile's ordinary-course documents indicate that the costs associated with its implementation plan (CMP) are consistently close to the budgeted amounts (NCP), exceeding them by only small amounts. (See Table 1 below.) The similarity of the costs in the actual implementation plan and the budgeted costs, derived from the Network Build Model, provides further validation of the accuracy of the costs used in the *IKK Declaration.*

Table 1: T-Mobile NCP and CMP Cost Estimates (2015-2018)



As explained by Document 30, the ultimate objective of the *overall* multi-stage process is to remain under a two-percent threshold because doing so "provides a robust balance between customer experience and maintaining a feasible solution deployment timeline within appropriate

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7 See TMUS-FCC-07785469 for the last pre-transaction ordinary course Network Build Model that predicted congestion and found a solution to relieve congestion on every congested sector.

8 The Network Build Model imposes caps on the number of certain types of solutions that can be implemented in a given year. In situations where these caps are binding, the Network Build Model predicts the a positive percentage of sectors will be congested even after implementation of the proposed solutions.

9 T-Mobile's most recent NCPs are contained in TMUS-FCC-00091380 (2015-2016 NCP), TMUS-FCC-00117379 (2017 NCP); and TMUS-FCC-07785471 (2018 NCP).

10 Document 22, pp. 2-3.

capital expense."[11] T-Mobile has found that churn begins to increase materially if more than two percent of sectors in a market are congested.[12]

The reason that T-Mobile uses a congestion target of zero percent when using the Network Build Model to identify necessary solutions is that using a zero-percent threshold in this stage of the planning process nevertheless leads to a positive percentage of sectors being congested in practice. T-Mobile has determined that a zero-percent threshold at the Network Build Model stage is an appropriate target for achieving the overall objective of having fewer than two percent of sectors actually be congested.[13]

Congestion is never totally eliminated for at least two reasons. First, traffic is stochastic. Uncertainties in forward-looking traffic forecasts mean that builds designed to achieve zero-percent congestion will result in less capacity than is necessary to solve the congestion in some locations and will result in more capacity than is necessary to solve congestion in other locations.[14] Because congestion cannot be less than zero percent, the inherent uncertainty in traffic forecasts along with the lead time necessary to augment network capacity means that actual realized congestion will be greater than zero percent at any specific time. Second, some planned builds may turn out to be infeasible or take time to implement.[15]

Illustrating the fact that utilizing a zero-percent congestion target in the Network Build Model does not, in fact, lead to zero congestion, T-Mobile's LTE congestion is currently approximately [redacted] even though the target in the Network Build Model is zero percent.[16] These data are consistent with T-Mobile's determination that setting a zero-percent threshold in the Network Build Model stage is an appropriate target for achieving the overall objective of having fewer than two percent of sectors actually be congested.

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11 Document 30, p. 1.

12 TMUS-FCC-07120092 at TMUS-FCC07120107; TMUS-FCC-02536140 at TMUS-FCC-02536154-155.

13 See TMUS-FCC-07108064 at TMUS-FCC-07108066-068 (noting that congestion would be zero if all plans can be implemented, but that the same "massive capacity deployment" plan is needed to keep congestion <2%); TMUS-FCC-07103524 at TMUS-FCC-07103542-543 (noting that having no more than two percent of sectors congested is the goal, but that that congestion "will reach zero if all plans can be implemented.").

14 TMUS-FCC-07120888 at TMUS-FCC-07120899 (showing that, although the Network Build Model is accurate overall, it forecasts congestion in some sectors where congestion does not occur and does not forecast congestion in other sectors where congestion does occur).

15 TMUS-FCC-07108064 at TMUS-FCC-07108068 (indicating that certain solutions such as cell splits take substantial time to implement). See also Reply Declaration of Neville R. Ray, WT Docket No. 18-197, September 17, 2018, ¶ 10 ("Our company goal is to fund and mitigate congestion in the network completely; however, absolute congestion avoidance is impractical due to issues with timely access to infrastructure, stochastic nature of traffic, and challenges with deploying congestion solutions.").

16 TMUS-FCC-06519841 at TMUS-FCC-06519842.

Attachment C

DOCUMENTARY SUPPORT FOR UNIT COSTS

The economic analysis reported in the Israel, Katz, and Keating Declaration ("IKK Declaration") generates marginal cost predictions by applying dollar valuations to the incremental solutions identified by T-Mobile's Network Build Model.[1] This note provides additional information regarding documents supporting the capital expenditures ("CapEx") and operating expenditures ("OpEx") cost per unit for each type of solution.

Two documents in the record provide comprehensive support for the unit costs of standalone Sprint incremental solutions:

- Document SPR-FCC-09372259 provides the basis for the CapEx; and
- Document SPR-FCC-11890138 provides the basis for the operating expenditures ("OpEx") associated with standalone Sprint incremental solutions.[2]

Exhibit 1 is a spreadsheet that Sprint prepared to show how the specific unit cost assumptions were derived from the above documents. The spreadsheet provides a mapping from the estimated values in these record documents to the dollar valuations of incremental solution costs that were provided for use in the IKK Declaration.

Exhibit 1 shows the solution options on the tab "Unit Cost Details with Links." For each solution, this table summarizes the (line item) components of CapEx and OpEx. And, for each of the individual components, the formula provides references to other tabs in the spreadsheet that have the underlying data and information.

T-Mobile has refined its estimates of unit costs of the incremental solutions for standalone T-Mobile and New T-Mobile. Specifically, T-Mobile has made the following adjustments to its unit costs

- T-Mobile has developed estimates of unit costs for a broader range of scenarios than those provided to IKK;
- T-Mobile has updated some of its cost estimates based on using the latest available data; and
- T-Mobile has corrected the costs for two items. First, the costs originally provided to IKK for the lowband overlay solution for both standalone T-Mobile and New T-Mobile were based on deployment of new equipment for 600 MHz spectrum. Second, the original estimate of the unit cost for the midband overlay solution for standalone T-

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1 Mark Israel, Michael Katz, and Bryan Keating, "Reply Declaration of Mark Israel, Michael Katz, and Bryan Keating," September 17, 2018, WT Docket No. 18-197 (hereinafter *IKK Declaration*).

2 SPR-FCC-11890138 at SPR-FCC-11890141.

The backhaul costs in this document reflect a blend across all backhaul solutions. Sprint assumed that the cost of leased backhaul would be [redacted].

Mobile also included the deployment of new equipment. In both cases, the solution in the Network Build Model does not require deployment of new equipment. Instead, it involves making use of existing equipment already on the site.

Exhibit 2 is a spreadsheet that T-Mobile prepared to show how the specific unit cost assumptions were derived from the underlying source data. In T-Mobile's documentation spreadsheet, the solutions are divided into two categories: the "Splits" tab contains unit costs for cell splits, sector adds, and small cells; and the "Overlays" tab contains unit costs for 5G upgrades and spectrum overlays. For each solution, the CapEx and OpEx are broken down into components, with the entries for each component being a formula that pulls data from other tabs that have the supporting details. In addition, the "~Source Index" tab identifies the database that is the source of the information on each cost component in the support detail tabs.

Table 1 and 2 below summarize the original and refined unit-cost figures for standalone T-Mobile and New T-Mobile, respectively.

Table 1: Original and Refined Unit Costs for Standalone T-Mobile

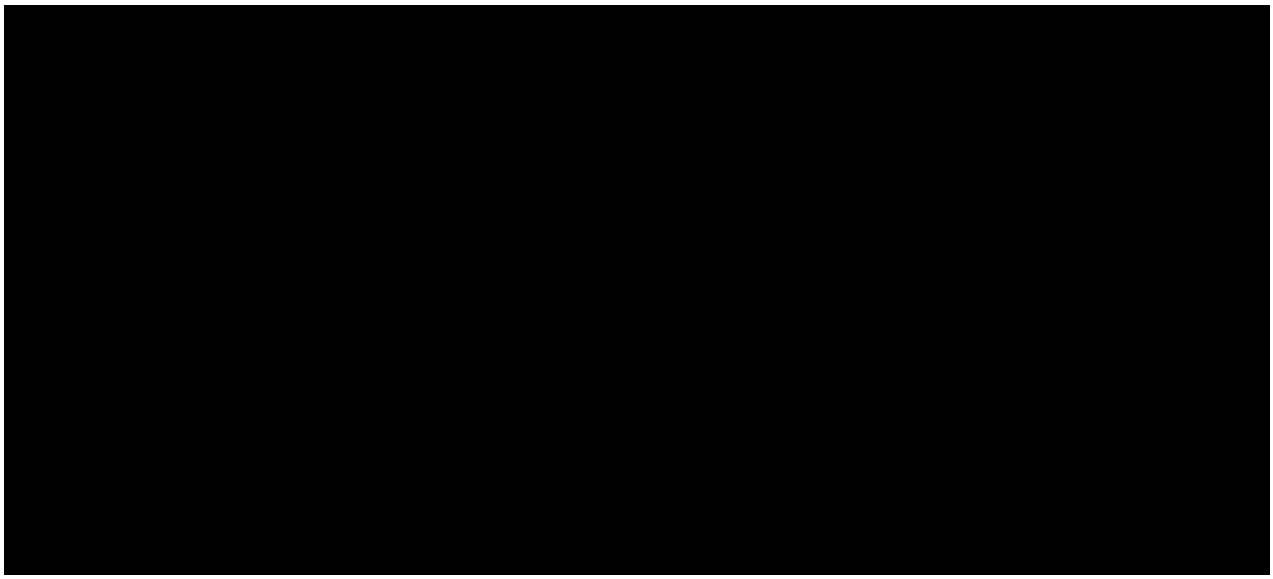

Table 2: Original and Refined Unit Costs for New T-Mobile