



January 27, 2020

**VIA ELECTRONIC FILING**

Ms. Marlene H. Dortch, Secretary  
Federal Communications Commission  
Office of the Secretary  
445 12th Street, SW  
Washington, DC 20554

Re: ***Expanding Flexible Use of the 3.7 to 4.2 GHz Band***, GN Docket No. 18-122

Dear Ms. Dortch:

The CBA attaches two separate analyses from NERA and Evercore, nationally respected economic and financial advisory firms, which value 280 MHz of C-band spectrum at \$43 billion to \$77 billion.<sup>1</sup> While the precise value of the spectrum will not be known until a C-band auction is held, the included analysis demonstrates in ways that are analytically rigorous, logical and thoughtful, that such numbers are no exaggeration. The potential significant value of this spectrum must not overshadow the fundamental principle of fairness to its incumbent users. The point is a simple one: if the government determines it to be in the public interest to push out incumbent users who for decades have built their businesses around this spectrum, then fairness and the law dictate these important rights-holders should receive fair value for their efforts in expediting the clearing of this spectrum and making it available far more quickly than would otherwise be possible.

The satellite operators comprising the CBA have been using C-band spectrum for 40 years. The United States has licensed or provided market access rights to the CBA operators to use the spectrum and orbital locations for the benefit of the 120 million American households who receive movies, TV broadcasts and other content from leading companies such as Discovery, Disney, Fox, NBCUniversal, QVC, ViacomCBS, WarnerMedia and others. The Commission allocated the spectrum for the use of fixed satellite services, and the rights are renewed every 15 years with an expectation of renewal in perpetuity. Based on this licensing scheme and over the last 40 years, the CBA companies built their businesses and made long-term contractual commitments to the content companies using their services. In so doing, the CBA member companies have invested more than \$50 billion<sup>2</sup> in designing, manufacturing and launching more than 230 U.S.-made satellites and generating tens of thousands of high-paying jobs.

The government appears poised to determine there is a better use for this spectrum -- to provide access for the deployment of 5G mobile services. Over the last two years, the CBA has greatly assisted the government in determining how to make this transition work. Substantially all of the planning is done, and we are ready to execute. However, we simply do not have the

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<sup>1</sup> See Attachments A and B.

<sup>2</sup> Amount expressed in estimated 2019 dollars.

flexibility to proceed unless we are offered the opportunity to share fairly and appropriately in the value being created through our tremendous past and future efforts. We continue to believe such sharing is most easily expressed through a formula directly tied to the actual realized proceeds of any C-band auction.

As the C-Band Alliance demonstrated in its January 16 filing, the Commission has the authority (i) to determine in advance of the auction that accelerated clearing payments would serve the public interest, (ii) to determine the amounts of those clearing payments, and (iii) to require that winning bidders make such payments to the incumbents in order to properly incentivize early clearing of the spectrum.<sup>3</sup> Because these payments would be made to incumbent licensees in order to remove, in an expedited fashion, existing encumbrances on the licenses being auctioned, clearing payments of this kind are not “auction proceeds” and cannot run afoul of either Section 309(j) or the Miscellaneous Receipts Act.<sup>4</sup>

If the FCC did *not* require accelerated clearing payments but instead relied on private negotiations following the auction, any amounts generated in the auction for the benefit of the Treasury would in all likelihood be modest. Bidders would have no certainty about what additional amounts they might have to agree to pay, post-auction, in order to secure accelerated clearing, and when such clearing may be finally achieved.<sup>5</sup>

Conversely, if the FCC *did* require fair and appropriate accelerated clearing payments, the C-band auction should generate proceeds well above what it could expect to receive without such payments. Such payments do *not* result in a redirection of proceeds from an auction, otherwise destined for the Treasury. Rather, this arrangement *creates* the opportunity for the Treasury to generate tens of billions of dollars in revenue for the government.

There can be no principled debate that the value of acceleration provided by the incumbents is closely linked to the value of the spectrum that they will be vacating.<sup>6</sup> For example, under a purely voluntary, post-auction negotiation of the kind often used in *Emerging Technologies*, highly-valued spectrum will result in an accelerated clearing price that is higher than such price for lower-valued spectrum.

Critically, there is no legal barrier to the Commission recognizing this economic reality. There is no FCC or court precedent that suggests the Commission is limited to imposing only a specific, pre-calculated amount for accelerated clearing. Opponents may argue that increasing the amount of acceleration payments as the auction value increases makes these acceleration payments *seem* more like “auction proceeds” or a “diversion from the Treasury,” but that does not make it so. Neither is true. If the FCC has the authority to require auction winners to make

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<sup>3</sup> Letter from Bill Tolpegin, Chief Executive Officer, C-Band Alliance, to Marlene Dortch, Secretary, FCC, GN Docket No. 18-22, at 9-11 (Jan. 16, 2020).

<sup>4</sup> *Id.* at 9.

<sup>5</sup> *Id.* at 10.

<sup>6</sup> Coleman Bazelon & Paroma Sanyal, Value Creation from an Accelerated Clearing of the C-Band Spectrum, The Brattle Group (Jan 16, 2020) (filed as Exhibit A to the Tolpegin Letter, *supra* n.3). The economic analysis by the Brattle Group shows that even using conservative assumptions, the value of acceleration tracks the value of the spectrum being auctioned at a linear, 1:1 rate.



acceleration payments (as it does), these payments are not transformed into “auction proceeds” if they simply reflect that higher auction values naturally result in higher fair and appropriate acceleration payments.

Indeed, by adopting a variable payment, the agency would be approximating the outcome of using the traditional, well-settled *Emerging Technologies* framework.<sup>7</sup> While the CBA believes a variable payment would best ensure the adoption of a fair accelerated clearing payment regardless of the ultimate value of the licenses at auction, it remains open to a pre-calculated target number so long as it reflects fair value for the cleared spectrum and fair relative value between the spectrum and accelerated clearing.

Please contact the undersigned with any questions regarding this letter.

Respectfully submitted,

\_\_\_\_\_/s/  
Bill Tolpegin  
Chief Executive Officer  
C-Band Alliance

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<sup>7</sup> Some may suggest that once the Commission identifies a specific accelerated clearing amount that it believes would cause the incumbents to clear more quickly, any increase in that amount as auction values climb would naturally cause bidders to reduce their ongoing bids by a commensurate amount, thereby reducing auction proceeds. But this ignores the economic principle, noted above, that the value of accelerated clearing to the new licensee increases as the value of the spectrum increases. In addition, an incumbent that might be motivated to clear for a particular accelerated payment amount assuming one auction result may well *not* be motivated to do so if that same amount turns out to be a substantially smaller percentage of a much higher auction result. A fair accelerated clearing amount must take these realities into account, or it risks jeopardizing the outcome of the auction and actually reducing the bid amounts.

**Attachment A**



# THE VALUE OF THE C-BAND IN THE U.S.

An analysis of international prices

JANUARY 2020

Prepared by NERA Economic Consulting for the C-Band Alliance

Dr. Hector Lopez

# International Auction Prices

- International auction prices are a source of hard-data that can be used to estimate the value of the C-Band in the U.S. However, international prices must be adjusted to reflect differences in license and industry conditions between other countries and the U.S.
- We adjust for license conditions by adjusting for differences in payments structures, annual fees, license duration, and year of award.<sup>1</sup>
- We further adjust for industry conditions using two methodologies:
  - **PPP**: Purchasing Power Parity exchange rates
    - PPP exchange rates capture general differences in price levels between countries. PPP exchange rates are more relevant than nominal exchange rates in this case because wireless services and spectrum licenses are not internationally tradable goods.
  - **Spectrum**: The historical ratio of U.S. auction prices to foreign prices for equivalent spectrum
    - This measure relies exclusively on auction data and works as a spectrum-exchange rate that may capture differences in the competitive environment not realized in a PPP only comparison.
- The analysis of international awards implies that the value of the C-Band in the U.S. is between **\$43 - \$77 billion**.<sup>2</sup>

## Notes:

1. See the appendix for a full description of the adjustment methodology.

2. Assumes 280 MHz of spectrum and a total population of 307 million (Census 2010) in PEAS 1 – 411, excluding Alaska and Hawaii.

# The Value of the C-Band

An analysis of international awards implies the value of the C-Band is between **\$0.50 - \$0.90 MHz-Pop**; a total value of **\$43 - \$77 billion** for 280 MHz for the continental U.S.

Actual auction proceeds will depend on the competitive dynamics in the U.S. in the auction, and auction design elements such as the reserve price.

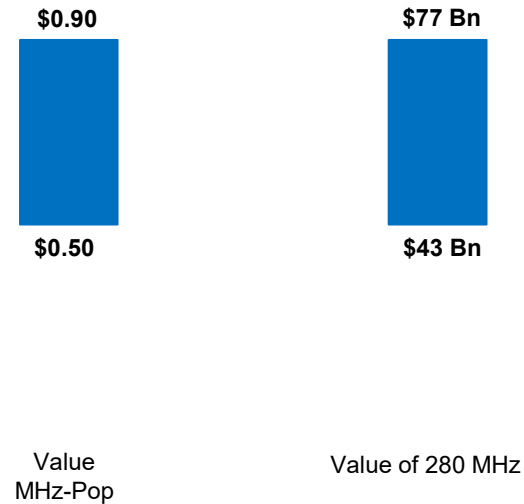
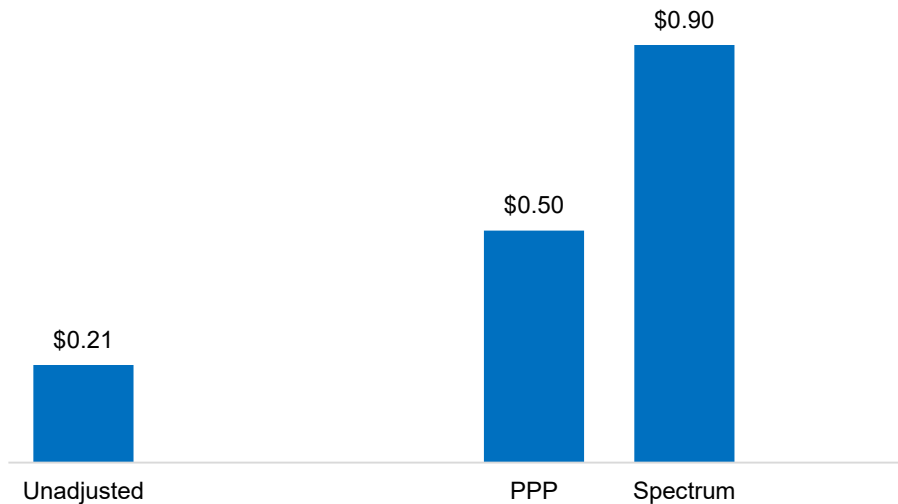
## Unadjusted Price<sup>1</sup>

## Adjusted Prices<sup>2</sup>

Adjustments address differences in price levels, profitability of the wireless industry, and license duration.

## Estimate of the Minimum Value in the U.S.

In each award, bidders competed until necessary to close the auction. This implies that their value for the C-Band was at least the price paid.



### Notes:

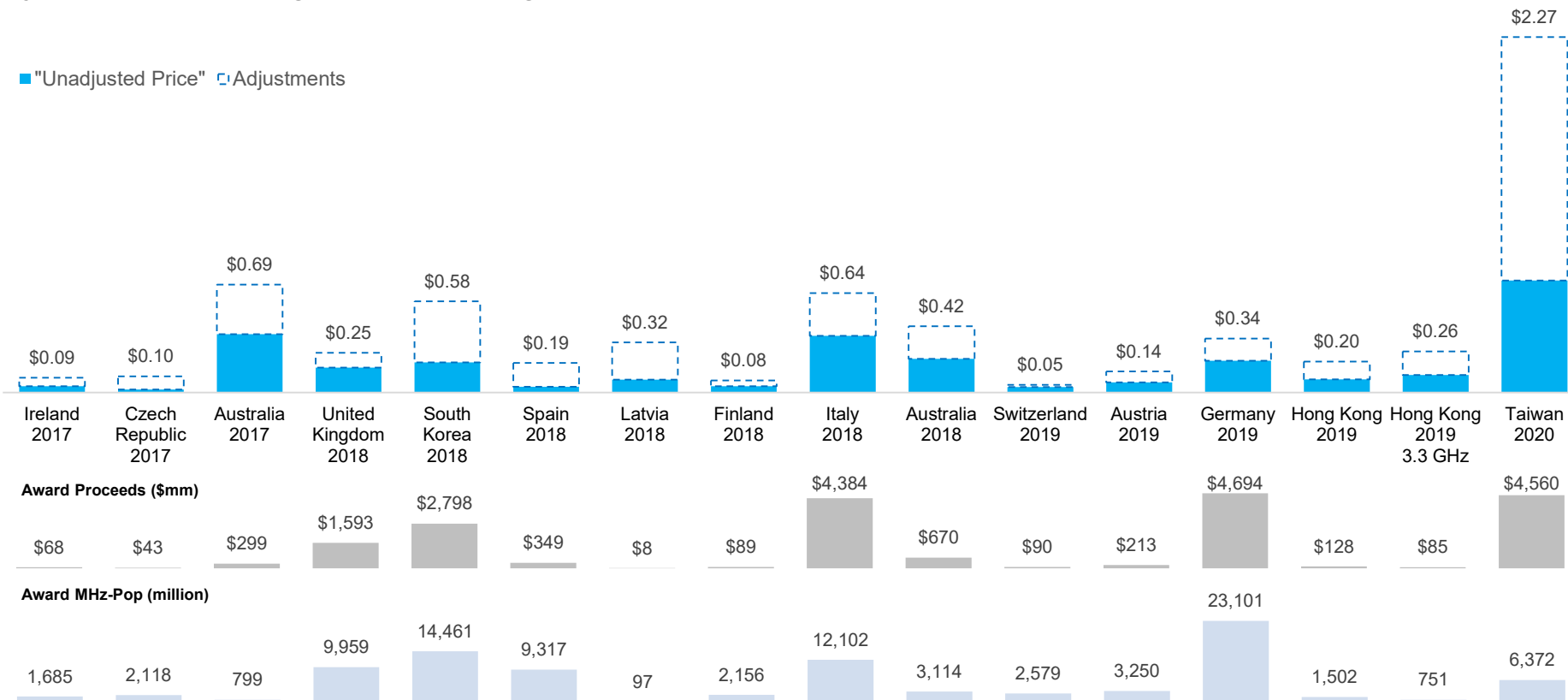
- Unadjusted Price:** MHz-Pop weighted average price of international C-Band awards using the nominal exchange rate.
- Adjustments.** MHz-Pop weighted average price of unadjusted prices adjusted for licenses differences such as payment structures, upfront fees, annual fees, timing of award, license duration, spectrum usability, and one of the following 'price-level' adjustments:
  - PPP:** Purchasing power parity
  - Spectrum:** Ratio of observed spectrum prices (nominal exchange rate) between foreign country and the U.S. for equivalent bands.

### Notes:

Assumes 280 MHz of spectrum and a total population of 307 million (Census 2010) in PEAS 1 – 411, excluding Alaska and Hawaii.

# International C-Band

There have been 16 international auctions of C-band spectrum for 5G use to date. The MHz-Pop weighted average unadjusted price is **\$0.21 MHz-Pop** and the MHz-Pop weighted average adjusted price using PPP exchange rates is **\$0.50 MHz-Pop**.



**Notes:**

Headline prices adjusted for licenses differences such as payment structures, upfront fees, annual fees, timing of award, license duration, spectrum usability, and PPP exchange rates.

We only include awards since Ireland, which marks the start of the 5G auction era.

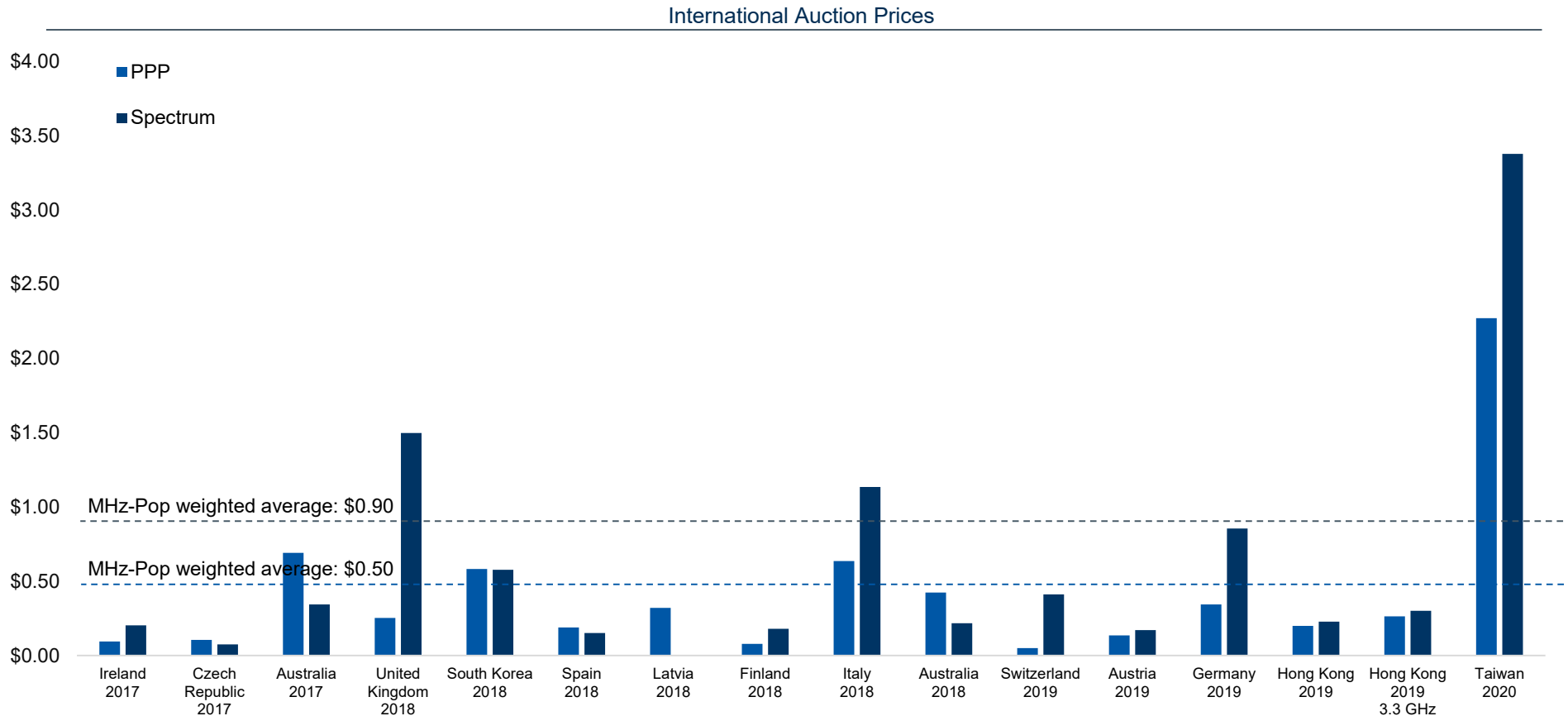
Australia (2017) value is based on a 32.5 MHz block covering Brisbane only (3<sup>rd</sup> largest city) purchased by Telstra. There were other 3.4 GHz lots available in the auction, but they included only a small amount of spectrum that could not be aggregated (2.5 to 4.5 MHz).

Germany (2019) benchmark excludes lot 01k 3.6 GHz because this lot is lower value owing to incumbent military use.



# Adjustments to International Prices

We also address differences in the wireless industries and spectrum awards by using the results of previous spectrum auctions. The fact that the Spectrum benchmark is higher than the PPP benchmark indicates that spectrum in the U.S. is typically sold for a premium over its PPP-adjusted international price.



**Notes:**

PPP: C-band Price in Foreign Country adjusted for license conditions \* PPP exchange rate.

Spectrum: Price of Band in the U.S. / Price of Band in Foreign Country \* C-band Price in Foreign Country. Average for the 700 MHz, 600 MHz, and AWS-3 bands.

# Benchmarking Methodology

# Overview of our approach

## NERA implements various adjustments to spectrum price benchmarks to facilitate like-for-like comparison across licences, awards and countries

- The standard unit for comparing prices of spectrum is price / MHz - Pop
  - i.e. licence price divided by the amount of spectrum in MHz divided by the licence area population
- In this annex, we provide information about:
  - Our standard data sources and methodology
  - The adjustments we make to benchmarks to facilitate like-for-like comparison
- As applicable, we make some or all of the following adjustments:
  1. Currency
    - We translate all prices into a common currency using either actual exchange rates or purchasing power parity exchange rates
  2. Payment structure for upfront fees
    - If some or all fees are deferred, we discount future payments using a standard WACC
  3. Annual Fees
    - If there are significant annual fees associated with a licence, we calculate the current value of future fees using a standard WACC
  4. Licence duration adjustment
    - Some licences are longer or shorter than others, so we adjust the value to reflect a common duration
  5. Timing of award
    - If benchmark awards are spread out over a long period, we may also use inflation data to adjust prices to a common reference year
  6. Excluded spectrum
    - In some awards, we exclude the “set-aside” or “reserved” blocks that sell at a significant discount (typically at or close to reserve price)

# Data sources and methodology

Input	Description
Financial Market Exchange Rates	We use annual average official exchange rates as reported by the World Bank.* <i>If the World Bank has not reported an exchange rate for a given year, we use the spot rate at the time of the auction from xe.com.</i>
Population	We use World Bank Population Estimates and Projections for all data points.** This may be different from country reported censuses or regulator reported population. Some regulators release population statistics at the time of the award, while others do not have the data (e.g. the FCC uses data from the 2010 census for PEA population estimates). To have one, consistent data source with one methodology, we use the World Bank dataset. As we report in \$/MHz-Pop, small differences in the population used often result in differences in benchmark results reported by different parties.
Regional licences (calculating relevant MHz amount)	<p>Where there are regional licence awards, we weight the MHz awarded to a nationwide equivalent. The benchmark MHz is equal to:</p> $MHz_{benchmark} = MHz_{licence} * \frac{population\ covered\ by\ licence}{country\ population}$ <p>This methodology is equivalent to the “total MHz-Pops” statistic commonly used in the United States.</p>
Inflation	<p>We adjust for inflation, where relevant to 2019 dollars using Bureau of Labor Statistics data (BLS). The adjustment is equal to:</p> $Inflation\ Adj = \frac{CPI_{2019}}{CPI_{award\ year}}$ <p>The BLS reports a historical CPI index such that prices in 1982-1984 is equal to 100 (CPI-U). For all years the annual averages except for 2019 (as the year has not completed and we use 2018 average).</p>

Note, for US C-band spectrum, the regional licence adjustment is used for Australia (2017).

\*Source: <https://data.worldbank.org/indicator/PA.NUS.FCRF>

\*\*Source: <https://datacatalog.worldbank.org/dataset/population-estimates-and-projections> (Updated 25 April 2019)

\*\*\*Source: <https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-201905.pdf>

# Nominal Exchange rate vs. PPP adjustments

- We provide benchmarks using both nominal exchange rates and Purchasing Power Parity (PPP) rates
- PPP benchmarks better facilitate comparisons of real costs for operators in countries with very different price levels
  - A popular example of PPP differences is the *Economist's* “Big Mac Index”, which highlights the significant difference between MacDonald’s Big Mac prices between countries (even after adjusting for market financial exchange rates)
  - In the Telecommunications industry, PPP differences often partially explain differences in ARPUs (e.g. T-Mobile USA’s ARPU is ~\$44<sup>1</sup> vs average ARPUs for Italian operators of \$13-16\*
- If the benchmark price of a licence increases after the PPP adjustment, this indicates that the benchmark country’s currency is relatively **more valuable** in that country (e.g. Italy):
  - This means that a consumer can purchase relatively more “goods and services” for the “same” amount of currency (adjusted by financial market rates)
  - Put another way, when a consumer pays \$30 dollars for mobile service in the United States, this is relatively **less “costly”** (from the point of view of opportunity cost or other goods they could have purchased) than a consumer paying the Euro equivalent of \$30 dollars in Italy.
  - The converse is true if the benchmark price decreases after the PPP adjustment
- We use the International Monetary Fund’s Implied PPP Index in our analysis (Accessed 23 April 2019)
  - The Implied PPP Index indexes all Local Currency Units (LCU, e.g. Euro in Italy) to the United States Dollar
  - The dataset can be found [here](#)
- A more detailed description of how the PPP conversion is calculated can be found on the International Comparison Program’s website [here](#)
- We believe PPP exchange rates are more relevant than nominal exchange rates when comparing spectrum prices in different counties with different price levels.

\*TeleGeography Blended ARPU, September 2018. There are **many** differences between both mobile operator costs (geography, population density, demographics, electricity) and market structure (number of MNOs, aggressive new entrants, ect.) between countries. These all affect ARPUs in a given country. There is no perfect way to adjust for all of these factors, and any such adjustment would be controversial. Some market analysts adjust for ARPU, while others use PPP adjustments such as ours. We deliberately report both financial market exchange rates as well as PPP rates for this reason, as the difference between adjustment methodologies can be significant.

<sup>1</sup> Telegeography Global Comms Database for September 2018 (Accessed 2 December 2019)

# Upfront Fees

- Upfront fees are typically the main, sometimes, sole component of licence cost
- Typically, upfront fees (or “headline price”) are paid within months of a spectrum award being completed, in which case we benchmark them with no adjustment
- In some countries, licensees are allowed to defer payment over a number of years
  - This is a de facto price discount
  - To account for this, we discount the value of deferred payments to identify the equivalent value had all fees been due upfront
- An example is Italy’s 2018 3.6 GHz auction\*
  - Compared headline revenues were EUR 4,346,820,000 for 200 MHz spectrum
  - The payment structure is as follows:
    - 2018: EUR 1,250,000,000
    - 2019: EUR 50,000,000
    - 2020: EUR 300,000,000
    - 2021: EUR 150,000,000
    - 2022: EUR 2,596,820,000 (the remainder of the auction fees)
  - Using a 8% rate (see WACC slide), this is equivalent to **EUR 3,581,313,001**

\*Article 1045, of the law 27 December 2017, n. 205 stipulated that if the total of the 3.6 GHz band exceeded EUR 1.25bn then the remaining fees would be paid over a tiered fee structure.

# Annual Fees

- If there are significant annual fees attached to a licence, we include their value in our price benchmark
- Often, other commentators report benchmarks excluding annual fees but this is misleading
  - Annual fees may be substantial component of the price
  - For example, annual fees accounted for 62% of the total price paid for a spectrum licence in the 2018 3.6 GHz Spanish auction (discounted at an 8% rate)
- We discount the value of annual fees over the duration of the licence to identify the equivalent value had all fees been due upfront, and add this to the upfront fee
  - For the simple case of a uniform annual fee paid yearly starting in year 0 (i.e. at the time of award), we use the formula set out below
  - For more complex payment structure, we adapt the formula
  - We do not account for adjustments for inflation as in the case in Ireland. In Ireland, the annual Spectrum Usage Fee (“SUF”) is adjusted yearly with Irish CPI.
- There are constraints on our ability to include annual fees in benchmarks
  - Annual fees may change over time; unless we have other information, our default approach is to assume that fees remain constant over time based on the amount at the time of the award
  - We **do not** include annual fees that are tied to revenue, number of base stations, or the number of subscribers, as
    - They are difficult to estimate (number of subscribers and revenue change, number of base stations is typically not public)
    - They may more properly be interpreted as a broader tax on the industry rather than a payment related to spectrum

$$Discounted\ AF = AF_0 * \sum_{i=0}^{y-1} \frac{1}{(1+d)^i}$$

- *Discounted AF* is the total that is added to upfront fees (or “headline” price)
- $AF_0$  is the annual fee paid in year 0
- $y$  is the duration of the licence
- $d$  is the discount rate used (see WACC slide)

# Weighted Average Cost of Capital (used for discounting)

- For consistency, we use the same WACC across all countries
  - We use 8% as a global estimate in our benchmarks to facilitate comparisons across all countries in the dataset
  - This is approximately equal to the average WACC for European mobile operators\*
  - This is a simplification; in practice, WACCs vary significantly between countries as well as between operators within countries

## WACC Formula

$$WACC_{post-tax} = r_e \frac{E}{V} + r_d \frac{D(1 - t_c)}{V}$$

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

- $r_e$  = return on equity (cost of equity)
- $r_d$  = return on debt (cost of debt)
- $D$  = market value of debt
- $V$  = market value of Firm (D+E)
- $t_c$  = marginal corporate tax rate

\*A 2017 study from the Body of European Regulators for Electronic Communications (BEREC) estimating WACC for EU member states. You will notice that there is a wide range of estimated pre-tax WACC rates across member countries, but the mean rate is 7.98% and the median is 7.89%. Available at: [https://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/reports/7316-berec-report-regulatory-accounting-in-practice-2017](https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/7316-berec-report-regulatory-accounting-in-practice-2017)



## Licence Duration Adjustment

- Licence durations vary widely across countries and this can have a significant impact on spectrum prices
- For example:
  - Australia usually uses 15 year licences, but the recent 3.6 GHz licences only run for approximately 11 years; they will likely be reclaimed and reauctioned on expiry, so duration is 11 years
  - UK: the initial licence term of 3.4 GHz licences is 20 years, but are subject to automatic extension unless revoked with 5 years notice; as new [annual] fees based on market value apply for any extension after the initial term, we assume that a UK licence is 20 years
  - USA: licences are typically only 10-12 years but are usually automatically renewed at low cost\* provided licence obligation are met; we assume these licences are perpetual
- Most international benchmarks are for licences with a defined duration of 10-20 years
- When benchmarking prices for the US market, we adjust upwards prices for other countries with fixed term licences to match the strong renewal expectation of U.S. licenses.
- The adjustment treats the spectrum licence as a yearly stream of cash flows that extends in perpetuity (similar to a Terminal Value calculation in a Discounted Cashflow model)

$$\text{Perpetuity price} = \frac{\text{Price}_y \text{ years}}{1 - \left(\frac{1+i}{1+d}\right)^y}$$

- $i$  is the expected rate of inflation (2%)
- $y$  is the duration of the fixed term of license
- $d$  is the discount rate used (see WACC slide)

\*Note that the “renewal fee” for US licences is purely administrative and insignificant. We do not include/adjust for this small renewal fee.

## Excluded spectrum

- In some auctions, some spectrum blocks are set-aside for new or small operators, may include onerous coverage obligations, or may include discounts, or generally include special conditions that deviate from the conditions typically observed in U.S. licenses.
- Sometimes, these policy-oriented special conditions ***lead to a very large differences between the prices of spectrum blocks with and without these special conditions.***
- In these cases, if we deemed spectrum blocks as non-comparable to U.S. licenses, we excluded them from the benchmarks.
- Inherently, there is some subjectivity to this selection. We give two examples from NERA's database below:

### Canada 600 MHz (2019)

- ISED, the Canadian regulator, excluded the three, nationwide mobile operators from bidding for 30 of the available 70 MHz of spectrum
- To compete for the “set-aside” spectrum, an operator had to be non-national and have facilities based services in the specific region
- The set-aside limited competition for approximately 43% of the available spectrum
- The prices paid varied significantly between the two winning nationwide mobile operators and all other winning bidders
  - Nationwide operators: **C\$1.89 MHz/pop**
  - Non-nationwide operators: **C\$0.81 MHz/pop**
- For our benchmark, we use only the spectrum purchased by nationwide operators as it is a better estimate of true market value

### Denmark 1800 MHz (2016)

- DEA, the Danish regulator, re-awarded 2x65 MHz to incumbent mobile operators in 2016
- As part of the auction design, the mobile operators were required to provide service to 3 separate “Coverage Areas” that comprised of areas with limited mobile service in Denmark
- In a stage prior to the main auction, operators were offered 2x10 MHz **at the reserve price** if they agreed to serve 1 of these Coverage areas
- All three mobile operators accepted the spectrum at reserve in exchange for the coverage obligation
- The remainder of the spectrum sold for **5x** the reserve price
- Including all spectrum available in the award would **underestimate** the market value of the spectrum in Denmark
- For our benchmark, we only include the spectrum that was awarded after competition between mobile operators

## QUALIFICATIONS, ASSUMPTIONS AND LIMITING CONDITIONS

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**NERA**

ECONOMIC CONSULTING

**Attachment B**

# C-Band Valuation Benchmarking Analysis

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January 2020

EVERCORE

*with the assistance of*  
**NERA**  
Economic Consulting

# Disclaimer

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These materials have been prepared by Evercore Group L.L.C. (“Evercore”) with the assistance of NERA Economic Consulting, Inc. (“NERA”) for the C-Band Alliance (the “CBA”) to whom such materials are directly addressed and delivered and may not be used or relied upon by any other person or entity or for any purpose other than as specifically contemplated. These materials are based on information provided by or on behalf of the CBA and/or other potential transaction participants, from public sources or otherwise reviewed by Evercore. Evercore assumes no responsibility for independent investigation or verification of such information and has relied on such information being complete and accurate in all material respects. To the extent such information includes estimates and forecasts of future financial performance prepared by or reviewed with the CBA and/or other potential transaction participants or obtained from public sources, Evercore has assumed that such estimates and forecasts have been reasonably prepared on bases reflecting the best currently available estimates and judgments of such management (or, with respect to estimates and forecasts obtained from public sources, represent reasonable estimates). No representation or warranty, express or implied, is made as to the accuracy or completeness of such information and nothing contained herein is, or shall be relied upon as, a representation, whether as to the past, the present or the future. These materials were designed for use by specific persons familiar with the business and affairs of the CBA. These materials are not intended to provide the sole basis for evaluating, and should not be considered a recommendation with respect to, any transaction or other matter. These materials have been developed by and are proprietary to Evercore and were prepared exclusively for the benefit and internal use of the CBA. Evercore disclaims any and all liability for any loss or damage (whether foreseeable or not) suffered or incurred by any other person or entity as a result of anything contained or omitted from these materials and such liability is expressly disclaimed.

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# Summary of International C-Band Benchmarks

Illustrative U.S. C-Band Proceeds (\$ Bn)<sup>1</sup>

\$35.6

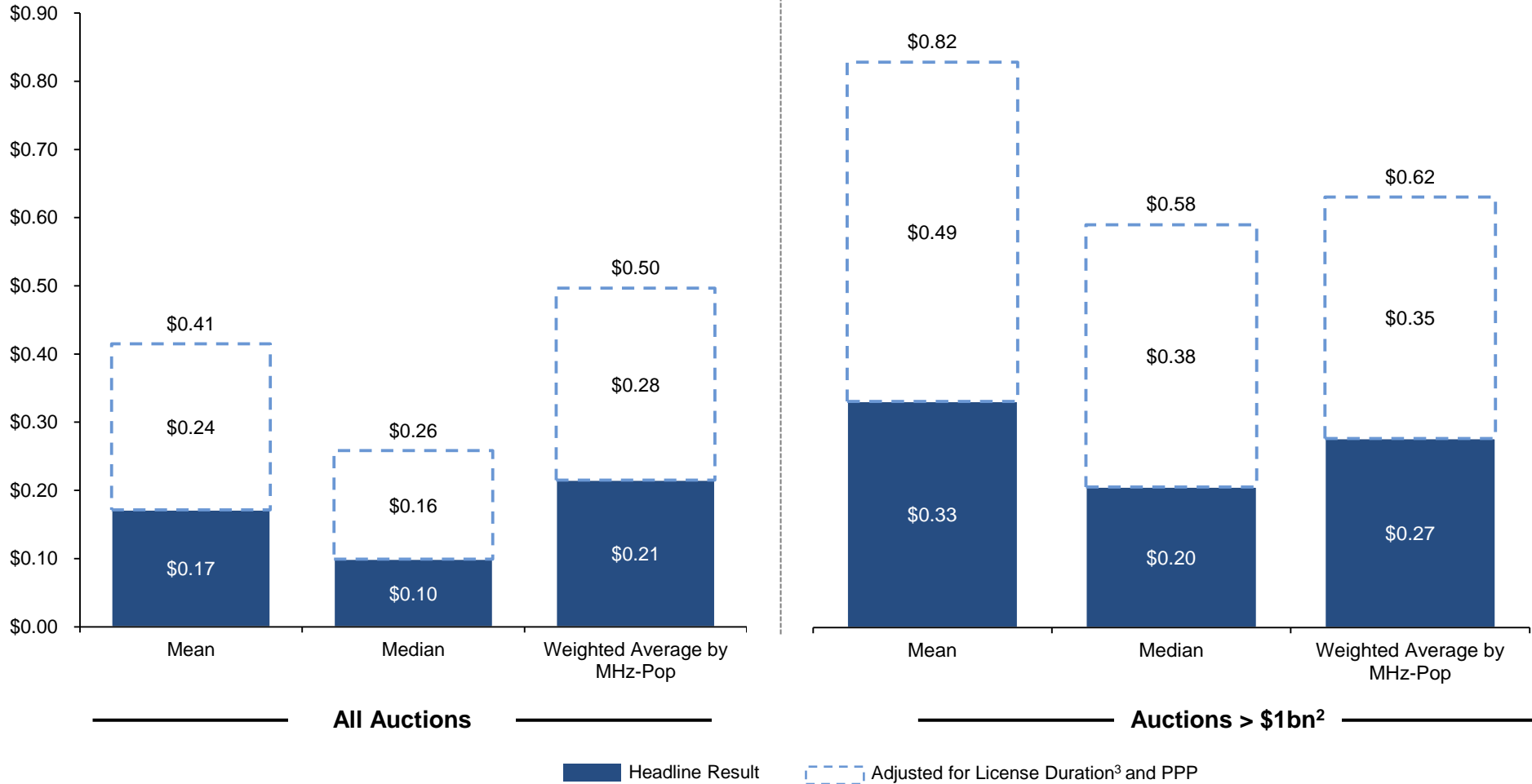
\$22.2

\$42.6

\$70.2

\$50.0

\$53.4



Source: NERA Economic Consulting

1. Applies international C-Band adjusted valuation benchmark to U.S. C-Band MHz-Pops of 85.9bn

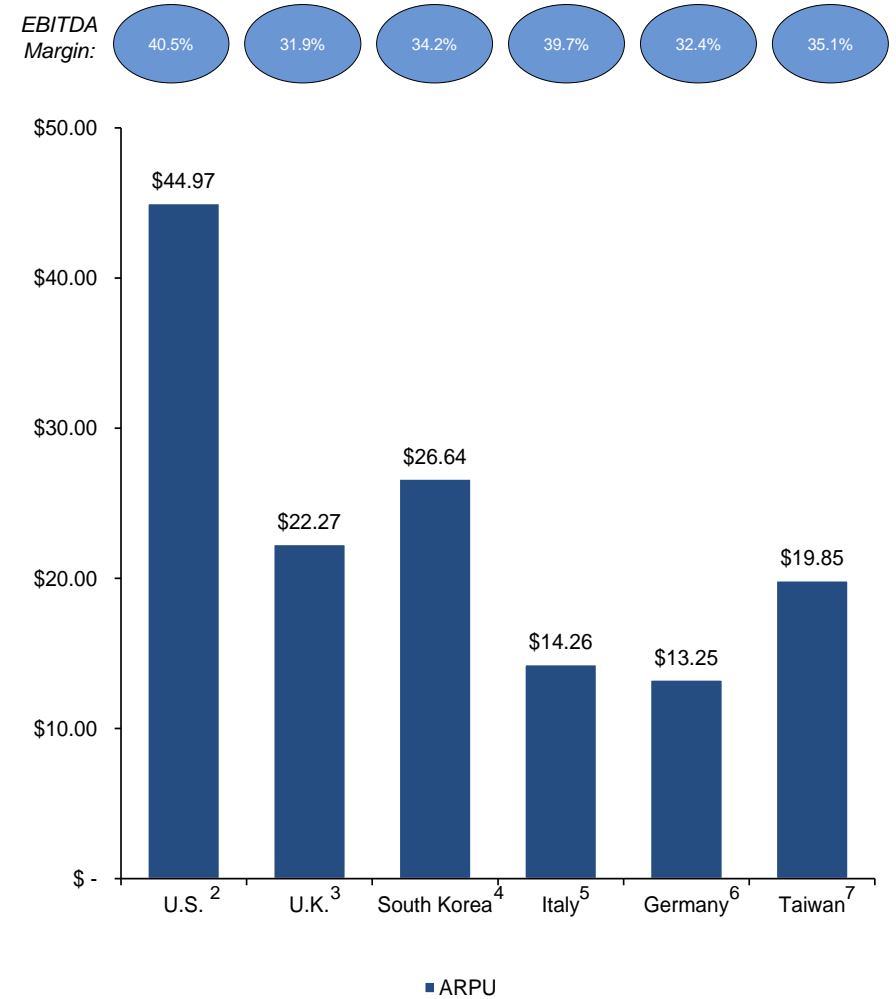
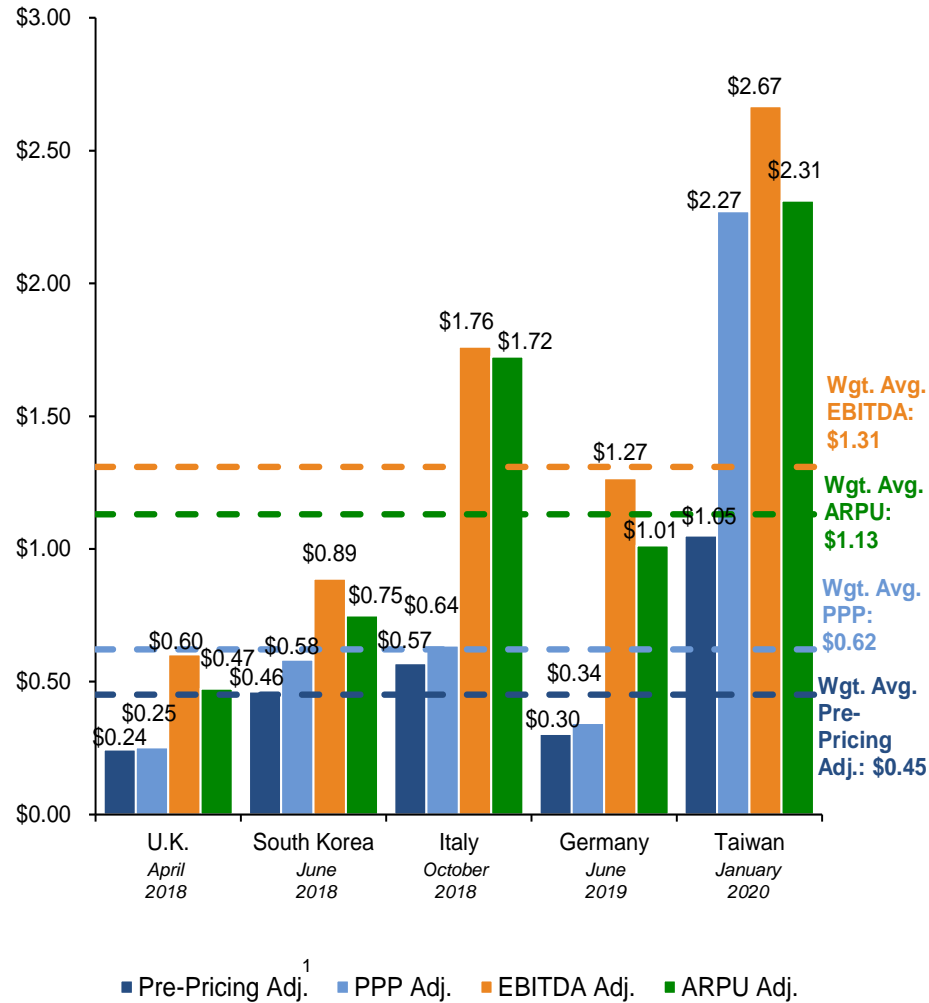
2. Includes the following auctions: U.K. (April 2018), S. Korea (June 2018), Italy (October 2018), Germany (April 2019) and Taiwan (January 2020)

3. Also adjusted for items such as payment structure and upfront fees, annual fees, timing of award and excluded spectrum



# Selected Large C-Band Auction Precedents

## Reference Data for ARPU and EBITDA Adjustments



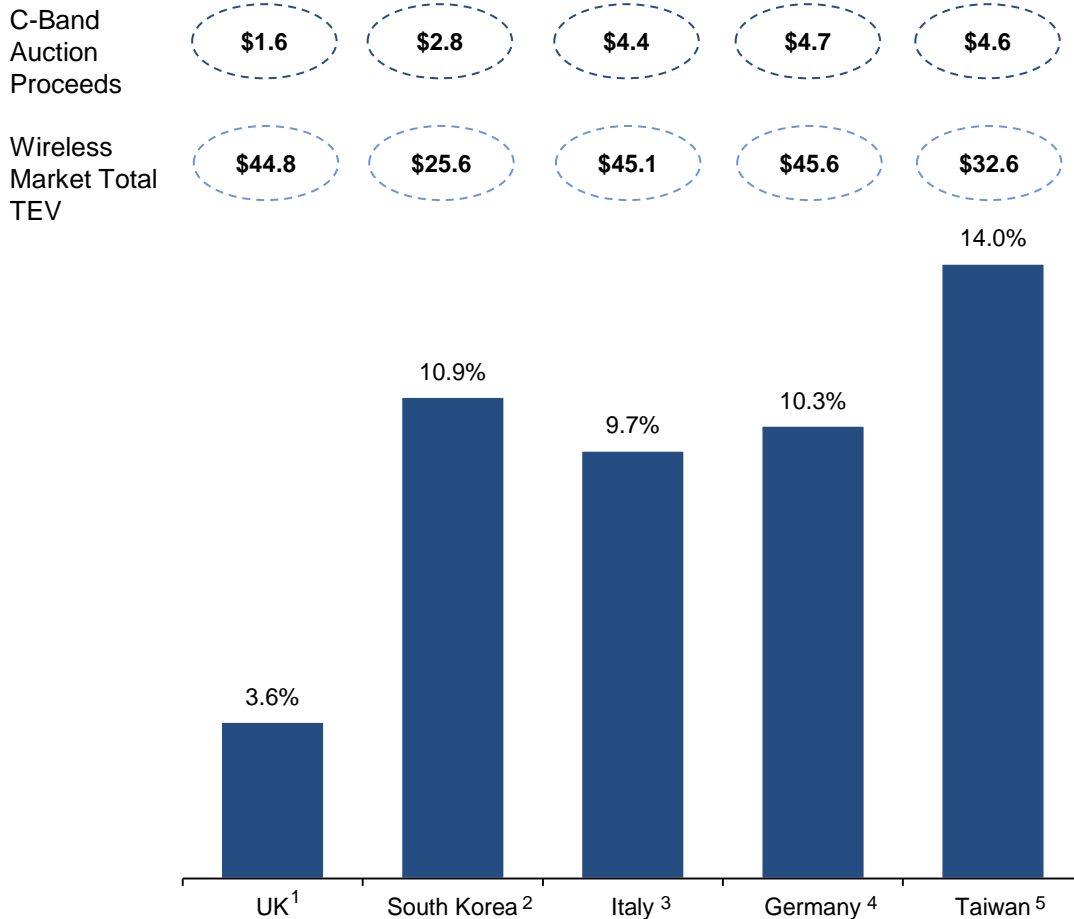
Source: NERA Economic Consulting, Company filings, Wall Street research

Note: Averages weighted by MHz-Pops of relevant auction

- Adjusted for items such as license duration, payment structure and upfront fees, annual fees, timing of award and excluded spectrum
- Based on average wireless ARPU and wireless EBITDA margin of Verizon, AT&T, T-Mobile and Sprint
- ARPU based on average of Vodafone (UK), EE (BT), Three and O2; EBITDA margin based on average of Three and O2; GBP/USD of 1.31 as of 6/30/19 and EUR/USD of 1.11 as of 6/30/19
- Based on ARPU and EBITDA margin of SK Telecom (Note: 85% of total SK Telecom revenue is wireless); KRW/USD of 0.0009 as of 6/30/19
- Based on average ARPU and EBITDA margin of Vodafone (Italy) and Wind Tre; EUR/USD of 1.11 as of 6/30/19
- ARPU based on average of Deutsche Telekom, Vodafone (Germany) and Telefónica Germany. EBITDA margin based on Telefónica Germany margin; EUR/USD of 1.11 as of 6/30/19
- ARPU based on average of Taiwan Mobile and Chunghwa Telecom. EBITDA margin based on Taiwan Mobile Wireless EBITDA margin; TWD/USD of 0.033 as of 1/20/20

# Implied Value of C-Band Auctions Relative to “Wireless Industry TEV”

## International C-Band Auction Proceeds / Wireless TEV



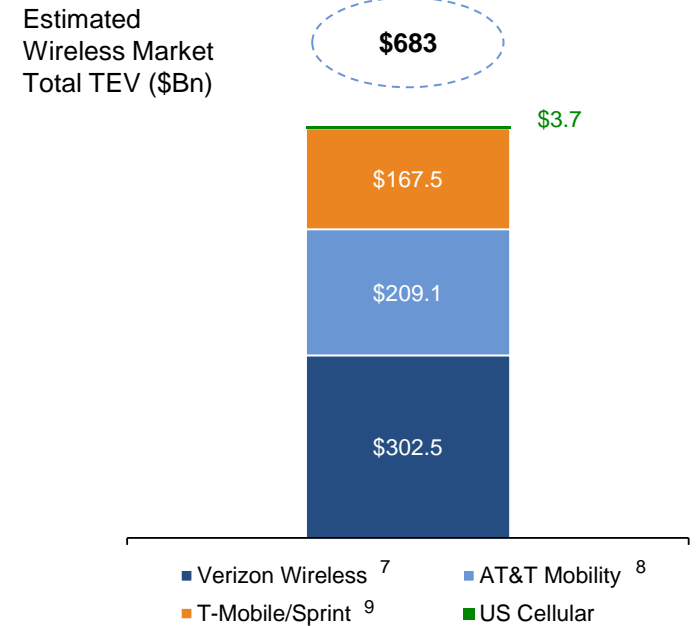
Source: Wall Street research, Company filings

Note: TEV stands for Total Enterprise Value

1. Estimated TEV of wireless businesses of Vodafone, BT EE, Three UK and O2 UK; grossed up by market share of 97%
2. Estimated TEV of wireless businesses of SK Telecom grossed up by market share of 47%
3. Estimated TEV of wireless businesses of Wind, Vodafone and Telecom Italia; grossed up by market share of 92%
4. Estimated TEV of wireless businesses of Telefonica Deutschland, Deutsche Telekom and Vodafone
5. Estimated TEV of wireless businesses of Taiwan Mobile grossed up by market share of 25%
6. U.S. Wireless TEV excluding Comcast, Charter and Dish for illustrative purposes
7. Wall Street consensus EBITDA of 2019E Wireless businesses at 7.0x multiple
8. Wall Street consensus EBITDA of 2019E Wireless businesses (excluding Mexico) at 7.0x multiple
9. Pro forma TEV of T-Mobile/Sprint at the announced exchange ratio
10. Assumes 280 MHz and U.S. population covered by C-Band of 307mm

(\$ in billions)

## Illustrative U.S. Wireless TEV Overview<sup>6</sup>



## U.S. C-Band Auction Sensitivity<sup>10</sup>

	Value (\$Bn)	% of US Wireless TEV
\$ / MHz - Pop	\$0.40	\$34.4 5.0%
	0.50	43.0 6.3%
	0.60	51.6 7.5%
	0.70	60.2 8.8%
	0.80	68.8 10.0%
	0.90	77.4 11.3%
1.00	86.0 12.6%	