



# FINAL CATALOG OF ELIGIBLE EXPENSES AND ESTIMATED COSTS

FEDERAL COMMUNICATIONS COMMISSION (FCC)  
SECURE AND TRUSTED COMMUNICATIONS NETWORKS REIMBURSEMENT PROGRAM

REVISED SEPTEMBER 30, 2021

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FOR DESIGN, IMPLEMENTATION, INSTALLATION, TESTING, OR OTHER COSTS AND/OR FEES PAID TO DEPLOY THE REPLACEMENT EQUIPMENT AND/OR SYSTEMS IN THE CONTERMINOUS (CONTIGUOUS) UNITED STATES. AN ADDITIONAL 30-50% NEEDED FOR SERVICES SPECIFIC TO: ALASKA, AMERICAN SAMOA, HAWAII, PUERTO RICO AND VIRGIN ISLANDS.....23

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**ABOUT THIS CATALOG**

As directed by the Federal Communications Commission (Commission), the Wireline Competition Bureau (Bureau) adopted this Revised Final Catalog of Eligible Expenses and Estimated Costs (Catalog) for use in the Secure and Trusted Communications Networks Reimbursement Program (Reimbursement Program). The Commission requires providers advanced communications services with 10 million or fewer customers seeking to participate in the Reimbursement Program to file a FCC Form 5640, Application Request for Funding Allocation, 47 CFR § 1.50004(c). The application must include an “estimate of costs reasonably incurred for the permanent removal, replacement, and disposal” of communications equipment or services that were produced or provided by Huawei Technologies Company and ZTE Corporation and obtained by the applicant on or before June 30, 2020. 47 CFR § 1.50004(a), (e)(1)(i). The Commission’s rules allow “[e]ligible providers [to] rely upon the predetermined estimated costs identified in the [Catalog]” when submitting their application cost estimates. *Id.*

The Catalog consists of categories and subcategories of costs that eligible providers of advanced communications services are expected to incur during the removal, replacement, and disposal process. The Catalog is organized by five basic components of a communications network: Core Layer, Distribution Layer, Access Layer, Software, and Services. For each itemized cost identified with a range, the applicant may rely on the cost estimate average identified when submitting their application. The Catalog is not a definitive list of what is considered eligible for reimbursement under the Reimbursement Program. If an applicant believes a cost estimate identified in the Catalog does not fully account for its specific circumstances or a cost category is not identified in the Catalog with a cost estimate range, then the applicant may provide an individualized cost estimate with supporting documentation in their application. The cost estimates identified in this Catalog do not guarantee a funding allocation or disbursement of funds from the Reimbursement Program.

The Commission contracted with Widelity, Inc. to produce a preliminary version of the Catalog dated March 25, 2021 based on a series of confidential interviews with communications industry stakeholders to understand the process and costs associated with removing, replacing, and disposing of covered communications equipment and services. After seeking and considering public comments, the Bureau revised and adopted a finalized version of the Catalog on August 3, 2021. On September 30, 2021, the Bureau made minor corrections to the Catalog. At the end of this final Catalog are charts detailing the changes reflected in the September 30 and August 3 versions of the Catalog.

The Catalog will be made available on the Commission’s website, and the line items and cost estimate averages taken from the ranges identified in the Catalog will be incorporated into the online filing portal for use by applicants when completing the Form 5640, Application Request for Funding Allocation.

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
1	<b>Access Layer Equipment</b> The access layer is responsible for connecting users to their immediate service providers. First, the communications start by enabling users to communicate with the communication system to allow the start of information exchange/transmission. These communications can either be wired or wireless.			
1.1.00	<b>Optical line terminal equipment (OLT)</b>	\$ 1,200.00	\$ 39,000.00	\$ 20,100.00
1.2.00	<b>Access WDM (Wavelength Division Multiplexing) &amp; OTN (Optical Transport Network)</b>			
1.2.1	Access WDM & OTN equipment, Small network, includes subscription (per node)	\$ 3,454.00	\$ 120,000.00	\$ 61,727.00
1.2.2	Access WDM & OTN equipment, Medium to Large network, includes subscription (per node)	\$ 65,000.00	\$ 330,000.00	\$ 197,500.00
1.3.00	<b>End-User Termination Point - FTTH</b>			
1.3.1	Customer ONT - indoor	\$ 100.00	\$ 425.00	\$ 262.50
1.3.2	Customer ONT - outdoor	\$ 270.00	\$ 535.00	\$ 402.50
1.3.3	Small Business/SOHO - Distribution Node to Multiple End-User (per node)	\$ 595.00	\$ 30,000.00	\$ 15,297.50
1.3.4	Large Business/Enterprise - Distribution Node to Multiple End-User (per node)	\$ 6,400.00	\$ 25,000.00	\$ 15,700.00
1.4.00	<b>Multi-service Access Node and Digital Subscriber Line Access Multiplexing Equipment (MSAN &amp; DSLAM)</b>			
1.5.00	<b>Ethernet Service Access Node (ESAN) (includes outdoor cabinet &amp; install)</b>	\$ 8,146.56	\$ 8,146.56	\$ 8,146.56
1.6.00	<b>LAN MDUs</b>			
1.6.1	LAN MDUs (Local Area Network Multi-Dwelling Units), Small, includes subscription	\$ 2,500.00	\$ 79,000.00	\$ 40,750.00
1.6.2	LAN MDUs (Local Area Network Multi-Dwelling Units), Medium, includes subscription	\$ 40,000.00	\$ 117,000.00	\$ 78,500.00
1.6.3	LAN MDUs (Local Area Network Multi-Dwelling Units), Large, includes subscription	\$ 115,000.00	\$ 240,000.00	\$ 177,500.00
1.7.00	<b>Home Network and Customer Premises Equipment (CPE)</b>			
1.7.1	CBRS/B48 Category 15 15-19 dBi Gain Outdoor Unit	\$ 200.00	\$ 375.00	\$ 287.50



Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
1.7.2	CBRS/B48 Category 15 High Gain Indoor Unit	\$ 200.00	\$ 260.00	\$ 230.00
1.7.3	SAS Integration Costs (per Radio)	\$ 62.00	\$ 124.00	\$ 93.00
1.8.00	<b>Customer Outreach to End-User - Public Relations/Notification</b>			
1.8.1	Legal review of customer notices & communications; public relations - (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
1.8.2	Smart Home - Reimbursable portions of Smart Homes are in the CPE (other portions: IP cameras, Wi-Fi doorbells, Wi-Fi Routers, Wi-Fi light switches, etc. would not be reimbursable)			
1.9.00	<b>Cable Coaxial Media Converters</b>	\$ 89.00	\$ 289.00	\$ 189.00
1.9.1	CMTS (per node)	\$ 8,500.00	\$ 16,000.00	\$ 12,250.00
1.10.00	<b>WLAN (Wireless Local Area Network)</b>			
1.10.1	WLAN - small	\$ 795.00	\$ 2,300.00	\$ 1,547.50
1.10.2	WLAN - medium to large network	\$ 2,400.00	\$ 3,825.00	\$ 3,112.50
1.11.00	<b>Site Cabinets - Optical Network Units (ONU)</b>	\$ 5,780.00	\$ 7,225.00	\$ 6,502.50
1.11.1	Fiber - FTTP (Fiber To The Premises) - per mile, trenched & buried, rural, flat, rocky - to urban	\$ 22,500.00	\$ 61,116.00	\$ 41,808.00
1.11.2	Fiber - FTTP (Fiber To The Premises) - per mile, aerial lashed, rural - to urban	\$ 18,500.00	\$ 34,000.00	\$ 26,250.00
2	<b>Distribution Layer Equipment Middle-mile, backhaul, or RAN (radio access network) equipment layered between the access and core layers of the network in which network traffic management policies are defined and enforced.</b>			
2.1.00	<b>Routers</b>			
2.1.1	Small Cell Site Router capable of L2/Ethernet and IP/MPLS with a mix of 1GE (8 or fewer) and 10GE interfaces (2 or fewer)	\$ 795.00	\$ 10,750.00	\$ 5,772.50
2.1.2	Medium Cell Site Router capable of L2/Ethernet and IP/MPLS with a mix of 1GE (20 or fewer) and 10GE interfaces (8 or fewer)	\$ 1,616.00	\$ 19,500.00	\$ 10,558.00
2.1.3	Large Cell Site Router capable of L2/Ethernet and IP/MPLS with a mix of 1GE (24 or	\$ 2,998.00	\$ 13,068.00	\$ 8,033.00

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
	fewer), 10GE (24 or fewer), and 100GE interfaces (4 or fewer)			
2.1.4	CellSite Router (1 Gig Port config L2 switch - 10 Gig Port config MPLS (Multiprotocol Label Switching) L3 router)	\$ 1,182.00	\$ 12,000.00	\$ 6,591.00
2.1.5	10G L2/Ethernet only NID/CellSite Router to IP/MPLS NID/CellSite Router	\$ 4,500.00	\$ 19,995.00	\$ 12,247.50
2.1.6	100G IP/MPLS Aggregation (non-redundant - redundant controllers)	\$ 17,500.00	\$ 170,000.00	\$ 93,750.00
2.2.00	<b>Switches</b>			
2.2.1	Switches - small business and campus networks, cloud grade	\$ 2,195.00	\$ 239,270.00	\$ 120,732.50
2.2.2	Switches - medium business and campus networks, cloud grade	\$ 239,270.00	\$ 478,537.00	\$ 358,903.50
2.2.3	Switches - Large business and campus networks, cloud grade	\$ 478,537.00	\$ 720,000.00	\$ 599,268.50
2.2.4	Switches - small enterprise and service provider, cloud grade	\$ 38,200.00	\$ 270,600.00	\$ 154,400.00
2.2.5	Switches - medium enterprise and service provider, cloud grade	\$ 270,600.00	\$ 541,200.00	\$ 405,900.00
2.2.6	Switches - large enterprise and service provider, cloud grade	\$ 541,200.00	\$ 850,000.00	\$ 695,600.00
2.3.00	<b>FTTH (Fiber To The Home) - GPON (Gigabyte Passive Optical Network) / XGS (10- Gigabit-capable symmetric passive optical network)</b>			
2.3.1	GPON/XGS Element Management System (10k subs)	\$ 15,000.00	\$ 190,100.00	\$ 102,550.00
2.3.2	GPON/XGS OLT	\$ 20,000.00	\$ 80,855.00	\$ 50,427.50
2.3.3	GPON/XGS OLT - Outside Plant	\$ 28,050.00	\$ 39,635.00	\$ 33,842.50
2.4.00	<b>VDSL (Very high-speed Digital Subscriber Line) Access Network</b>			
2.4.1	VDSL - ISP vs. OSP (Inside Plant vs. Outside Plant)	\$ 19,805.00	\$ 26,475.00	\$ 23,140.00
2.5.00	<b>Cell Edge Aggregation</b>			
2.5.1	Edge Aggregation - for 8 Cell Sites	\$ 312,000.00	\$ 415,000.00	\$ 363,500.00
2.5.2	Edge Aggregation - for 16 Cell Sites	\$ 450,000.00	\$ 600,000.00	\$ 525,000.00
2.5.3	Edge Aggregation - for 32 Cell Sites	\$ 628,000.00	\$ 835,000.00	\$ 731,500.00
2.6.00	<b>Network Security Equipment</b>			
2.6.1	Network security equipment - small network	\$ 1,000.00	\$ 33,667.00	\$ 17,333.50
2.6.2	Network security equipment - medium network	\$ 33,667.00	\$ 150,000.00	\$ 91,833.50

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
2.6.3	Network security equipment - large network	\$ 67,333.00	\$ 500,000.00	\$ 283,666.50
2.7.00	<b>Distribution WDM &amp; OTN</b>			
2.7.1	WDM & OTN equipment, Small network, includes subscription (per node)	\$ 83,000.00	\$ 102,000.00	\$ 92,500.00
2.7.2	WDM & OTN equipment, Medium to Large network, includes subscription (per node)	\$ 165,000.00	\$ 330,000.00	\$ 247,500.00
2.8.00	<b>Microwave PTP (point to point links)</b>			
2.8.1	Microwave Radio pair (5.8 GHz 2+0 500 Mbps basic hop - 11 GHz 4+0 2.8 Gbps hop with switching)	\$ 6,560.00	\$ 36,200.00	\$ 21,380.00
2.8.2	Microwave Radio pair (Indoor, split-mount, small varying radio link capacities and capabilities)	\$ 7,327.00	\$ 53,674.00	\$ 30,500.50
2.8.3	Microwave Radio pair (Indoor, split-mount, small to medium radio link capacities and capabilities)	\$ 10,318.00	\$ 56,666.00	\$ 33,492.00
2.8.4	Microwave Radio pair (Indoor, split-mount, medium to large radio link capacities and capabilities)	\$ 16,043.00	\$ 62,390.00	\$ 39,216.50
2.8.5	Microwave Radio pair, 2+0, 80MHz Channel, 1.4 Gbps (11GHz or 18GHz)	\$ 10,700.00	\$ 16,000.00	\$ 13,350.00
2.8.6	Microwave Radio pair, 4+0, 80 MHz Channel, 2.8 Gbps (11GHz or 18GHz)	\$ 24,200.00	\$ 36,300.00	\$ 30,250.00
2.8.7	Microwave Radio pair, 2+0, 50MHz Channel, 850 Mbps (23 GHz)	\$ 10,700.00	\$ 16,000.00	\$ 13,350.00
2.8.8	Microwave Radio pair, 4+0, 50 MHz Channel, 1.7 Gbps (23 GHz)	\$ 24,200.00	\$ 36,300.00	\$ 30,250.00
2.8.9	Microwave Radio pair, 1+0, 2000 MHz Channel, 10 Gbps (80 GHz)	\$ 9,600.00	\$ 14,400.00	\$ 12,000.00
2.8.10	Microwave L2 Processing Shelf	\$ 5,500.00	\$ 8,500.00	\$ 7,000.00
2.9.00	<b>Microwave PTMP (point to multipoint)</b>			
2.9.1	28/39 GHz PTMP Microwave Hub Node (access point), includes 90° sector antenna (LMDS A2/A3 or B Band)	\$ 3,400.00	\$ 11,500.00	\$ 7,450.00
2.9.2	28/39 GHz PTMP Microwave Remote Node, includes 1' parabolic antenna	\$ 1,614.00	\$ 4,000.00	\$ 2,807.00
2.9.3	28/39 GHz PTMP Microwave Remote Node, includes 2' parabolic antenna	\$ 1,701.00	\$ 4,100.00	\$ 2,900.50
2.9.4	28/39 GHz PTMP Microwave Remote Node, includes 3' parabolic antenna	\$ 1,439.00	\$ 4,100.00	\$ 2,769.50
2.10.00	<b>Microwave Antennas - Single Pole</b>			
2.10.1	0.3 - 1.2 meter (1 - 4 foot)	\$ 425.00	\$ 1,850.00	\$ 1,137.50

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
2.10.2	1.8 - 3.0 meter (6 - 10 foot)	\$ 2,475.00	\$ 3,668.50	\$ 3,071.75
2.11.00	<b>Microwave Antennas - Dual Polarization</b>			
2.11.1	0.3 - 1.2 meter (1 - 4 foot)	\$ 425.00	\$ 1,976.70	\$ 1,200.85
2.11.2	1.8 - 3.0 meter (6 - 10 foot)	\$ 2,700.00	\$ 4,268.00	\$ 3,484.00
2.12.00	<b>Microwave Antennas - Dual Polarization – Ultra High Performance</b>			
2.12.1	0.3 - 1.2 meter (1 - 4 foot)	\$ 3,490.00	\$ 5,250.00	\$ 4,370.00
2.12.2	1.8 - 3.0 meter (6 - 10 foot)	\$ 7,250.00	\$ 30,000.00	\$ 18,625.00
2.13.00	<b>Microwave Antennas - mmWave Flat Panel</b>			
2.13.1	Flat Panel	\$ 3,852.00	\$ 4,708.00	\$ 4,280.00
2.13.2	0.3 to 0.6 meter (1-2 foot, single polarization)	\$ 430.00	\$ 1,650.00	\$ 1,040.00
2.13.3	0.3 to 0.6 meter (1-2 foot, dual polarization)	\$ 1,400.00	\$ 2,050.00	\$ 1,725.00
2.14.00	<b>Antenna - LTE (Long Term Evolution) Multi-band, &gt;16dBi</b>			
2.14.1	2 port - 2T2R through 8 port - 8T8R	\$ 544.00	\$ 6,450.00	\$ 3,497.00
2.14.2	10 port - 10T10R through 20 port - 20T20R	\$ 1,479.00	\$ 10,994.50	\$ 6,236.75
2.15.00	<b>Antenna - LTE &amp; CBRS (Citizens Broadband Radio Service), &gt;16dBi</b>			
2.15.1	8 port - 8T8R through 20 port - 20T20R	\$ 4,455.00	\$ 9,795.50	\$ 7,125.25
2.16.00	<b>Antenna - CBRS only</b>			
2.16.1	2 port - 2T2R through 16 port - 16T16R	\$ 895.50	\$ 5,225.00	\$ 3,060.25
2.17.00	<b>Hybrid Cable &amp; Radio/Antenna Jumpers, Tower Ancillary Components</b>			
2.17.1	Cable breakout interconnect 100', maximum of 12 power conductors & 24 fiber	\$ 1,527.00	\$ 2,560.00	\$ 2,043.50
2.17.2	Cable breakout interconnect 200', maximum of 12 power conductors & 24 fiber	\$ 1,693.00	\$ 2,800.00	\$ 2,246.50
2.17.3	Cable breakout interconnect 300', maximum of 12 power conductors & 24 fiber	\$ 1,913.00	\$ 7,200.00	\$ 4,556.50
2.17.4	Cable breakout interconnect 400', maximum of 12 power conductors & 24 fiber	\$ 4,699.00	\$ 10,000.00	\$ 7,349.50
2.17.5	"Raycap" Over-voltage Protection / Fiber Management – each	\$ 1,500.00	\$ 4,000.00	\$ 2,750.00

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
2.17.6	OVP to radio power/fiber jumpers, coax jumpers (each)	\$ 190.00	\$ 950.00	\$ 570.00
2.18.00	<b>LAN MDUs (Local Area Network Multi-Dwelling Units)</b>			
2.18.1	Small Networks	\$ 1,900.00	\$ 75,000.00	\$ 38,450.00
2.18.2	Medium Networks	\$ 69,366.00	\$ 150,000.00	\$ 109,683.00
2.18.3	Large Networks	\$ 139,700.00	\$ 250,000.00	\$ 194,850.00
2.19.00	<b>Bearer - 5G Transport - connects all categories of the mobile network infrastructure, including fronthaul, midhaul, and backhaul.</b>			
2.19.1	Bearer - small network	\$ 17,000.00	\$ 20,000.00	\$ 18,500.00
2.19.2	Bearer - medium to large network	\$ 23,000.00	\$ 34,000.00	\$ 28,500.00
2.20.00	<b>5G</b>			
2.21.00	<b>LTE FDD (Frequency Division Duplex)</b>			
2.21.1	2-port capable, low-mid band radio for 1 sector (5Mhz, FDD, LTE or W-CDMA (Wideband Code Division Multiple Access))	\$ 4,000.00	\$ 14,872.00	\$ 9,436.00
2.21.2	4-port capable, low-mid band radio for 1 sector (5Mhz, FDD, LTE or W-CDMA)	\$ 11,525.00	\$ 22,496.00	\$ 17,010.50
2.21.3	Expansion of 2-port low-mid band radio for 1 sector (additional 5Mhz of (FDD), nominal to large amount of power)	\$ 1,609.00	\$ 5,844.00	\$ 3,726.50
2.21.4	Expansion of 4-port low-mid band radio for 1 sector (additional 5Mhz of (FDD), nominal to large amount of power)	\$ 1,735.00	\$ 7,844.00	\$ 4,789.50
2.22.00	<b>LTE TDD (Time Division Duplex)</b>			
2.22.1	4-port capable, low-mid band radio for 1 sector (20Mhz, TDD)	\$ 4,000.00	\$ 21,842.00	\$ 12,921.00
2.22.2	8-port capable, low-mid band radio for 1 sector (20Mhz, TDD)	\$ 21,318.00	\$ 28,517.00	\$ 24,917.50
2.22.3	Expansion of 2,4,8-port low-mid band radio for 1 sector (additional 20Mhz of (TDD), nominal to large amount of power)	\$ 3,000.00	\$ 13,000.00	\$ 8,000.00
2.23.00	<b>LTE BBU (Baseband Units)</b>			
2.23.1	Rack Mounted or Outdoor Mounted baseband unit (BBU)	\$ 7,461.00	\$ 54,773.00	\$ 31,117.00

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
2.23.2	W-CDMA RNC (Radio Network Controller, small network, <50k subscribers)	\$ 391,278.00	\$ 840,918.00	\$ 616,098.00
2.23.3	W-CDMA RNC (Radio Network Controller, medium network, <250k subscribers)	\$ 840,918.00	\$ 1,070,246.00	\$ 955,582.00
2.23.4	W-CDMA RNC (Radio Network Controller, large network, <500k subscribers)	\$ 1,070,246.00	\$ 2,274,859.00	\$ 1,672,552.50
2.24.00	<b>1 Sector Bundle - 10/20MHz channels - RU (Radio Unit), CDU (Cabinet Distributed Unit), shelf, cables, SFP's, and antennas</b>			
2.24.1	Single sector CBRS 4T4R base station and Baseband Unit - 10/20MHz channel	\$ 16,538.00	\$ 17,504.00	\$ 17,021.00
2.24.2	Single sector CBRS 64T64R base station and Baseband Unit - 10/20MHz channel	\$ 28,792.00	\$ 30,412.00	\$ 29,602.00
2.25.00	<b>1 Sector Bundle - 40MHz channels - RU, CDU, DU shelf, cables, SFP's, and antennas</b>			
2.25.1	Single sector CBRS 4T4R base station and Baseband Unit - 40MHz channel	\$ 16,538.00	\$ 17,504.00	\$ 17,021.00
2.25.2	Single sector CBRS 64T64R base station and Baseband Unit - 40MHz channel	\$ 34,365.00	\$ 36,315.00	\$ 35,340.00
2.26.00	<b>1 Sector Bundle - 60MHz channels - RU, CDU, DU shelf, cables, SFP's, and antennas</b>			
2.26.1	Single sector CBRS 4T4R base station and Baseband Unit - 60MHz channel	\$ 16,807.00	\$ 17,788.00	\$ 17,297.50
2.26.2	Single sector CBRS 64T64R base station and Baseband Unit - 60MHz channel	\$ 39,940.00	\$ 42,217.00	\$ 41,078.50
2.26.3	4T4R CBRS Radio Unit, 4T4R pole mounting bracket, 4T4R 10meter CPRI optical cable	\$ 4,842.00	\$ 5,137.00	\$ 4,989.50
2.26.4	64T64R CBRS Radio Unit, 64T64R pole mounting bracket, 64T64R CPRI Optical module, 10 meter CPRI cable	\$ 15,963.00	\$ 16,902.00	\$ 16,432.50
2.27.00	<b>Rapid Deployed, Self-contained 5G Cell Site with Attached Core</b>			
2.27.1	HIGH - 5G Fully Integrated, EMP Hardened Cellsite with Mobile Edge compute and embedded 5G Core - 600mhz - 6ghz; 30ghz and up + Counter UAS Radar & Video Surveillance	\$ 800,000.00	\$ 1,400,000.00	\$ 1,100,000.00
2.27.2	MEDIUM - 5G Fully Integrated, EMP Hardened Cellsite with Mobile Edge compute and embedded 5G Core - 600mhz - 6ghz; 30ghz and up + Diverse Backhaul (Free space Optic and/or MM wave)	\$ 500,000.00	\$ 799,000.00	\$ 649,500.00
2.27.3	LOW - 5G Fully Integrated, EMP Hardened Cellsite with Mobile Edge compute and embedded 5G Core - 600mhz - 6ghz with Fiber Media Gateway	\$ 250,000.00	\$ 500,000.00	\$ 375,000.00
2.27.4	Solar Cell Site Power Solution (<24 hour solution) - Green Power Solution	\$ 50,000.00	\$ 100,000.00	\$ 75,000.00
2.27.5	Solar Cell Site Power Solution (24 to 48 hour solution) - Green Power Solution	\$ 101,000.00	\$ 300,000.00	\$ 200,500.00
2.27.6	Generator -based power Cell Site Power Solution - Green Power Solution	\$ 75,000.00	\$ 150,000.00	\$ 112,500.00
2.27.7	5G RAN & Core Consulting – per hour	\$ 200.00	\$ 500.00	\$ 350.00

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
2.28.00	<b>Bundled BBU/RRH (Base Band Unit/Remote Radio Head)</b>			
	<b>Fixed Wireless</b>			
2.28.1	2T2R-8T8R eNodeB with 3 sectors, single spectrum band of up to 20 MHz/sector. Fixed Wireless features. Range due to Low Power radio (20W) vs High Power radio (up to 320W). Price includes Remote Radio Units (RRU), Base Band Unit (BBU), Ancillaries, Software Features, and Capacity Licensing. Price excludes antennas, tower cabling, tower ancillaries and over voltage protection (OVP)	\$ 27,000.00	\$ 56,000.00	\$ 41,500.00
2.28.2	mMIMO eNodeB with 3 sectors, single spectrum band of up to 20 MHz/sector. Fixed Wireless features. Range due to Low Power radio (120W) vs High Power radio (up to 240W). Price includes Radio+Antenna, BBU, Ancillaries, Software Features, and Capacity Licensing. Price excludes tower cabling, tower ancillaries and over voltage protection (OVP)	\$ 85,000.00	\$ 115,000.00	\$ 100,000.00
	<b>Mobility Wireless - nonMIMO</b>			
2.28.3	2T2R-8T8R eNodeB with 3 sectors, single spectrum band of up to 20 MHz/sector. Mobility features. Range due to Low Power radio (20W) vs High Power radio (up to 320W). Price includes RRHs, BBU, Ancillaries, Software Features, and Capacity Licensing. Price excludes antennas, tower cabling, tower ancillaries and over voltage protection (OVP)	\$ 45,000.00	\$ 69,000.00	\$ 57,000.00
	<b>Mobility Wireless - mMIMO</b>			
2.28.4	mMIMO eNodeB 3 Sector Per Band (64T64R 20 MHz 1 Band - 64T64R 60 MHz 1 Band with Advanced Mobility Features)	\$ 85,000.00	\$ 368,172.00	\$ 226,586.00
2.29.00	<b>Bundled Open-RAN</b>			
2.29.1	Macrocell 4G 20MHz Carrier (Bundle - Antennas, RU/RRU, BBU Software, GPS Receiver, STU (Subscriber Terminal Unit), RIU (Radio Interface Unit), Mechanical Mounting, Cables and Connectors, SFPs (Small Form-Factor Pluggable))	\$ 39,000.00	\$ 52,000.00	\$ 45,500.00
2.29.2	Macrocell - 5G Sub6 100MHz Carrier (Bundle - Antennas, RU/RRU, BBU Software, GPS Receiver, STU, RIU, Mechanical Mounting, Cables and Connectors, SFPs)	\$ 91,000.00	\$ 125,000.00	\$ 108,000.00
2.29.3	Macrocell - 5G mmWave (Bundle - RU/RRU, BBU Software, GPS Receiver, DU (Open RAN Distributed Unit), Mechanical Mounting, Cables and Connectors, SFPs)	\$ 45,000.00	\$ 60,000.00	\$ 52,500.00
2.30.0	<b>SAS Integration Costs (per Radio)</b>	\$ 62.00	\$ 124.00	\$ 93.00

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
2.31.0	<b>Open vRAN eNodeB</b> Model is based on single band 50 site cluster. It includes RRU (Remote Radio Unit)/CU (Control Unit)/DU (Distributed Unit)/SW (Software)/NFVi (Network Functions Virtualization infrastructure). SW include all features, power licenses, and optional features			
2.31.1	B71 (3 sector site) or B5 (3 sector) One RRU Type	\$ 27,016.00	\$ 64,838.00	\$ 45,927.00
2.31.2	B41 (3 sector site) One RRU Type	\$ 28,196.00	\$ 67,670.00	\$ 47,933.00
2.31.3	B66 or B4(3 sector) One RRU Type	\$ 30,146.00	\$ 72,350.00	\$ 51,248.00
2.31.4	B2 or B25 (3 sector) One RRU type	\$ 30,146.00	\$ 72,350.00	\$ 51,248.00
2.31.5	B48 One RRU Type	\$ 27,971.00	\$ 67,130.00	\$ 47,550.50
2.31.6	B71/B25 (3 Sector for each RRU) Two RRU Type (dual band per sector)	\$ 43,156.00	\$ 103,574.00	\$ 73,365.00
2.31.7	B71/B12/B41 (3 Sector for each RRU) Three RRU Type (tri-band per sector)	\$ 63,229.00	\$ 151,749.00	\$ 107,489.00
2.32.0	<b>RAN (Open RAN/ vRAN) Components</b>			
2.32.1	RRU - band 71 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	\$ 5,430.00	\$ 13,032.00	\$ 9,231.00
2.32.2	RRU - band 41 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	\$ 5,690.00	\$ 13,656.00	\$ 9,673.00
2.32.3	RRU - band 12 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	\$ 6,340.00	\$ 15,216.00	\$ 10,778.00
2.32.4	RRU - band 66 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	\$ 6,340.00	\$ 15,216.00	\$ 10,778.00
2.32.5	RRU - band 25 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	\$ 6,340.00	\$ 15,216.00	\$ 10,778.00
2.32.6	RRU - band 2 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	\$ 6,340.00	\$ 15,216.00	\$ 10,778.00
2.32.7	RRU - band 5 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	\$ 6,340.00	\$ 15,216.00	\$ 10,778.00
2.32.8	RRU - band 4 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	\$ 6,340.00	\$ 15,216.00	\$ 10,778.00
2.32.9	RRU - band 48 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc. SW price is per RRU for B48	\$ 3,780.00	\$ 9,072.00	\$ 6,426.00
2.33.0	<b>DU (Distributed Unit)</b>			
2.33.1	Multi-Access Edge Server (indoor)	\$ 3,680.00	\$ 5,520.00	\$ 4,600.00
2.33.2	Multi-Access Edge Server (outdoor)	\$ 9,642.40	\$ 14,463.60	\$ 12,053.00
2.33.3	vDU Server	\$ 8,000.00	\$ 10,000.00	\$ 9,000.00



Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
2.34.0	<b>CU (Control Unit)</b>			
2.34.1	Edge Computing vCompute NODE	\$ 11,975.20	\$ 17,962.80	\$ 14,969.00
2.34.2	vCU Server	\$ 10,000.00	\$ 12,000.00	\$ 11,000.00
2.35.0	<b>SFP - Small Form-Factor Pluggable Transceiver</b>			
2.35.1	SFP - 10G	\$ 175.00	\$ 175.00	\$ 175.00
2.36.0	<b>GPS</b>			
2.36.1	GPS Antenna, Lightning Arrestor, GPS Splitter 1:8, Cable Assembly-Coaxial (35')	\$ 1,560.00	\$ 1,694.00	\$ 1,627.00
2.37.0	<b>GSM&amp;UMTS (Universal Mobile Telecommunications System)</b>			
2.37.1	3G/UMTS RNC (Radio Network Controller) Small - Medium (50 - 1000 nodes)	\$ 300,000.00	\$ 750,000.00	\$ 525,000.00
2.37.2	3G/UMTS NodeB HW/SW addition to eNodeB	\$ 11,000.00	\$ 13,000.00	\$ 12,000.00
2.38.0	<b>Small Cell</b>			
2.38.1	Small Cell, LTE B42 B43 B48 integrated antenna eNodeB	\$ 4,000.00	\$ 20,000.00	\$ 12,000.00
2.39.0	<b>Tower Shelter</b>			
2.39.1	New shelter: Shelter, delivery, crane, labor, pad	\$ 75,000.00	\$ 85,000.00	\$ 80,000.00
2.40.0	<b>Outdoor Cabinets</b>			
2.40.1	Cabinet, Power Distribution Unit, 4 to 8 Rectifiers, 1 to 2 Battery Strings, optional Heat Exchanger	\$ 10,000.00	\$ 33,813.00	\$ 21,906.50
2.40.2	Outdoor Cabinet Install (Provide and Install)	\$ 5,250.00	\$ 6,300.00	\$ 5,775.00
2.40.3	Relocate CSR to New Cabinet	\$ 1,950.00	\$ 2,350.00	\$ 2,150.00
2.40.4	Install batteries and rectifiers	\$ 1,500.00	\$ 1,850.00	\$ 1,675.00
2.40.5	Install Outdoor Mounting Rack H-Frame	\$ 750.00	\$ 900.00	\$ 825.00
2.41.0	<b>Indoor Cabinets</b>			
2.41.1	Indoor cabinet (small to large site, optional battery backup included.	\$ 9,766.00	\$ 29,561.00	\$ 19,663.50
2.41.2	Indoor Power Plants / Rectifiers / Batteries	\$ 6,000.00	\$ 38,000.00	\$ 22,000.00

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
3	<b>Core Layer Equipment</b> The Core Layer of the network is the central element that provides services to those elements connected at the access layer of the network. One of the main functions of the core layer is that it is an aggregation point that provides proper routing of all voice and data traffic. All access and distribution layers of the network will be connected to the core via fiber or microwave backhaul connections			
3.1.00	EPC			
3.1.1	4G/5G-NSA Evolved Packet Core - Small, SGW, PGW, MME (10K subs to 50K subs, includes deployment)	\$ 250,000.00	\$ 1,200,000.00	\$ 725,000.00
3.1.2	4G/5G-NSA Evolved Packet Core - Medium, SGW, PGW, MME (50K subs to 200K subs), cost per site, includes deployment	\$ 100,000.00	\$ 2,550,000.00	\$ 1,325,000.00
3.1.3	4G/5G-NSA Evolved Packet Core - Large, Distributed, SGW, PGW, MME (greater than 200K subs - redundant solution, per site, includes deployment)	\$ 1,250,000.00	\$ 4,250,000.00	\$ 2,750,000.00
3.1.4	4G/5G-NSA Evolved Packet Core - Large, Distributed, SGW, PGW, MME (greater than 200K subs - distributed, geo-redundant solution, per site, includes deployment)	\$ 4,401,710.00	\$ 8,320,688.00	\$ 6,361,199.00
3.1.5	HSS Subscriber Data - Small, HSS (up to 50K subs, includes deployment)	\$ 400,000.00	\$ 650,000.00	\$ 525,000.00
3.1.6	HSS Subscriber Data - Medium, Per site - HSS (50K subs vs 250K subs, includes deployment)	\$ 1,250,000.00	\$ 2,250,000.00	\$ 1,750,000.00
3.1.7	HSS Subscriber Data - Medium, Per site - HSS (250K subs vs 500K subs, includes deployment)	\$ 2,500,000.00	\$ 6,000,000.00	\$ 4,250,000.00
3.1.8	Mobile Position System (MPS) - Medium (60K subs) - Large (500Ksubs)	\$ 561,000.00	\$ 1,071,000.00	\$ 816,000.00
3.1.9	PCRF Server - Small, PCRF (up to 50K subs)	\$ 150,000.00	\$ 500,000.00	\$ 325,000.00
3.1.10	PCRF Server - Small Design, Installation, Commissioning, Integration, Migration Services	\$ 70,000.00	\$ 250,000.00	\$ 160,000.00
3.1.11	3G HLR added to HSS - Small, HLR (up to 50K subs, includes deployment)	\$ 250,000.00	\$ 500,000.00	\$ 375,000.00
3.1.12	3G HLR added to HSS - Medium, Per site - HLR (50K subs vs 250K subs, includes deployment)	\$ 500,000.00	\$ 1,000,000.00	\$ 750,000.00
3.1.13	3G HLR added to HSS - Medium, Per site - HLR (250K subs vs 500K subs, includes deployment)	\$ 1,000,000.00	\$ 2,500,000.00	\$ 1,750,000.00
3.1.14	Design, Installation, Commissioning, Integration, Migration Services - Medium solution, 3G HLR added to HSS - Medium	\$ 500,000.00	\$ 500,000.00	\$ 500,000.00
3.1.15	AAA Server - Small, AAA (up to 50K subs)	\$ 150,000.00	\$ 150,000.00	\$ 150,000.00
3.1.16	Design, Installation, Commissioning, Integration, Migration Services - Small solution, AAA	\$ 70,000.00	\$ 80,000.00	\$ 75,000.00

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Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
	Server - Small			
3.1.17	AAA Server - Medium, Per site - AAA (50K subs vs 250K subs)	\$ 250,000.00	\$ 400,000.00	\$ 325,000.00
3.1.18	AAA Server - Medium, Per site - AAA (250K subs vs 500K subs)	\$ 400,000.00	\$ 800,000.00	\$ 600,000.00
3.1.19	Design, Installation, Commissioning, Integration, Migration Services - Medium solution, AAA Server - Medium	\$ 375,000.00	\$ 425,000.00	\$ 400,000.00
3.1.20	Design, Installation, Commissioning, Integration Services, Mobile Switching Center	\$ 475,000.00	\$ 525,000.00	\$ 500,000.00
3.1.21	IMS Core, Per site - CSCF, TAS, A-SBC, ES, LIG, MRF, DRA/DEA, DNS, ENUM (50K - 250K subs)	\$ 6,250,000.00	\$ 6,250,000.00	\$ 6,250,000.00
3.1.22	IMS Core, Per site - CSCF, TAS, A-SBC, ES, LIG, MRF, DRA/DEA, DNS, ENUM (250K - 500K subs)	\$ 10,000,000.00	\$ 10,000,000.00	\$ 10,000,000.00
3.1.23	3G Packet Core addition to 4G EPC - Small to Medium, SGSN, GGSN (up to 500K subs, includes deployment)	\$ 750,000.00	\$ 1,409,947.00	\$ 1,079,973.50
3.1.24	WiFi Packet Data Gateway - ePDG (Small - 10K subs vs 50K subs, includes deployment)	\$ 550,000.00	\$ 650,000.00	\$ 600,000.00
3.1.25	WiFi Packet Data Gateway - ePDG (Medium - 50K subs vs 250K subs, includes deployment)	\$ 650,000.00	\$ 1,000,000.00	\$ 825,000.00
3.2.00	<b>Cloud Core</b>			
3.2.1	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, Small Network), includes Design, Installation, Commissioning, Integration Services	\$ 320,000.00	\$ 1,200,000.00	\$ 760,000.00
3.2.2	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, Medium Network), includes Design, Installation, Commissioning, Integration Services	\$ 1,500,000.00	\$ 8,320,688.00	\$ 4,910,344.00
3.2.3	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, Large Network), includes Design, Installation, Commissioning, Integration Services	\$ 2,000,000.00	\$ 24,381,688.00	\$ 13,190,844.00
3.2.4	Cloud - Virtual Stand Alone IMS (CTAS, IMS Core, MRF, AGW, A-SBC, HSS, ePDG, I-SBC, DRA, PCRF, 4G EPC, E-CSCF, LI interface, SMSC, MMSC, VM)	\$ 849,230.00	\$ 1,049,230.00	\$ 949,230.00
3.3.00	<b>RAN Core / EMS</b>			
3.3.1	IMS and RAN Element Management System, Compact EMS with Basic Licensing, includes	\$ 450,000.00	\$ 1,103,425.00	\$ 776,712.50

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Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
	hardware (10K to 50K subs), includes Design, Installation, Commissioning, Integration Services			
3.3.2	IMS and RAN Element Management System, Medium EMS with Basic Licensing, includes hardware (50K to 100K subs), includes Design, Installation, Commissioning, Integration Services	\$ 1,500,000.00	\$ 8,320,688.00	\$ 4,910,344.00
3.3.3	IMS and RAN Element Management System, Large EMS with Premium Licensing, includes hardware (>250 subs), includes Design, Installation, Commissioning, Integration Services	\$ 14,988,658.00	\$ 15,888,492.00	\$ 15,438,575.00
3.3.4	Packet Core Element Management System, Packet Core EMS (50K subs vs 250K subs), includes hardware (50K to 100K subs), includes Design, Installation, Commissioning, Integration Services	\$ 250,000.00	\$ 470,000.00	\$ 360,000.00
3.3.5	Design, Installation, Commissioning, Integration Services, Packet Core EMS Add-ons	\$ 150,000.00	\$ 300,000.00	\$ 225,000.00
3.3.6	Design, Installation, Commissioning, Integration Services IMS/EMS Add-Ons	\$ 150,000.00	\$ 500,000.00	\$ 325,000.00
3.4.00	<b>WDM &amp; OTN – Core Equipment (Wavelength Division Multiplexing &amp; Optical Transport Network)</b>			
3.4.1	Core Equipment for WDM & OTN (per node)	\$ 136,000.00	\$ 2,100,000.00	\$ 1,118,000.00
	<b>Microwave - (see Distribution Layer)</b>			
3.5.00	<b>Core Server Hardware</b>			
3.5.1	RGS Server	\$ 17,500.00	\$ 18,000.00	\$ 17,750.00
3.5.2	RGS-E Server	\$ 19,500.00	\$ 20,000.00	\$ 19,750.00
3.5.3	NFV Server	\$ 13,000.00	\$ 15,000.00	\$ 14,000.00
3.5.4	Aggregation Router (range is Small 1G ports L2 Switch - Medium 10G/25G ports MPLS L3 Router)	\$ 10,000.00	\$ 250,000.00	\$ 130,000.00
3.5.5	Core Routers, small networks	\$ 25,000.00	\$ 391,667.00	\$ 208,333.50
3.5.6	Core Routers, medium networks	\$ 391,667.00	\$ 783,333.00	\$ 587,500.00
3.5.7	Core Routers, large networks	\$ 783,333.00	\$ 1,200,000.00	\$ 991,666.50

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Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
3.5.8	Core Switches, small networks	\$ 25,000.00	\$ 325,000.00	\$ 175,000.00
3.5.9	Core Switches, medium networks	\$ 325,000.00	\$ 650,000.00	\$ 487,500.00
3.5.10	Core Switches, large networks	\$ 650,000.00	\$ 1,000,000.00	\$ 825,000.00
<b>3.6.00 Operation Support Systems (OSS)</b>				
3.6.1	OSS/BSS Design - Process Automation & Network Roll-out (based on 1 million subscribers)	\$ 500,000.00	\$ 550,000.00	\$ 525,000.00
3.6.2	OSS/BSS Design - Network & Service Assurance (based on 1 million subscribers)	\$ 700,000.00	\$ 750,000.00	\$ 725,000.00
3.6.3	OSS/BSS Design - Network Testing & Management (based on 1 million subscribers)	\$ 200,000.00	\$ 250,000.00	\$ 225,000.00
3.6.4	OSS/BSS Yearly License Costs & Fees (based on 1 million subscribers)	\$ 700,000.00	\$ 750,000.00	\$ 725,000.00
<b>3.7.00 Orchestration</b>				
3.7.1	Orchestration Design - Service Design & Creation (based on 1 million subscribers)	\$ 550,000.00	\$ 600,000.00	\$ 575,000.00
3.7.2	Orchestration Design - Universal Cloud Orchestration (based on 1 million subscribers)	\$ 1,200,000.00	\$ 1,300,000.00	\$ 1,250,000.00
3.7.3	Orchestration Yearly License Costs & Fees (based on 1 million subscribers)	\$ 900,000.00	\$ 950,000.00	\$ 925,000.00
<b>3.8.00 Cloud Computing</b>				
3.8.00		\$ 55,000.00	\$ 330,000.00	\$ 192,500.00
<b>3.9.00 Optical Transmission</b>				
3.9.1	Small to Medium Network	\$ 60,000.00	\$ 170,000.00	\$ 115,000.00
3.9.2	Medium to Large Network	\$ 170,000.00	\$ 240,000.00	\$ 205,000.00
<b>3.10.00 Data Transmission</b>				
3.10.1	Small to Medium Network	\$ 19,000.00	\$ 26,000.00	\$ 22,500.00
3.10.2	Medium to Large Network	\$ 26,000.00	\$ 38,000.00	\$ 32,000.00
<b>4 Software</b>				
4	<b>Instructions that tell a computer what to do. Software comprises the entire set of programs, procedures, and routines associated with the operation of a computer system. Applications include conceiving, specifying, designing, programming, testing, maintenance and developing equipment applications, components or systems that are continuously used.</b>			
4.1.1	Active Ethernet (AE) functionality for provisioning and alarming	\$ 4,500.00	\$ 7,300.00	\$ 5,900.00

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Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
4.1.2	Voice Core	\$ 500,000.00	\$ 1,000,000.00	\$ 750,000.00
4.1.3	Data (Ran CORE)	\$ 950,000.00	\$ 1,300,000.00	\$ 1,125,000.00
4.1.4	Network Management SW	\$ 100,000.00	\$ 115,000.00	\$ 107,500.00
4.1.5	SDN-enabled management and control software (per device, 1yr to 3yr sub)	\$ 2,000.00	\$ 105,000.00	\$ 53,500.00
4.1.6	RAN Element Management System (Small EMS with Basic Licensing - Medium EMS with Premium Licensing)	\$ 450,000.00	\$ 1,000,000.00	\$ 725,000.00
4.1.7	Core Element Management System (10K subscriber core - 250K subscribe core)	\$ 150,000.00	\$ 540,000.00	\$ 345,000.00
4.1.8	Per Call Measurement Data Server (PCMD)	\$ 100,000.00	\$ 500,000.00	\$ 300,000.00
4.1.9	Software Licenses (per radio) to include: M2M, Cat-M1, Narrowband IoT, and similar items	\$ 6,850.00	\$ 9,133.00	\$ 7,991.50
<b>4.2.0 Licenses</b>				
4.2.1	4G IOT License - Perpetual - per Subscriber	\$ 0.02	\$ 1.04	\$ 0.53
4.2.2	4G Connectivity License - Perpetual - per Subscriber	\$ 0.09	\$ 4.74	\$ 2.42
4.2.3	4G Communications License - Perpetual - per Subscriber	\$ 0.11	\$ 5.76	\$ 2.94
4.2.4	5G SA/NSA IOT License - Perpetual - per Subscriber	\$ 0.11	\$ 1.18	\$ 0.65
4.2.5	5G SA/NSA Connectivity License - Perpetual - per Subscriber	\$ 0.12	\$ 6.62	\$ 3.37
4.2.6	5G SA/NSA Communications License - Perpetual - per Subscriber	\$ 0.11	\$ 6.07	\$ 3.09
4.2.7	4G+5G NSA IOT License - Perpetual - per Subscriber	\$ 0.03	\$ 1.73	\$ 0.88
4.2.8	4G+5G NSA Connectivity License - Perpetual - per Subscriber	\$ 0.15	\$ 8.04	\$ 4.10
4.2.9	4G+5G NSA Communications License - Perpetual - per Subscriber	\$ 0.13	\$ 7.14	\$ 3.64
4.2.10	LTE Software License, perpetual license, technology LTE TDD/FDD, per cell/carrier	\$ 1,000.00	\$ 10,000.00	\$ 5,500.00
4.2.11	5G NR (new radio) Software License, perpetual license, technology 5G NR TDD/FDD, per cell/carrier	\$ 1,000.00	\$ 10,000.00	\$ 5,500.00
4.2.12	5G NR (new radio) mMIMO (massive MIMO) Software License, perpetual license, technology 5G NR TDD/FDD, per cell/carrier	\$ 1,000.00	\$ 10,000.00	\$ 5,500.00
4.2.13	LTE Open RAN eNB SW Fee, cost of (1) perpetual license per cell site, technology LTE TDD/FDD	\$ 2,000.00	\$ 20,000.00	\$ 11,000.00
4.2.14	5G NR Open RAN eNB SW Fee, cost of (1) perpetual license per cell site, technology 5G NR TDD/FDD	\$ 2,000.00	\$ 20,000.00	\$ 11,000.00
4.2.15	Open RAN Management System, cost of one perpetual license for 1 cell/carrier, technology	\$ 100.00	\$ 5,000.00	\$ 2,550.00

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
	LTE/5G NR TDD/FDD			
5	<b>Services</b> For design, implementation, installation, testing, or other costs and/or fees paid to deploy the replacement equipment and/or systems in the conterminous (contiguous) United States. An additional 30-50% needed for Services Specific to: Alaska, American Samoa, Hawaii, Puerto Rico and Virgin Islands.			
5.1.00	<b>Preplanning</b>			
5.1.1	NTP (Notice to Proceed) Package (per site)	\$ 850.00	\$ 1,000.00	\$ 925.00
5.1.2	A&E Walk (per site)	\$ 3,150.00	\$ 5,500.00	\$ 4,325.00
5.1.3	Utility Coordination	\$ 250.00	\$ 2,744.17	\$ 1,497.09
5.1.4	Consultation with Counsel on Finalized Rules & Regulations - (3-10 hours)	\$ 1,500.00	\$ 5,000.00	\$ 3,250.00
5.2.00	<b>Site Acquisition</b>			
5.2.1	Existing Colocation (per site, flat fee) – (Low) without A&E, permitting and Legal; (High) full scope	\$ 2,900.00	\$ 30,000.00	\$ 16,450.00
5.3.00	<b>Site Surveys</b>			
5.3.1	Drone - Visual Inspection (per site)	\$ 925.00	\$ 2,058.13	\$ 1,491.57
5.3.2	Drone - Infrared Inspection - expenses not included (per site)	\$ 5,000.00	\$ 10,000.00	\$ 7,500.00
5.3.3	Drone - Additional field work - day rate - expenses not included	\$ 1,500.00	\$ 2,000.00	\$ 1,750.00
5.3.4	Site survey - (from ground) distance to site/complexity of site (including ground measurement) (per site)	\$ 945.00	\$ 25,000.00	\$ 12,972.50
5.4.00	<b>RF Engineering</b>			
5.4.1	Construction Drawings (per site)	\$ 2,031.00	\$ 5,333.33	\$ 3,682.17
5.4.2	MPE Survey RF Emissions (per site)	\$ 1,219.24	\$ 1,700.00	\$ 1,459.62
5.4.3	Modeling, Site Design, Performance Troubleshooting, Internal Team Optimization (per site)	\$ 3,585.20	\$ 5,053.00	\$ 4,319.10
5.4.4	RF Model Tuning - Propagation Model per morphology (Sub Urban,Urban,Dense Urban or Rural)	\$ 79,923.00	\$ 140,000.00	\$ 109,961.50
5.4.5	Drone - Performance Mapping (RF Measurements) (per site)	\$ 15,000.00	\$ 30,000.00	\$ 22,500.00

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Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
<b>5.5.00</b>	<b>Interim Facility Requirement</b>			
5.5.1	Cost of temporary site (COW) during tower replacement or modification	\$ 37,710.53	\$ 60,000.00	\$ 48,855.27
<b>5.6.00</b>	<b>Leasing</b>			
5.6.1	Negotiation of co-location contracts/leases (2-4 hours per contract)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.6.2	Lease review (per site)	\$ 450.00	\$ 823.25	\$ 636.63
5.6.3	Attend Scoping Meeting/Coordinate with RF (per site)	\$ 236.00	\$ 450.00	\$ 343.00
5.6.4	Landlord consent and notice to Landlord (per site)	\$ 400.00	\$ 1,125.00	\$ 762.50
5.6.5	Site Plan - (lease exhibit) (per site)	\$ 1,250.00	\$ 2,150.00	\$ 1,700.00
5.6.6	Co-location application (per site)	\$ 479.27	\$ 800.00	\$ 639.64
<b>5.7.00</b>	<b>Project Management</b>			
5.7.1	Project Management - carrier internal (per person per month)	\$ 7,785.00	\$ 12,975.00	\$ 10,380.00
5.7.2	Review work orders and related purchase orders - (1-4 hour per work order)	\$ 500.00	\$ 2,000.00	\$ 1,250.00
5.7.3	Project Management (per person per month)	\$ 25,950.00	\$ 51,900.00	\$ 38,925.00
5.7.4	Construction Management (per person per month)	\$ 21,666.00	\$ 25,950.00	\$ 23,808.00
5.7.5	NOC Staff Augments - (per person per month)	\$ 14,705.00	\$ 17,300.00	\$ 16,002.50
5.7.6	Transition Planning for Cutover - complexity of equipment changes (per site)	\$ 5,000.00	\$ 15,000.00	\$ 10,000.00
5.7.7	Transition Planning for Cutover: Optical Network Subscriber and network migration services up to 16 nodes additional for add-on's	\$ 3,500.00	\$ 11,000.00	\$ 7,250.00
5.7.8	Legal review of customer communications related liability, indemnification and risk management in associated contracts and SOW - (6-8 hours)	\$ 3,000.00	\$ 4,000.00	\$ 3,500.00
<b>5.8.00</b>	<b>Spectrum Planning and Management</b>			
5.8.1	Leasing or purchase of additional spectrum and related negotiations - (8-10 hours per agreement)	\$ 4,000.00	\$ 5,000.00	\$ 4,500.00
5.8.2	Preparation of purchase or lease agreement (3-5 hours per agreement)	\$ 1,500.00	\$ 2,500.00	\$ 2,000.00
5.8.3	Preparation and submission of any required FCC filings for permission (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
<b>5.9.00</b>	<b>Training</b>			
5.9.1	Product, Engineering and Operations Training Courses (classroom or web per student/day)	\$ 750.00	\$ 1,625.00	\$ 1,187.50



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Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
5.9.2	Onsite-Knowledge Transfer (per week)	\$ 7,000.00	\$ 12,000.00	\$ 9,500.00
5.9.3	Subscription (per person 5-11 plus flat fee)	\$ 17,300.00	\$ 32,900.00	\$ 25,100.00
5.9.4	Optical Training Service - 3 to 4 day instruction	\$ 13,030.00	\$ 15,704.00	\$ 14,367.00
5.9.5	Open vRAN Training - 3 to 4 day	\$ 10,000.00	\$ 15,000.00	\$ 12,500.00
5.10.00	<b>Resident Engineer/Staff</b>			
5.10.1	RAN/CORE Engineer - to provide on-site support during and after turn-over for 1 year (per person/per quarter)	\$ 50,000.00	\$ 100,000.00	\$ 75,000.00
5.10.2	Network Operations - to provide on-site support during and after turn-over – internal labor (per person/per year)	\$ 93,600.00	\$ 156,000.00	\$ 124,800.00
5.11.00	<b>VoLTE Voice Coordination with Providers</b>			
5.11.1	VOLTE Optimization (per site)	\$ 3,675.00	\$ 4,928.00	\$ 4,301.50
5.12.00	<b>Structural Engineering / Tower Studies</b>			
5.12.1	Structural Analysis - complexity of design (per site)	\$ 2,261.14	\$ 4,550.00	\$ 3,405.57
5.12.2	Mount Analysis - size of tower, complexity of loading scenarios (per site)	\$ 1,250.00	\$ 8,000.00	\$ 4,625.00
5.12.3	Tower/Mount Mapping (per tower)	\$ 11,084.03	\$ 13,720.86	\$ 12,402.45
5.12.4	Review Contracts and Statements of Work - (2-3 hours per contract)	\$ 1,000.00	\$ 1,500.00	\$ 1,250.00
5.13.00	<b>Negotiating with Tower Owners</b>			
5.13.1	Executed Agreement (per site)	\$ 3,688.76	\$ 5,200.00	\$ 4,444.38
5.13.2	Fully Executed Amendment (per site)	\$ 3,250.00	\$ 4,390.68	\$ 3,820.34
5.13.3	Fully Executed Amendment - Non-MLA (per site)	\$ 3,000.00	\$ 4,939.51	\$ 3,969.76
5.13.4	Legal review of tower leases and support of negotiations - (8-10 hours per lease)	\$ 4,000.00	\$ 5,000.00	\$ 4,500.00
5.14.00	<b>Network Engineering Services</b>			
5.14.1	CIQ creation/review (per site)	\$ 384.62	\$ 840.00	\$ 612.31
5.14.2	SCF Creation / WO for new sites up to 12 carriers (per site)	\$ 600.00	\$ 3,200.00	\$ 1,900.00
5.14.3	Engineering Services (RAN) (per site)	\$ 250.00	\$ 500.00	\$ 375.00
5.14.4	Engineering Services (Core) (per core)	\$ 5,000.00	\$ 50,000.00	\$ 27,500.00

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Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
5.14.5	Engineering Services (IP Network) (per site)	\$ 250.00	\$ 1,000.00	\$ 625.00
5.14.6	Engineering Services (Microwave Backhaul) (per link)	\$ 250.00	\$ 650.00	\$ 450.00
5.14.7	Engineering Services (Microwave Backhaul) FCC PCN Coordination) (per link)	\$ 2,500.00	\$ 2,500.00	\$ 2,500.00
5.14.8	Negotiation & Review of RF engineering, AM Detuning, Interference or Intermodulation analysis, RF Emissions Study, and RF Exposure Measurements contracts - (2-3 hours per contract)	\$ 1,000.00	\$ 1,500.00	\$ 1,250.00
5.14.9	Open RAN deployment services, CU/DU deployment instantiation support, per man/hour	\$ 100.00	\$ 500.00	\$ 300.00
5.14.10	Tier 2 & Tier 3 Operational Support, per man/hour	\$ 100.00	\$ 500.00	\$ 300.00
5.15.00	<b>Tower/Water Tower/Barn/Rooftop Preparation</b>			
5.15.1	Remove RRH/RRU, Antenna and cabling	\$ 1,850.00	\$ 3,000.00	\$ 2,425.00
5.15.2	Remove 3 RRH/RRU, 3 Antenna and 3 cabling	\$ 3,250.00	\$ 3,700.00	\$ 3,475.00
5.15.3	Remove BBU	\$ 500.00	\$ 700.00	\$ 600.00
5.15.4	Remove BBU and replace with new BBU	\$ 2,500.00	\$ 3,200.00	\$ 2,850.00
5.15.5	Antenna Install (with material)	\$ 5,650.00	\$ 6,850.00	\$ 6,250.00
5.15.6	Radio Install - each radio - height of radios on tower; # RF jumper cables per radio/antenna	\$ 1,000.00	\$ 3,500.00	\$ 2,250.00
5.15.7	Install new Power Trunk	\$ 3,850.00	\$ 4,650.00	\$ 4,250.00
5.15.8	Install new Fiber Trunk	\$ 4,200.00	\$ 5,100.00	\$ 4,650.00
5.15.9	Install Hybrid Cable (without Material)	\$ 1,199.35	\$ 7,625.00	\$ 4,412.18
5.15.10	Fiber Inspection, Cleaning and Light Source & Power Meter Testing * Post Installation (per 24 fibers)	\$ 2,000.00	\$ 4,423.65	\$ 3,211.83
5.15.11	Raycap Install/Upgrade	\$ 650.00	\$ 916.67	\$ 783.34
5.15.12	Install Sector Frame	\$ 4,850.00	\$ 8,572.26	\$ 6,711.13
5.15.13	Installation of outdoor cabinet with one battery string	\$ 4,112.64	\$ 5,898.45	\$ 5,005.55
5.15.14	Installation of outdoor battery cabinet with two strings of batteries	\$ 5,746.67	\$ 8,572.00	\$ 7,159.34
5.15.15	Installation of indoor cabinet with one battery string	\$ 390.63	\$ 875.00	\$ 632.82
5.15.16	Installation of indoor battery cabinet with two strings of batteries	\$ 781.25	\$ 5,157.00	\$ 2,969.13
5.15.17	PDU Installation (tower top, providing PDU)	\$ 1,252.33	\$ 1,586.95	\$ 1,419.64
5.15.18	DC power plant Install	\$ 1,250.00	\$ 2,975.00	\$ 2,112.50
5.16.00	<b>Antenna/Radio R&amp;R - Tower up to 200', Not Water Tank</b>			

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
5.16.1	Rip & Replace - Up to (3) Antenna Replacement (Install/Swap up to (3) new antennas, with associated jumpers, plumbing/re-plumbing etc.)	\$ 7,650.00	\$ 13,240.39	\$ 10,445.20
5.16.2	Rip & Replace - Up to (6) Antenna Replacement (Install/Swap up to (6) new antennas, with associated jumpers, plumbing/re-plumbing etc.)	\$ 11,677.45	\$ 23,293.97	\$ 17,485.71
5.16.3	Rip & Replace - Up to (3) Radios (RRH/RRU) Replacement (Install/Swap up to (3) new radios, with associated jumpers, plumbing/re-plumbing accordingly etc. No new antennas or hybrid)	\$ 7,000.00	\$ 19,301.12	\$ 13,150.56
5.16.4	Rip & Replace - Up to (6) Radios (RRH/RRU) Replacement (Install/Swap up to (6) new radios, with associated jumpers, plumbing/re-plumbing accordingly etc. No new antennas or hybrid)	\$ 11,100.00	\$ 21,888.39	\$ 16,494.20
5.16.5	Rip & Replace - Up to (6) New Radios, (3) New Antennas (Install/Swap up to (6) new radios, (3) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	\$ 17,687.17	\$ 28,776.09	\$ 23,231.63
5.16.6	Rip & Replace - Up to (9) New Radios, (3) New Antennas (Install/Swap up to (9) new radios, (3) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	\$ 19,500.00	\$ 32,250.00	\$ 25,875.00
5.16.7	Rip & Replace - Up to (12) New Radios, (6) New Antennas (Install/Swap up to (12) new radios, (6) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	\$ 29,212.94	\$ 49,602.02	\$ 39,407.48
5.16.8	Install/Swap up to (18) new radios, (9) new antennas with associated jumpers, plumbing/re-plumbing accordingly etc. No new hybrid)	\$ 38,201.86	\$ 48,747.17	\$ 43,474.52
5.17.00	<b>Antenna/Radio R&amp;R - Non-penetrating Roof Mounted</b>			
5.17.1	Rip & Replace - Up to (3) Antenna Replacement (Install/Swap up to (3) new antennas, with associated jumpers, plumbing/re-plumbing etc.)	\$ 6,805.30	\$ 9,073.73	\$ 7,939.52
5.17.2	Rip & Replace - Up to (6) Antenna Replacement (Install/Swap up to (6) new antennas, with associated jumpers, plumbing/re-plumbing etc.)	\$ 12,470.48	\$ 16,627.31	\$ 14,548.90
5.17.3	Rip & Replace - Up to (3) Radios (RRH/RRU) Replacement (Install/Swap up to (3) new radios, with associated jumpers, plumbing/re-plumbing accordingly etc. No new antennas or hybrid)	\$ 9,475.84	\$ 12,634.46	\$ 11,055.15

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
5.17.4	Rip & Replace - Up to (6) Radios (RRH/RRU) Replacement (Install/Swap up to (6) new radios, with associated jumpers, plumbing/re-plumbing accordingly etc. No new antennas or hybrid)	\$ 13,291.30	\$ 17,721.73	\$ 15,506.52
5.17.5	Rip & Replace - Up to (6) New Radios, (3) New Antennas (Install/Swap up to (6) new radios, (3) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	\$ 16,582.07	\$ 22,109.42	\$ 19,345.75
5.17.6	Rip & Replace - Up to (9) New Radios, (3) New Antennas (Install/Swap up to (9) new radios, (3) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	\$ 18,063.61	\$ 24,084.82	\$ 21,074.22
5.17.7	Rip & Replace - Up to (12) New Radios, (6) New Antennas (Install/Swap up to (12) new radios, (6) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	\$ 32,201.51	\$ 42,935.35	\$ 37,568.43
5.18.00	<b>Shelter Cable Entry Port Additions</b>			
5.18.1	Up to six (6) entry ports (provide and install)	\$ 406.25	\$ 2,032.56	\$ 1,219.41
5.19.00	<b>Ground Buss Bars</b>			
5.19.1	Tower or Shelter Buss bar addition	\$ 231.25	\$ 520.72	\$ 375.99
5.20.00	<b>Tower Modifications</b>			
5.20.1	Modification Design (per site)	\$ 1,100.00	\$ 5,159.04	\$ 3,129.52
5.20.2	Foundation Drawings/Inspection (per site)	\$ 6,858.19	\$ 9,514.28	\$ 8,186.24
5.20.3	Foundation Install <200' (Monopole/SS)	\$ 39,726.54	\$ 130,999.37	\$ 85,362.96
5.20.4	Foundation Install <200' (Monopole/SS) - Batch Plant	\$ 85,794.41	\$ 282,909.46	\$ 184,351.94
5.20.5	Demo Existing Tower	\$ 13,109.00	\$ 25,000.00	\$ 19,054.50
5.20.6	Minor Tower reinforcement/modifications - size of tower, extent of reinforcing	\$ 1,000.00	\$ 10,000.00	\$ 5,500.00
5.20.7	Build new <200' monopole (Erection only including crane)	\$ 14,154.00	\$ 29,000.00	\$ 21,577.00
5.20.8	Build new <200' monopole - Materials	\$ 36,063.00	\$ 117,651.05	\$ 76,857.03
5.20.9	Build new <300' SST (Erection only including crane)	\$ 16,332.00	\$ 42,500.00	\$ 29,416.00
5.20.10	Build new <300' SST - Materials	\$ 33,000.00	\$ 93,514.98	\$ 63,257.49
5.20.11	Major Tower reinforcement/modifications - size of tower; tower design; tower foundations;	\$ 10,000.00	\$ 100,000.00	\$ 55,000.00

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		Low	High	Average
	guy wires			
5.20.12	Serous Tower reinforcement/modifications - tower foundation mods; tower "wrap"	\$ 100,000.00	\$ 250,000.00	\$ 175,000.00
5.20.13	Carrier Relocation BOM (per site)	\$ 650.00	\$ 14,789.99	\$ 7,720.00
5.20.14	Carrier Relocation Civil Work (per site)	\$ 1,785.71	\$ 32,357.15	\$ 17,071.43
5.20.15	Carrier Relocation L&A Work (per site)	\$ 23,332.30	\$ 65,391.43	\$ 44,361.87
5.21.00	<b>Site Work</b>	\$ 3,000.00	\$ 10,000.00	\$ 6,500.00
5.21.1	Pre-Construction Site Walk - distance to site, size of tower	\$ 971.19	\$ 2,150.00	\$ 1,560.60
5.21.2	Parallel/New 200A Service	\$ 8,792.00	\$ 27,721.79	\$ 18,256.90
5.21.3	Upgrade to 200A Service	\$ 6,000.00	\$ 7,000.00	\$ 6,500.00
5.21.4	Conduit and Fiber from Cabinet to H Frame	\$ 1,750.00	\$ 2,150.00	\$ 1,950.00
5.21.5	Hand Trenching from Backhaul Cabinet to New Cabinet (25')	\$ 1,724.46	\$ 2,750.00	\$ 2,237.23
5.21.6	Trenching and Cabling from New Cabinet to Power Panel (100' – includes materials)	\$ 15,150.00	\$ 18,350.00	\$ 16,750.00
5.21.7	Re-cable MW Dish to New Cabinet (100' – includes materials)	\$ 1,450.00	\$ 1,750.00	\$ 1,600.00
5.21.8	Install Ice Bridge (~30')	\$ 4,680.00	\$ 6,450.00	\$ 5,565.00
5.21.9	Cement Pad Install	\$ 3,683.94	\$ 8,252.03	\$ 5,967.99
5.21.10	Install BBU (rack or cabinet)	\$ 1,900.00	\$ 3,893.46	\$ 2,896.73
5.21.11	Installation of new 19" rack in existing shelter	\$ 2,796.00	\$ 3,322.00	\$ 3,059.00
5.21.12	GPS install	\$ 370.00	\$ 2,075.47	\$ 1,222.74
5.21.13	Install collar mounts (Tri & Quad) V-Booms, (with materials) – (Per Mount)	\$ 3,628.00	\$ 8,042.00	\$ 5,835.00
5.21.14	Install MOVE platform (with Materials) (Per Mount)	\$ 28,600.00	\$ 33,600.00	\$ 31,100.00
5.21.15	DC Cable Pull Through Conduit Sizes #16AWG to #2AWG	\$ 550.00	\$ 700.00	\$ 625.00
5.21.16	Re-use/Re-working existing hybrid (Cabling to new equipment and baseband along with required testing) – up to 12 fibers	\$ 3,437.00	\$ 4,084.00	\$ 3,760.50
5.21.17	Install Hybrid Cable (with Material)	\$ 17,100.00	\$ 20,700.00	\$ 18,900.00
5.21.18	Upgrade Generator (modification reports, labor and modification)	\$ 23,500.00	\$ 75,000.00	\$ 49,250.00
5.21.19	Site Inspection - distance to site/complexity of site	\$ 800.00	\$ 25,000.00	\$ 12,900.00
5.21.20	Environmental Work (per site)	\$ 6,000.00	\$ 7,000.00	\$ 6,500.00
5.21.21	Solar Design (per site)	\$ 15,000.00	\$ 20,000.00	\$ 17,500.00
5.21.22	25-50 Amp Solar Upgrade (Install and Material) (per site)	\$ 62,500.00	\$ 162,500.00	\$ 112,500.00
5.21.23	75-100 Amp Solar Upgrade (Install and Material) (per site)	\$ 187,500.00	\$ 325,000.00	\$ 256,250.00

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5.21.24	Commissioning and Integration of single technology – per site	\$ 1,785.00	\$ 2,630.51	\$ 2,207.76
5.21.25	Closeout Package – Microwave (per link)	\$ 1,500.00	\$ 2,500.00	\$ 2,000.00
5.21.26	Closeout Package – (per site)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
<b>5.22.00 Cable Sweep &amp; PIM Testing</b>				
5.22.1	PIM Test and Remediate* 0 to 12 Paths	\$ 1,050.00	\$ 9,014.25	\$ 5,032.13
5.22.2	PIM Test and Remediate* 13 to 24 Paths	\$ 2,950.00	\$ 5,450.00	\$ 4,200.00
5.22.3	PIM Test and Remediate* 25 to 36 Paths	\$ 4,500.00	\$ 6,250.00	\$ 5,375.00
5.22.4	Sweep Test (per line)	\$ 171.00	\$ 900.00	\$ 535.50
<b>5.23.00 Connectivity Upgrades or Extensions</b>				
5.23.1	Review of interconnection and colocation agreements - (2-5 hours per contract)	\$ 1,000.00	\$ 2,500.00	\$ 1,750.00
<b>5.24.00 Tower/Installation Crews</b>				
5.24.1	Mobilization Less than or Equal to 250 Miles (2-4 Member Crew)	\$ 1,800.00	\$ 6,000.00	\$ 3,900.00
5.24.2	Mobilization 251-500 Miles (2-4 Member Crew)	\$ 1,620.00	\$ 4,050.00	\$ 2,835.00
5.24.3	Mobilization Greater than 500 Miles (2-4 Member Crew)	\$ 2,187.00	\$ 7,967.50	\$ 5,077.25
5.24.4	Mobilization Ground Crew - (2-4 Member Crew) - day rate	\$ 4,363.61	\$ 8,571.00	\$ 6,467.31
5.24.5	Mobilization Tower (2-4 Member Crew) - day rate	\$ 11,429.00	\$ 17,142.00	\$ 14,285.50
5.24.6	Troubleshooting – RRU Replacement during the maintenance window on site per hour (Up to four-man crew)	\$ 872.72	\$ 1,105.91	\$ 989.32
5.24.7	Troubleshooting – RRU Replacement during the non-maintenance window on site per hour (Up to four-man crew)	\$ 872.72	\$ 1,105.91	\$ 989.32
5.24.8	General Troubleshooting – Up to 4 hours of onsite troubleshooting (Up to four men crew)	\$ 3,490.89	\$ 4,423.65	\$ 3,957.27
5.24.9	General Troubleshooting – Up to 8 hours of onsite troubleshooting (Up to four men crew)	\$ 6,981.77	\$ 8,847.30	\$ 7,914.54
5.24.10	Troubleshooting – Single Antenna replacement during the maintenance window	\$ 1,570.90	\$ 4,887.24	\$ 3,229.07
5.24.11	Troubleshooting – Antenna replacement during the non-maintenance window	\$ 1,570.90	\$ 4,887.24	\$ 3,229.07
5.24.12	Maintenance window work per night/per 3-man crew (per night)	\$ 5,890.87	\$ 8,063.95	\$ 6,977.41
5.24.13	Microwave Pathing - During Construction (per link)	\$ 2,250.00	\$ 3,000.00	\$ 2,625.00
5.24.14	Microwave Pathing - Post Construction (per link)	\$ 3,500.00	\$ 4,666.67	\$ 4,083.34
5.24.15	Microwave Commissioning and Integration (per link)	\$ 2,093.00	\$ 3,000.00	\$ 2,546.50

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
5.24.16	Microwave relocation during construction (per site)	\$ 16,692.00	\$ 26,742.85	\$ 21,717.43
5.25.00	<b>Helicopter Lift (e.g., for a rooftop tower, complex tower, tall structure, or terrain constrained location requiring helicopter lift)</b>			
5.25.1	Max 1000 lbs - 6 hr day rate + hourly	\$ 14,000.00	\$ 30,000.00	\$ 22,000.00
5.25.2	Max lift 3,200 lbs - 6 hr day rate + hourly	\$ 36,000.00	\$ 76,000.00	\$ 56,000.00
5.25.3	Mobilization/demobilization is priced by the hourly rate for each helicopter - 6 hours/each	\$ 15,000.00	\$ 54,000.00	\$ 34,500.00
5.26.00	<b>Equipment Rental</b>			
5.26.1	Crane - Ave 8 hour hook time based on tower height, miles, size, hourly rate	\$ 1,450.00	\$ 30,450.00	\$ 15,950.00
5.26.2	Bucket Truck (day rate) - dependent on location	\$ 937.50	\$ 1,250.00	\$ 1,093.75
5.26.3	Manlift or Boomlift 45-135' (day rate) - dependent on location	\$ 395.00	\$ 2,359.47	\$ 1,377.24
5.26.4	Manlift or Boomlift 45-135' (week rate) - dependent on location	\$ 869.00	\$ 7,524.54	\$ 4,196.77
5.26.5	Manlift or Boomlift 45-135' (monthly rate) - dependent on location	\$ 1,777.00	\$ 10,833.00	\$ 6,305.00
5.26.6	Gin Pole Cost (per job)	\$ 7,725.49	\$ 32,447.07	\$ 20,086.28
5.26.7	Matting for Temporary Roads - Grid Mats Cost per 100ft	\$ 2,500.00	\$ 7,500.00	\$ 5,000.00
5.26.8	Snow Removal Equipment – per vehicle	\$ 500.00	\$ 1,500.00	\$ 1,000.00
5.26.9	Prime Mover or Similar for Towing - per vehicle	\$ 2,500.00	\$ 10,000.00	\$ 6,250.00
5.26.10	Straight Truck or Similar for Counterweight - per vehicle	\$ 500.00	\$ 2,000.00	\$ 1,250.00
5.26.11	Forklift of Similar for Component Transport - per vehicle	\$ 500.00	\$ 2,000.00	\$ 1,250.00
5.28.00	<b>Virtual/Cloud Core Deployment</b>			
5.28.1	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, up to 10k subscribers)	\$ 150,000.00	\$ 1,324,893.00	\$ 737,446.50
5.28.2	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, up to 50k subscribers)	\$ 1,324,893.00	\$ 1,852,250.00	\$ 1,588,571.50
5.28.3	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, >200k subscribers)	\$ 1,852,250.00	\$ 2,401,168.00	\$ 2,126,709.00
5.28.4	Cloud - Virtual IMS (CTAS, IMS Core, MRF, AGW, A-SBC, HSS, ePDG, I-SBC, DRA, PCRF, 4G EPC, E-CSCF, LI interface, SMSC, MMSC, VM), up to 10k subscribers	\$ 500,000.00	\$ 1,497,230.00	\$ 998,615.00

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5.28.5	Cloud - Virtual IMS (CTAS, IMS Core, MRF, AGW, A-SBC, HSS, ePDG, I-SBC, DRA, PCRF, 4G EPC, E-CSCF, LI interface, SMSC, MMSC, VM), up to 100k subscribers	\$ 1,325,000.00	\$ 2,354,630.00	\$ 1,839,815.00
5.28.6	Cloud - Virtual IMS (CTAS, IMS Core, MRF, AGW, A-SBC, HSS, ePDG, I-SBC, DRA, PCRF, 4G EPC, E-CSCF, LI interface, SMSC, MMSC, VM), >200k subscribers	\$ 2,150,000.00	\$ 3,000,000.00	\$ 2,575,000.00
<b>5.29.00</b>	<b>GPON/XGS (FTTH) Deployments</b>			
5.29.1	Backbone WDM/optical transport networking equipment – (per network)	\$ 75,000.00	\$ 300,000.00	\$ 187,500.00
5.29.2	Deployment - Cloud Computing – (per network)	\$ 50,000.00	\$ 20,000,000.00	\$ 10,025,000.00
5.29.3	Deployment - Optical Transmission – (per network)	\$ 50,000.00	\$ 20,000,000.00	\$ 10,025,000.00
5.29.4	Deployment - Data Transmission – (per network)	\$ 15,000.00	\$ 10,000,000.00	\$ 5,007,500.00
5.29.5	Deployment - GPON/XGS EMS – FTTH – (per network)	\$ 10,000.00	\$ 100,000.00	\$ 55,000.00
5.29.6	RAN EMS Deployment – (per network)	\$ 200,000.00	\$ 750,000.00	\$ 475,000.00
<b>5.30.00</b>	<b>Location (Facility) Upgrades for New Equipment</b>			
5.30.1	Research to ensure compliance with tower standards (ANSI/TIA-222-H) due to modifications triggering non-compliant towers to comply - (3-5 hours per site)	\$ 1,500.00	\$ 2,500.00	\$ 2,000.00
5.30.2	Due diligence review of modifications/upgrades for compliance with FCC NEPA rules, including Section 106 Review, and FAA and ASR rules (3-5 hours per site)	\$ 1,500.00	\$ 2,500.00	\$ 2,000.00
5.30.3	Depending on spectrum licenses, preparation and submission of any required FCC applications for modifications for facility upgrades, equipment changes, and preparation of any FAA applications and ASR applications for structure modifications or lighting changes - (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.30.4	Preparation and submission of any required post-construction filings including notifications to FAA and FCC of completion of construction, and any required application filings for spectrum applications or licenses - (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
<b>5.31.00</b>	<b>Field Engineering</b>			
5.31.1	Optical Fiber Optic Characterization - 8 Strands	\$ 6,634.00	\$ 6,634.00	\$ 6,634.00
5.31.2	Onsite Sr. Optical Engineer Support (40 hours)	\$ 19,049.00	\$ 19,049.00	\$ 19,049.00
5.31.3	Remote Sr Optical Engineer Support (40 hours)	\$ 12,536.00	\$ 12,536.00	\$ 12,536.00



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5.32.0	<b>Off-site Integration &amp; Staging</b>			
5.32.1	NAIC Integration Add-on for UPS, Router, Switch, Server, Appliance, Storage 10RU+ per Device (from 5 to 15 devices)	\$ 3,135.00	\$ 6,051.00	\$ 4,593.00
5.32.2	NAIC Integration Add-on for UPS, Router, Switch, Server, Appliance, Storage Up to 9RU per Device (10 - 20 devices)	\$ 3,664.00	\$ 4,683.00	\$ 4,173.50
5.32.3	Optical 2-Slot to 16 Slot Level 1 Staging	\$ 5,267.00	\$ 5,283.00	\$ 5,275.00
5.33.0	<b>Lab Testing - Interoperability Testing and Compliance for New Equipment</b>			
5.33.1	Engineering consulting for network planning & scenario analysis (remote per week)	\$ 15,241.00	\$ 22,862.00	\$ 19,051.50
5.33.2	IoT (Interoperability testing) for RAN & Core compatibility (per network)	\$ 80,000.00	\$ 336,000.00	\$ 208,000.00
5.33.3	IoT (Interoperability testing) for RAN compatibility (per network)	\$ 80,000.00	\$ 336,000.00	\$ 208,000.00
5.33.4	Contract review - (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.34.0	<b>National Environmental Policy Act (NEPA) &amp; National Historic Preservation Act (NHPA)</b>	\$ 1,300.00	\$ 1,550.00	\$ 1,425.00
5.34.1	Due Diligence Review for compliance with FCC NEPA and Section 106 rules for colocation - (3-5 hours per site)	\$ 1,500.00	\$ 2,500.00	\$ 2,000.00
5.34.2	Legal Review for Environmental Consultant SOWs for NEPA and Section 106. and all work related - (2-3 hours per site)	\$ 1,000.00	\$ 1,500.00	\$ 1,250.00
5.34.3	Regulatory Management (per site)	\$ 1,000.00	\$ 1,200.00	\$ 1,100.00
5.35.0	<b>Attorney</b>			
5.35.1	Negotiate and review vendor contracts - (6-12 hours per contract)	\$ 3,000.00	\$ 6,000.00	\$ 4,500.00
5.35.2	Legal review of Environmental Consultant Contracts and SOWs for Phase I Environmental Review - (1-3 hours per contract)	\$ 500.00	\$ 1,500.00	\$ 1,000.00
5.35.3	Preparation of any required FAA and ASR filings - (5-8 hours per application)	\$ 2,500.00	\$ 4,000.00	\$ 3,250.00
5.35.4	Legal fees for research and preparation and filing for any zoning or local permitting requirements - (3-4 hours per site)	\$ 1,500.00	\$ 2,000.00	\$ 1,750.00
5.35.5	Review insurance requirements and OSHA standards for tower climbers - (3-6 hours)	\$ 1,500.00	\$ 3,000.00	\$ 2,250.00
5.35.6	Spectrum acquisition agreement - (4-8 hours per contract)	\$ 2,000.00	\$ 4,000.00	\$ 3,000.00
5.35.7	Review contracts for proper insurance, indemnification, liability and risk management - (2-4	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00

Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
	hours)			
5.35.8	Review contracts for disposal to ensure compliance with law and liability related issues - (2- 4 hours per contract)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.35.9	Review of applicable tax code (2-4 hours per inquiry)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.36.0	<b>Legal Fees Zoning/Permitting issues</b>			
5.36.1	Zoning and Permitting determination (per site)	\$ 500.00	\$ 823.25	\$ 661.63
5.36.2	Zoning drawing (per site)	\$ 2,000.00	\$ 2,606.96	\$ 2,303.48
5.36.3	Zoning Approval (per site)	\$ 1,800.00	\$ 2,881.38	\$ 2,340.69
5.36.4	Attendance at additional zoning hearings	\$ 1,150.00	\$ 1,400.00	\$ 1,275.00
5.36.5	Complex zoning (including attendance at 2 hearings)	\$ 4,433.61	\$ 5,750.00	\$ 5,091.81
5.36.6	Completion and submittal of permit (building or electrical) (per site)	\$ 1,330.08	\$ 1,650.00	\$ 1,490.04
5.36.7	Permit Pickup (per site)	\$ 665.04	\$ 900.00	\$ 782.52
5.36.8	Legal fees for research and preparation and filing for any zoning or local permitting requirements (per site)	\$ 1,500.00	\$ 2,000.00	\$ 1,750.00
5.36.9	Jurisdictional Fees (per site)	\$ 3,500.00	\$ 4,250.00	\$ 3,875.00
5.36.10	Phase 1 ESA (per site)	\$ 1,800.00	\$ 4,665.09	\$ 3,232.55
5.36.11	NEPA/SHPO Checklist only (per site)	\$ 416.76	\$ 515.90	\$ 466.33
5.36.12	Photo Simulation (per site)	\$ 1,350.00	\$ 1,650.00	\$ 1,500.00
5.36.13	Negotiation & Review of RF engineering contracts -- (2-4 hours per contract)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.37.0	<b>Legal Fees Zoning/Permitting Issues - Microwave</b>			
5.37.1	FCC Licensing - Microwave - (1-2 hours)	\$ 500.00	\$ 1,000.00	\$ 750.00
5.37.2	New facilities - (1-2 hours)	\$ 500.00	\$ 1,000.00	\$ 750.00
5.37.3	Modify facilities - (4-6 hours)	\$ 2,000.00	\$ 3,000.00	\$ 2,500.00
5.37.4	Requests for Special Temporary Authority - (6-8 hours)	\$ 3,000.00	\$ 4,000.00	\$ 3,500.00
5.37.5	Rule Waivers - (4-6 hours)	\$ 2,000.00	\$ 3,000.00	\$ 2,500.00
5.37.6	Spectrum Leasing (De Facto) - (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.37.7	FCC legal review and application filings - Fixed Wireless Link Replacement (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.38.0	<b>Disposal Costs/Logistics</b>			

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5.38.1	Staging, transportation, warehousing and disposal (per site)	\$ 1,992.00	\$ 5,000.00	\$ 3,496.00
5.38.2	Decommission - Up to (3) antennas (6) runs of coax, mounts and miscellaneous hardware from tower top to inside the shelter to QWS	\$ 3,125.00	\$ 9,169.72	\$ 6,147.36
5.38.3	Decommission - Up to (9) antennas (12) runs of coax, mounts and miscellaneous hardware from tower top to inside the shelter to QWS	\$ 5,625.00	\$ 21,249.53	\$ 13,437.27
5.38.4	Decommission - Each additional antenna (including) , associated mount, line and miscellaneous hardware.	\$ 438.45	\$ 625.00	\$ 531.73
5.38.5	Decommission - Microwave antenna (including), associated mount, elliptical line and miscellaneous hardware.	\$ 1,687.50	\$ 6,058.12	\$ 3,872.81
5.38.6	Decommission In Shelter - 2nd eNodeB Rack, diplexers w/mount, RF coax jumpers:	\$ 1,437.50	\$ 4,293.98	\$ 2,865.74
5.38.7	Decommission - existing hybrid cable	\$ 898.39	\$ 5,174.72	\$ 3,036.56
5.38.8	Decommission - remove waveguide, fiber, CAT5/6, coaxial cable up to 1 5/8" (per foot)	\$ 1.04	\$ 6.75	\$ 3.90
5.38.9	Decommission - one outdoor cabinet	\$ 1,891.00	\$ 3,619.97	\$ 2,755.49
5.38.10	Decommission - Indoor 19" Rack with existing legacy BBU	\$ 4,071.65	\$ 6,333.68	\$ 5,202.67
5.38.11	Decommission - Indoor 19" Rack with up two battery strings	\$ 4,316.48	\$ 6,714.53	\$ 5,515.51
5.38.12	Decommission - Single antenna	\$ 317.18	\$ 401.93	\$ 359.56
5.39.0	<b>Compliant Disposal</b>			
5.39.1	Inventory, processing, destruction, disposal, recycling reporting and certification of Recycling - Citing ITAR (per site) - Transport not included	\$ 900.00	\$ 3,000.00	\$ 1,950.00
5.40.0	<b>FCC Filing Fees</b>			
5.40.1	New, Modification (Microwave) - per call sign (with \$250 regulatory fee)	\$ 555.00	\$ 555.00	\$ 555.00
5.40.2	Modify facilities - per call sign	\$ 140.00	\$ 305.00	\$ 222.50
5.40.3	Extension of Construction Authority (Microwave) - per call sign	\$ 110.00	\$ 110.00	\$ 110.00
5.40.4	Duplicate License (Microwave) - per call sign	\$ 70.00	\$ 70.00	\$ 70.00
5.40.5	Requests for Special Temporary Authority (Microwave) - Fee Exempt (per link)	\$ 140.00	\$ 140.00	\$ 140.00
5.40.6	Rule Waivers/Spectrum Leasing for new or sublease, Transfer of Control of a Lessee or a Sublessee or Extend Term of a Lease or Sublease (Microwave/Broadband 2.5GHz) - per call sign -\$70 each additional	\$ 110.00	\$ 110.00	\$ 110.00
5.40.7	Major modification for spectrum leasing (Microwave/Broadband 2.5GHz) - per lease ID	\$ 305.00	\$ 305.00	\$ 305.00

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5.40.8	New, Modification or Major Modification (Broadband 2.5GHz) - per call sign	\$ 305.00	\$ 305.00	\$ 305.00
5.40.9	Certification of Completion of Construction (Broadband 2.5GHz) - per call sign	\$ 895.00	\$ 895.00	\$ 895.00
5.40.10	Extension of Construction Authority (Broadband 2.5 GHz) - per call sign	\$ 305.00	\$ 305.00	\$ 305.00
5.40.11	Special Temporary Authority (Broadband 2.5 GHz) - per call sign or Market/Channel Block	\$ 140.00	\$ 140.00	\$ 140.00
5.40.12	New, Additional Facility, Major Modification (Cellular Radiotelephone) - per call sign	\$ 450.00	\$ 450.00	\$ 450.00
5.40.13	Minor Modification (Cellular Radiotelephone) - per call sign	\$ 120.00	\$ 120.00	\$ 120.00
5.40.14	Special Temporary Authority (Cellular Radiotelephone) - per request	\$ 395.00	\$ 395.00	\$ 395.00
5.40.15	Spectrum Leasing for new or sublease / Assignment of authorization or Transfer of Control (Full or Partial) / Transfer of Control of a Lessee or a Sublessee, Extend Term of a Lease or Sublease or Major Modification for Spectrum Leasing (Cellular Radio Telephone) - per call sign/lease	\$ 450.00	\$ 450.00	\$ 450.00
5.40.16	Minor modification for spectrum leasing (Cellular Radiotelephone) - per lease ID	\$ 120.00	\$ 120.00	\$ 120.00
5.40.17	Domestic 214 Application -\$1,155.00	\$ 1,155.00	\$ 1,155.00	\$ 1,155.00
5.41.0	<b>Tariff Filings</b>			
5.41.1	Tariff Filing Fee (per transmittal or cover letter)	\$ 925.00	\$ 925.00	\$ 925.00
5.41.2	Application for Special Permission Filing (request for waiver of any rule in Part 61)	\$ 925.00	\$ 925.00	\$ 925.00
5.41.3	Waiver of Part 69 Tariff Rules (per request)	\$ 925.00	\$ 925.00	\$ 925.00
5.42.0	<b>Accounting</b>			
5.42.1	Review of Depreciation Update Study (single state)	\$ 35,000.00	\$ 40,000.00	\$ 37,500.00
5.42.2	Each Additional State	\$ 1,285.00	\$ 1,285.00	\$ 1,285.00
5.42.3	Petition for Waiver (per petition)	\$ 8,000.00	\$ 9,000.00	\$ 8,500.00
5.42.4	Part 36 Separation Rules (per request)	\$ 8,000.00	\$ 9,000.00	\$ 8,500.00
5.43.0	<b>Security - Onsite</b>			
5.43.1	Fence/Compound Work (per site)	\$ 6,000.00	\$ 19,003.20	\$ 12,501.60
5.43.2	Security Guard - Hourly Rate	\$ 25.00	\$ 45.00	\$ 35.00
5.44.0	<b>Snow Cat Usage (8-12 hours day, plus operator expense)</b>	\$ 1,590.00	\$ 2,310.00	\$ 1,950.00

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5.45.0	<b>Storage, Warehousing, Material Handling</b>			
5.45.1	Contract review & negotiations (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.45.2	Logistics and Material Management & Warehousing (per site)	\$ 500.00	\$ 21,429.00	\$ 10,964.50
5.45.3	Kitting (per site) (receive products from multiple OEMs and suppliers and integrate the related items into a single package, pallet or other format as desired)	\$ 125.00	\$ 1,200.00	\$ 662.50
5.45.4	Storage (monthly)	\$ 4,000.00	\$ 6,000.00	\$ 5,000.00
5.46.0	<b>KPIs Pre &amp; Post Installation Support</b>			
5.46.1	Pre and post swap cluster KPI monitoring (per site)	\$ 1,652.00	\$ 3,000.00	\$ 2,326.00
5.47.0	<b>Drive Testing - Signal Strength Verification</b>			
5.47.1	Pre and post swap cluster drive testing (per site)	\$ 2,677.00	\$ 5,264.00	\$ 3,970.50
5.47.2	Single site verification drive testing (per site)	\$ 1,570.00	\$ 2,856.00	\$ 2,213.00
5.47.3	Troubleshooting (per hour/per man)	\$ 100.00	\$ 392.00	\$ 246.00
5.47.4	Pre-Launch Cluster Optimization - Pre and Post Drive Test (Up to 12 Carrier) (per site)	\$ 2,600.00	\$ 5,712.00	\$ 4,156.00
5.47.5	Mobility or FWA (non M-MIMO) Ground services base integration, cut over support, call / data test package for site with shelter (per site)	\$ 7,500.00	\$ 10,500.00	\$ 9,000.00
5.47.6	Cluster Optimization (Drive based) for FWA or Mobility (Per Technology (LTE or UMTS)), 10-Site Cluster)	\$ 71,900.00	\$ 77,900.00	\$ 74,900.00
5.47.7	Single site verification stationary testing for FWA (per site)	\$ 4,000.00	\$ 8,000.00	\$ 6,000.00
5.48.0	<b>911 &amp; E911 Services and Drive Test Services (47 CFR § 9.10(i)(2)(i)(B)(4)) (50m x/y)</b>			
5.48.1	Rehome E911 Drive Cost (per Cell Site) - ensuring call connects to right 911	\$ 375.00	\$ 568.00	\$ 471.50
5.48.2	Accuracy Testing (50 meter x/y) (Cost per Test Point, Average about 10 test points per County)	\$ 275.00	\$ 300.00	\$ 287.50
5.48.3	PSAP or County level KPI Accuracy Results Reports (Per Report)	\$ 300.00	\$ 350.00	\$ 325.00
5.48.4	TXT2911 Rehome/Reset (Per Radio Technology, One Time Fee)	\$ 2,000.00	\$ 3,000.00	\$ 2,500.00
5.48.5	VoWiFi Rehome/Reset (Per Radio Technology, One Time Fee)	\$ 4,500.00	\$ 5,500.00	\$ 5,000.00
5.48.6	Mobilization fee (Charge each time tester is moved to a new state or carrier market area)	\$ 1,000.00	\$ 1,000.00	\$ 1,000.00
5.48.7	Stand-by Fee (Per day)	\$ 1,000.00	\$ 1,400.00	\$ 1,200.00
5.48.8	Hosted SMLC Location Server License and Set-up- One Time Fee ("OTF") (per project)	\$ 40,000.00	\$ 40,000.00	\$ 40,000.00

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5.48.9	Hosted SMLC Location Server Monthly Recurring Fee per Cell Site ("MRF")	\$ 20.00	\$ 30.00	\$ 25.00
5.48.10	Project Management Set-up - One Time Fee ("OTF") (per site dependent on complexity)	\$ 5,000.00	\$ 10,000.00	\$ 7,500.00
5.48.11	LPM Reporting Tool reset up One Time Fee ("OTF") Per Radio Technology	\$ 4,500.00	\$ 5,500.00	\$ 5,000.00
5.49.0	<b>End-User Location - Truck roll or self-install (per end-user)</b>	\$ 2,500.00	\$ 12,500.00	\$ 7,500.00
5.49.1	Legal review of customer notices & communications; public relations (2-4 hours)	\$ 1,000.00	\$ 2,000.00	\$ 1,500.00
5.51.0	<b>Services Specific to: Alaska, American Samoa, Hawaii, Puerto Rico and Virgin Islands Plus 30-50% additional costs for the service items listed in the conterminous (contiguous) United States. Additional taxes, duties and/or custom fees will be required. Freight: requires special transportation charges such as Ferry/Barge</b>			
5.51.1	Mobilization Costs - Virgin Islands (per site)	\$ 14,350.00	\$ 17,250.00	\$ 15,800.00
	<b>Other - (considered eligible, but cannot determine range due to highly variable costs and therefore cannot rely on Catalog for cost estimate)</b>			
2.17.7	Ancillary Tower/Site Material (hangers, grips, hoists, adapters, jumpers, grounding kit, bolts, nuts, washers, ties, lugs, wire, heat shrink, single fiber and power runs, etc.)	\$ 5,000.00		
2.37.3	3G/UMTS MSC, Mobile Switching Center, 3G/UMTS MGC, MGW (up to 50K subs)	\$ 2,000,000.00		
3.5.11	Network Security Equipment			
4.1.10	Network Automation			
5.14.11	Network Integrator Services			
5.27.00	<b>Special Access Sites - Varies by Site/Region</b>			
5.50.0	<b>Taxes - Dependent on location and or exemption</b>			
5.51.2	Hawaii: 40' Flat - 100' Monopoles in Sections   2 Pieces per Platform, Non-Stackable   Max 48' Length, 3.5' Diameter (5 Sites @ 8 Pallets - container(s) needed)	\$ 59,621.00		
5.51.3	Hawaii: 20' Container High Cube - Palletized Outdoor Cabinets with BBU, RRHs, Antenna, EPCs (5 Sites @ 1 Container)	\$ 5,622.00		
5.51.4	Hawaii: Fuel Surcharge - subject to the rate in effect at the time of shipment.	\$ 14,533.00		
5.51.5	Seattle to Dutch Harbor: 1-20' Container Concrete	\$ 6,731.47		
5.51.6	Seattle to Dutch Harbor: 20' Flat - 15K pounds minimum (Rated at \$41.02 per 100 pounds, subject to a minimum of \$34.88 per square foot plus transfer fee)	\$ 6,502.00		

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Index	Description	Range of Estimated Costs		Costs
		Low	High	Average
5.51.7	Dutch Harbor: Fuel Surcharge - subject to the rate in effect at the time of shipment	\$ 2,023.28		
5.51.8	Dutch Harbor to Adak: 2-20' Container Concrete and 1-20' Flat	\$ 13,427.40		

**DESCRIPTION OF CHANGES OR CORRECTIONS IN FINAL VERSION DATED SEPTEMBER 30, 2021 AS COMPARED TO VERSION  
Dated August 3, 2021**

<b>Index</b>	<b>Cost Category/Subcategory Description</b>	<b>Description of Change</b>
2.1.2	Medium Cell Site Router capable of L2/Ethernet and IP/MPLS with a mix of 1GE (20 or fewer) and 10GE interfaces (8 or fewer)	Corrected the average cost estimate based on the range of estimated costs.
2.1.3	Large Cell Site Router capable of L2/Ethernet and IP/MPLS with a mix of 1GE (24 or fewer), 10GE (24 or fewer), and 100GE interfaces (4 or fewer)	Corrected the average cost estimate based on the range of estimated costs.
5.1.4	Participation in FCC Rulemaking - (8-15 hours per filing)	Deleted cost subcategory and range of cost estimates and renumbered item 5.1.5 to 5.1.4.
5.16.5	Rip & Replace - Up to (6) New Radios, (3) New Antennas (Install/Swap up to (6) new radios, (3) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	Corrected a typographical error in the placement of the comma for the low end of the range of cost estimates, revising from "\$1,7687.17" to "\$17,687.17."

**DESCRIPTION OF CHANGES IN FINAL VERSION AS COMPARED TO PRELIMINARY VERSION CATALOG OF ELIGIBLE  
EXPENSES AND ESTIMATED COSTS DATED MARCH 25, 2021**

<b>Index</b>	<b>Cost Category/Subcategory Description</b>	<b>Description of Change</b>
1	<b>Access Layer Equipment</b>	
NA	Optical distribution network devices (ODN) - See Metro WDM & OTN	Consolidated cost subcategory with Index 2.7.0 – Distribution WDM & OTN.
1.2.1	Access WDM & OTN equipment, Small network, includes subscription	Decreased the low end of the range of estimated costs from \$83,000.00 to \$3,454.00.
1.3.00	<b>End-User Termination Point - FTTH</b>	Description changed from "CPE - FTTH"
1.3.3	Small Business/SOHO - Distribution Node to Multiple End-User (per node)	Description changed from "Small Business/SOHO CPE"



Index	Cost Category/Subcategory Description	Description of Change
1.3.4	Large Business/Enterprise - Distribution Node to Multiple End-User (per node)	Description changed from "Large Business/Enterprise CPE"
1.4.00	<b>Multi-Service Access Node and Digital Subscriber Line Access Multiplexing Equipment (MSAN &amp; DLSAM)</b>	
NA	VDSL (Very high-speed Digital Subscriber Line) CPE	Deleted cost category and range of cost estimates.
1.7.00	<b>Home Network and Customer Premises Equipment (CPE)</b>	
1.7.1	CBRS/B48 Category 15 15-19 dBi Gain Outdoor Unit	Description changed from "CPE - CBRS/B48 Category 15 15-19 dBi Gain Outdoor Unit"
1.7.2	CBRS/B48 Category 15 High Gain Indoor Unit	Description changed from CPE - CBRS/B48 Category 15 High Gain Indoor Unit
1.7.3	SAS Integration Costs (per Radio)	Added cost subcategory and range of estimated costs from \$62.00 (low) to \$124.00 (high).
1.8.00	<b>Customer Outreach to End-User - Public Relations/Notification</b>	
1.8.2	Smart Home - Reimbursable portions of Smart Homes are in the CPE (other portions: IP cameras, Wi-Fi doorbells, WiFi Routers, Wi-Fi light switches, etc. would not be reimbursable)	Description changed to add "WiFi Routers."
1.9.1	CMTS (per node)	Added cost subcategory and range of estimated costs from \$8,500 (low) to \$16,000 (high).
2.1.1	Small Cell Site Router capable of L2/Ethernet and IP/MPLS with a mix of 1GE (8 or fewer) and 10GE interfaces (2 or fewer)	Added new cost subcategory and range of estimated costs from \$795.00 (low) to \$10,750.00 (high).
2.1.2	Medium Cell Site Router capable of L2/Ethernet and IP/MPLS with a mix of 1GE (20 or fewer) and 10GE interfaces (8 or fewer)	Added new cost subcategory and range of estimated costs from \$1,616.00 (low) to \$19,500.00 (high).
2.1.3	Large Cell Site Router capable of L2/Ethernet and IP/MPLS with a mix of 1GE (24 or fewer), 10GE (24 or fewer), and 100GE interfaces (4 or fewer)	Added new cost subcategory and range of estimated costs from \$2,998.00 (low) to \$13,068.00 (high).
2.1.4	Cell Site Router (1 Gig Port config L2 switch - 10 Gig Port config MPLS (Multiprotocol Label Switching) L3 router)	Increased the low end of the range of estimated costs from \$795.00 to \$1,182.00.

Index	Cost Category/Subcategory Description	Description of Change
2.7.00	<b>Distribution WDM &amp; OTN</b>	Renamed from "Metro WDM & OTN."
2.7.1	WDM & OTN equipment, Small network, includes subscription (per node)	Added new cost subcategory and range of estimated costs from \$83,000.00 (low) to \$102,000.00 (high).
2.7.2	WDM & OTN equipment, Medium to Large network, includes subscription (per node)	Added new cost subcategory and range of estimated costs from \$165,000.00 (low) to \$330,000.00 (high).
2.11.00	<b>Microwave Antennas - Dual Polarization</b>	Revised cost category description from "Microwave Antennas - Dule Pole."
2.12.00	<b>Microwave Antennas - Dual Polarization – Ultra High Performance</b>	Added new cost category.
2.12.1	0.3 - 1.2 meter (1 - 4 foot)	Added new cost subcategory and range of estimated costs from \$3,490.00 (low) to \$5,250.00 (high).
2.12.2	1.8 - 3.0 meter (6 - 10 foot)	Added new cost subcategory and range of estimated costs from \$7,250.00 (low) to \$30,000.00 (high).
2.14.00	<b>Antenna - LTE (Long Term Evolution) Multi-band, &gt;16dBi</b>	
2.14.2	10 port - 10T10R through 20 port - 20T20R	Revised cost subcategory description.
2.17.00	<b>Hybrid Cable &amp; Radio/Antenna Jumpers, Tower Ancillary Components</b>	Renamed cost category from "Cable Breakout Interconnection - Hybrid Cable."
2.17.1	Cable breakout interconnect 100', maximum of 12 power conductors & 24 fiber	Revised cost subcategory description.
2.17.2	Cable breakout interconnect 200', maximum of 12 power conductors & 24 fiber	Revised cost subcategory description.
2.17.3	Cable breakout interconnect 300', maximum of 12 power conductors & 24 fiber	Revised cost subcategory description.
2.17.4	Cable breakout interconnect 400', maximum of 12 power conductors & 24 fiber	Revised cost subcategory description.
2.17.5	"Raycap" Over-voltage Protection / Fiber Management – each	Added new cost subcategory and range of estimated costs from \$1,500.00 (low) to \$4,000.00 (high).

Index	Cost Category/Subcategory Description	Description of Change
2.17.6	OVP to radio power/fiber jumpers, coax jumpers (each)	Added new cost subcategory and range of estimated costs from \$190.00 (low) to \$950.00 (high).
2.23.00	<b>LTE BBU (Baseband Units)</b>	
2.23.1	Rack Mounted or Outdoor Mounted baseband unit (BBU)	Revised cost subcategory description.
2.27.00	<b>Rapid Deployed, Self-contained 5G cell site with attached Core</b>	
2.27.1	HIGH - 5G Fully Integrated, EMP Hardened Cellsite with Mobile Edge compute and embedded 5G Core - 600mhz - 6ghz; 30ghz and up + Counter UAS Radar & Video Surveillance	Added new cost subcategory and range of estimated costs.
2.27.2	MEDIUM - 5G Fully Integrated, EMP Hardened Cellsite with Mobile Edge compute and embedded 5G Core - 600mhz - 6ghz; 30ghz and up + Diverse Backhaul (Free space Optic and/or MM wave)	Added new cost subcategory and range of estimated costs.
2.27.3	LOW - 5G Fully Integrated, EMP Hardened Cellsite with Mobile Edge compute and embedded 5G Core - 600mhz - 6ghz with Fiber Media Gateway	Added new cost subcategory and range of estimated costs.
2.27.4	Solar Cell Site Power Solution (<24 hour solution) - Green Power Solution	Added new cost subcategory and range of estimated costs.
2.27.5	Solar Cell Site Power Solution (24 to 48 hour solution) - Green Power Solution	Added new cost subcategory and range of estimated costs.
2.27.6	Generator -based power Cell Site Power Solution - Green Power Solution	Added new cost subcategory and range of estimated costs.
2.27.7	5G RAN & Core Consulting – per hour	Added new cost subcategory and range of estimated costs.
2.28.00	<b>Bundled BBU/RRH (Base Band Unit/Remote Radio Head)</b>	
NA	<b>Fixed Wireless</b>	

Index	Cost Category/Subcategory Description	Description of Change
2.28.1	2T2R-8T8R eNodeB with 3 sectors, single spectrum band of up to 20 MHz/sector. Fixed Wireless features. Range due to Low Power radio (20W) vs High Power radio (up to 320W). Price includes Remote Radio Units (RRU), Base Band Unit (BBU), Ancillaries, Software Features, and Capacity Licensing. Price excludes antennas, tower cabling, tower ancillaries and over voltage protection (OVP)	Revised cost subcategory description.
2.28.2	mMIMO eNodeB with 3 sectors, single spectrum band of up to 20 MHz/sector. Fixed Wireless features. Range due to Low Power radio (120W) vs High Power radio (up to 240W). Price includes Radio+Antenna, BBU, Ancillaries, Software Features, and Capacity Licensing. Price excludes tower cabling, tower ancillaries and over voltage protection (OVP)	Revised cost subcategory description.
NA	<b>Mobility Wireless - nonMIMO</b>	
2.28.3	2T2R-8T8R eNodeB with 3 sectors, single spectrum band of up to 20 MHz/sector. Mobility features. Range due to Low Power radio (20W) vs High Power radio (up to 320W). Price includes RRHs, BBU, Ancillaries, Software Features, and Capacity Licensing. Price excludes antennas, tower cabling, tower ancillaries and over voltage protection (OVP)	Revised cost subcategory description.
NA	<b>Mobility Wireless - mMIMO</b>	
2.28.4	mMIMO eNodeB 3 Sector Per Band (64T64R 20 MHz 1 Band - 64T64R 60 MHz 1 Band with Advanced Mobility Features)	Revised cost subcategory description.
2.30.0	<b>SAS Integration Costs (per Radio)</b>	Added new cost category and range of estimated costs.
2.31.0	<b>Open vRAN eNodeB</b> <b>Model is based on single band 50 site cluster. It includes RRU (Remote Radio Unit)/CU (Control Unit)/DU (Distributed Unit)/SW (Software)/NFVi (Network Functions Virtualization infrastructure). SW include all features, power licenses, optional features.</b>	

Index	Cost Category/Subcategory Description	Description of Change
2.31.1	B71 (3 sector site) or B5 (3 sector) One RRU Type	Reduced the low-end of the range of estimated costs from \$43,225.60 to \$27,016.00.
2.31.2	B41 (3 sector site) One RRU Type	Reduced the low-end of the range of estimated costs from \$45,225.60 to \$28,196.00.
2.31.3	B66 or B4(3 sector) One RRU Type	Reduced the low-end of the range of estimated costs from \$48,233.60 to \$30,146.00.
2.31.4	B2 or B25 (3 sector) One RRU type	Reduced the low-end of the range of estimated costs from \$48,233.60 to \$30,146.00.
2.31.5	B48 One RRU Type	Reduced the low-end of the range of estimated costs from \$44,753.60 to \$27,971.00.
2.31.6	B71/B25 (3 Sector for each RRU) Two RRU Type (dual band per sector)	Reduced the low-end of the range of estimated costs from \$69,049.60 to \$43,156.00.
2.31.7	B71/B12/B41 (3 Sector for each RRU) Three RRU Type (tri-band per sector)	Reduced the low-end of the range of estimated costs from \$101,166.40 to \$63,229.00.
2.32.0	<b>RAN (Open RAN/ vRAN) Components</b>	
2.32.1	RRU - band 71 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	Reduced the low-end of the range of estimated costs from \$8,688.00 to \$5,430.00.
2.32.2	RRU - band 41 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	Reduced the low-end of the range of estimated costs from \$9,104.00 to \$5,690.00.
2.32.3	RRU - band 12 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	Reduced the low-end of the range of estimated costs from \$10,144.00 to \$6,340.00.
2.32.4	RRU - band 66 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	Reduced the low-end of the range of estimated costs from \$10,144.00 to \$6,340.00.
2.32.5	RRU - band 25 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	Reduced the low-end of the range of estimated costs from \$10,144.00 to \$6,340.00.
2.32.6	RRU - band 2 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	Reduced the low-end of the range of estimated costs from \$10,144.00 to \$6,340.00.

Index	Cost Category/Subcategory Description	Description of Change
2.32.7	RRU - band 5 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	Reduced the low-end of the range of estimated costs from \$10,144.00 to \$6,340.00
2.32.8	RRU - band 4 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc.	Reduced the low-end of the range of estimated costs from \$10,144.00 to \$6,340.00
2.32.9	RRU - band 48 - Perpetual license, w/ SW; all-inclusive power, features, carriers etc. SW price is per RRU for B48	Reduced the low-end of the range of estimated costs from \$10,144.00 to \$6,340.00
2.33.0	<b>DU (Distributed Unit)</b>	
2.33.1	Multi-Access Edge Server (indoor)	Revised cost subcategory description.
2.33.2	Multi-Access Edge Server (outdoor)	Revised cost subcategory description.
2.34.0	<b>CU (Control Unit)</b>	
2.34.1	Edge Computing vCompute NODE	Revised cost subcategory description.
2.37.0	<b>GSM&amp;UMTS (Universal Mobile Telecommunications System)</b>	
NA	3G/UMTS MSC, Mobile Switching Center, 3G/UMTS MGC, MGW (up to 50K subs)	Deleted cost subcategory and range of estimated costs.
2.41.0	<b>Indoor Cabinets</b>	
2.41.2	Indoor Power Plants / Rectifiers / Batteries	Added new cost subcategory and range of estimated costs.
3	<b>Core Layer Equipment</b> The Core Layer of the network is the central element that provides services to those elements connected at the access layer of the network. One of the main functions of the core layer is that it is an aggregation point that provides proper routing of all voice and data traffic. All access and distribution layers of the network will be connected to the core via fiber or microwave backhaul connections.	
3.1.00	<b>EPC</b>	
3.1.8	Mobile Position System (MPS) - Medium (60K subs) - Large (500Ksubs)	Added new cost subcategory and range of estimated costs.
3.1.9	PCRF Server - Small, PCRF (up to 50K subs)	Added new cost subcategory and range of estimated costs.
3.1.10	PCRF Server - Small Design, Installation, Commissioning, Integration, Migration Services	Added new cost subcategory and range of estimated costs.
3.2.00	<b>Cloud Core</b>	

Index	Cost Category/Subcategory Description	Description of Change
3.2.1	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, Small Network), includes Design, Installation, Commissioning, Integration Services	Revised cost subcategory description.
3.2.2	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, Medium Network), includes Design, Installation, Commissioning, Integration Services	Revised cost subcategory description.
3.2.3	Cloud - Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, eCGF, MME, PCRF, Large Network), includes Design, Installation, Commissioning, Integration Services	Revised cost subcategory description.
3.3.00	<b>RAN Core / EMS</b>	
3.3.1	IMS and RAN Element Management System, Compact EMS with Basic Licensing, includes hardware (10K to 50K subs), includes Design, Installation, Commissioning, Integration Services	Revised cost subcategory description and revised the range of estimated costs, increasing the low-end cost estimate from \$300,000.00 to \$450,000.00 and increasing the high-end cost estimate from \$525,000.00 to \$1,103,425.00.
3.3.2	IMS and RAN Element Management System, Medium EMS with Basic Licensing, includes hardware (50K to 100K subs), includes Design, Installation, Commissioning, Integration Services	Revised cost subcategory description and revised the range of estimated costs, increasing the low-end cost estimate from \$1,000,000.00 to \$1,500,000.00.
3.3.3	IMS and RAN Element Management System, Large EMS with Premium Licensing, includes hardware (>250 subs), includes Design, Installation, Commissioning, Integration Services	Added new cost subcategory and range of estimated costs.
3.3.4	Packet Core Element Management System, Packet Core EMS (50K subs vs 250K subs), includes hardware (50K to 100K subs), includes Design, Installation, Commissioning, Integration Services	Revised cost subcategory description and revised the range of estimated costs, increasing the low-end from \$150,000.00 to \$250,000.00.
3.3.5	Design, Installation, Commissioning, Integration Services, Packet Core EMS Add-ons	Revised cost subcategory description.
3.3.6	Design, Installation, Commissioning, Integration Services IMS/EMS Add-Ons	Revised cost subcategory description.

Index	Cost Category/Subcategory Description	Description of Change
3.4.00	<b>WDM &amp; OTN – Core Equipment (Wavelength Division Multiplexing &amp; Optical Transport Network)</b>	
3.4.1	Core Equipment for WDM & OTN (per node)	Consolidated two cost subcategories for "Metro WDM & OTN equipment," "Small" and "Medium to Large" subcategories, into one cost subcategory, revising description, and adding new range of cost estimates.
3.5.00	<b>Core Server Hardware</b>	
3.5.3	NFV Server	Added new cost subcategory and range of estimated costs.
4	<b>Software</b> Instructions that tell a computer what to do. Software comprises the entire set of programs, procedures, and routines associated with the operation of a computer system. Applications include conceiving, specifying, designing, programming, testing, maintenance and developing equipment applications, components or systems that are continuously used.	
NA	Network Automation (Highly Variable)	Moved cost category to new category "Other," but did not include range of estimated costs due to highly variable costs. See Index 4.1.10.
4.1.6	RAN Element Management System (Small EMS with Basic Licensing - Medium EMS with Premium Licensing)	Added new cost subcategory and range of estimated costs.
4.1.8	Per Call Measurement Data Server (PCMD)	Added new cost subcategory and range of estimated costs.
4.1.9	Software Licenses (per radio) to include: M2M, Cat-M1, Narrowband IoT, and similar items	Added new cost subcategory and range of estimated costs.
5	<b>Services</b>	
5.1.00	<b>Preplanning</b>	
5.1.1	NTP (Notice to Proceed) Package (per site)	Revised cost category description to add per-unit of measurement.
5.2.00	<b>Site Acquisition</b>	
5.2.1	Existing Colocation (per site, flat fee) – (Low) without A&E, permitting and Legal; (High) full scope	Revised cost category description and added per-unit of measurement.



Index	Cost Category/Subcategory Description	Description of Change
5.3.00	<b>Site Surveys</b>	
5.3.1	Drone - Visual Inspection (per site)	Revised cost category description to add per-unit of measurement.
5.3.2	Drone - Infrared Inspection - expenses not included (per site)	Revised cost category description to add per-unit of measurement.
5.3.4	Site survey - (from ground) distance to site/complexity of site (including ground measurement) (per site)	Revised cost category description to add per-unit of measurement.
5.4.00	<b>RF Engineering</b>	
5.4.1	Construction Drawings (per site)	Revised cost category description to add per-unit of measurement.
5.4.2	MPE Survey RF Emissions (per site)	Revised cost category description to add per-unit of measurement.
5.4.3	Modeling, Site Design, Performance Troubleshooting, Internal Team Optimization (per site)	Revised cost category description to add per-unit of measurement.
5.4.4	RF Model Tuning - Propagation Model per morphology (Sub Urban,Urban,Dense Urban or Rural)	Added new cost subcategory and range of estimated costs.
5.4.5	Drone - Performance Mapping (RF Measurements) (per site)	Revised cost category description to add per-unit of measurement.
5.6.00	<b>Leasing</b>	
5.6.2	Lease review (per site)	Revised cost category description to add per-unit of measurement.
5.6.3	Attend Scoping Meeting/Coordinate with RF (per site)	Added new cost subcategory and range of estimated costs.
5.6.4	Landlord consent and notice to Landlord (per site)	Added new cost subcategory and range of estimated costs.
5.6.5	Site Plan - (lease exhibit) (per site)	Revised cost category description to add per-unit of measurement.
5.6.6	Co-location application (per site)	Revised cost category description to add per-unit of measurement.
5.7.00	<b>Project Management</b>	
5.7.1	Project Management - carrier internal (per person per month)	Revised cost subcategory description to delete "internal labor."
5.7.5	NOC Staff Augments - (per person per month)	Revised cost category description to add per-unit of measurement.
5.7.6	Transition Planning for Cutover - complexity of equipment changes (per site)	Added new cost subcategory and range of estimated costs.
5.7.7	Transition Planning for Cutover: Optical Network Subscriber and network migration services up to 16 nodes additional for add-on's	Revised cost subcategory description from "Hot/Cold/Warm swap Planning."
5.10.00	<b>Resident Engineer/Staff</b>	

Index	Cost Category/Subcategory Description	Description of Change
5.10.2	Network Operations - to provide on-site support during and after turn- over – internal labor (per person/per year)	Revised cost subcategory description to delete "internal labor."
5.12.00	<b>Structural Engineering / Tower Studies</b>	
5.12.1	Structural Analysis - complexity of design (per site)	Revised cost category description to add per-unit of measurement.
5.12.2	Mount Analysis - size of tower, complexity of loading scenarios (per site)	Revised cost category description to add per-unit of measurement.
5.12.3	Tower/Mount Mapping (per tower)	Revised cost category description to add per-unit of measurement.
5.13.00	<b>Negotiating with Tower Owners</b>	
5.13.1	Executed Agreement (per site)	Revised cost category description to add per-unit of measurement.
5.13.2	Fully Executed Amendment (per site)	Revised cost category description to add per-unit of measurement.
5.13.3	Fully Executed Amendment - Non-MLA (per site)	Revised cost category description to add per-unit of measurement.
5.14.00	<b>Network Engineering Services</b>	
5.14.2	SCF Creation / WO for new sites up to 12 carriers (per site)	Revised cost category description to add per-unit of measurement.
NA	Network Integrator Services (Highly Variable)	Moved cost category to new category "Other," but did not include range of estimated costs due to highly variable costs. See Index 5.14.11.
5.15.00	<b>Tower/Water Tower/Barn/Rooftop Preparation</b>	
NA	Rip & Replace - Up to (12) New Radios, (6) New Antennas (Install/Swap up to (12) new radios, (6) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	Deleted cost subcategory and range of estimated costs.
5.15.11	Raycap Install/Upgrade	Added new cost subcategory and range of estimated costs.
5.15.12	Install Sector Frame	Added new cost subcategory and range of estimated costs.
5.15.13	Installation of outdoor cabinet with one battery string	Added new cost subcategory and range of estimated costs.
5.15.14	Installation of outdoor battery cabinet with two strings of batteries	Added new cost subcategory and range of estimated costs.
5.15.15	Installation of indoor cabinet with one battery string	Added new cost subcategory and range of estimated costs.
5.15.16	Installation of indoor battery cabinet with two strings of batteries	Added new cost subcategory and range of estimated costs.
5.15.17	PDU Installation (tower top, providing PDU)	Added new cost subcategory and range of estimated costs.

Index	Cost Category/Subcategory Description	Description of Change
5.15.18	DC power plant Install	Added new cost subcategory and range of estimated costs.
5.16.00	<b>Antenna/Radio R&amp;R - Tower up to 200', not water tank</b>	Added new cost category.
5.16.1	Rip & Replace - Up to (3) Antenna Replacement (Install/Swap up to (3) new antennas, with associated jumpers, plumbing/re-plumbing etc.)	Added new cost subcategory and range of estimated costs.
5.16.2	Rip & Replace - Up to (6) Antenna Replacement (Install/Swap up to (6) new antennas, with associated jumpers, plumbing/re-plumbing etc.)	Added new cost subcategory and range of estimated costs.
5.16.3	Rip & Replace - Up to (3) Radios (RRH/RRU) Replacement (Install/Swap up to (3) new radios, with associated jumpers, plumbing/re-plumbing accordingly etc. No new antennas or hybrid)	Added new cost subcategory and range of estimated costs.
5.16.4	Rip & Replace - Up to (6) Radios (RRH/RRU) Replacement (Install/Swap up to (6) new radios, with associated jumpers, plumbing/re-plumbing accordingly etc. No new antennas or hybrid)	Added new cost subcategory and range of estimated costs.
5.16.5	Rip & Replace - Up to (6) New Radios, (3) New Antennas (Install/Swap up to (6) new radios, (3) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	Added new cost subcategory and range of estimated costs.
5.16.6	Rip & Replace - Up to (9) New Radios, (3) New Antennas (Install/Swap up to (9) new radios, (3) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	Added new cost subcategory and range of estimated costs.
5.16.7	Rip & Replace - Up to (12) New Radios, (6) New Antennas (Install/Swap up to (12) new radios, (6) new antennas with associated jumpers, plumbing/re-plumbing etc. No new hybrid)	Added new cost subcategory and range of estimated costs.
5.16.8	Install/Swap up to (18) new radios, (9) new antennas with associated jumpers, plumbing/re-plumbing accordingly etc. No new hybrid)	Added new cost subcategory and range of estimated costs.
5.20.00	<b>Tower Modifications</b>	
5.20.1	Modification Design (per site)	Revised cost category description to add per-unit of measurement.
5.20.2	Foundation Drawings/Inspection (per site)	Revised cost category description to add per-unit of measurement.

Index	Cost Category/Subcategory Description	Description of Change
5.20.13	Carrier Relocation BOM (per site)	Revised cost category description to add per-unit of measurement.
5.20.14	Carrier Relocation Civil Work (per site)	Revised cost category description to add per-unit of measurement.
5.20.15	Carrier Relocation L&A Work (per site)	Revised cost category description to add per-unit of measurement.
5.21.00	<b>Site Work</b>	
5.21.11	Installation of new 19" rack in existing shelter	Added new cost subcategory and range of estimated costs.
5.21.13	Install collar mounts (Tri & Quad) V-Booms, (with materials) – (Per Mount)	Added new cost subcategory and range of estimated costs.
5.21.14	Install MOVE platform (with Materials) (Per Mount)	Added new cost subcategory and range of estimated costs.
5.21.16	Re-use/Re-working existing hybrid (Cabling to new equipment and baseband along with required testing) – up to 12 fibers	Added new cost subcategory and range of estimated costs.
5.21.20	Environmental Work (per site)	Revised cost category description to add per-unit of measurement.
5.21.21	Solar Design (per site)	Revised cost category description to add per-unit of measurement.
5.21.22	25-50 Amp Solar Upgrade (Install and Material) (per site)	Revised cost category description to add per-unit of measurement.
5.21.23	75-100 Amp Solar Upgrade (Install and Material) (per site)	Revised cost category description to add per-unit of measurement.
5.21.24	Commissioning and Integration of single technology – per site	Added new cost subcategory and range of estimated costs.
5.21.25	Closeout Package – Microwave (per link)	Added new cost subcategory and range of estimated costs.
5.21.26	Closeout Package – (per site)	Added new cost subcategory and range of estimated costs.
5.24.00	<b>Tower/Installation Crews</b>	
5.24.1	Mobilization Less than or Equal to 250 Miles (2-4 Member Crew)	Revised the range of cost estimates to increase the high-end cost estimate from \$3,000.00 to \$6,000.00.
5.24.12	Maintenance window work per night/per 3-man crew (per night)	Revised cost subcategory description to add per-unit of measurement.
5.24.13	Microwave Pathing - During Construction (per link)	Revised cost subcategory description to add per-unit of measurement.
5.24.14	Microwave Pathing - Post Construction (per link)	Revised cost subcategory description to add per-unit of measurement.
5.24.15	Microwave Commissioning and Integration (per link)	Revised cost subcategory description to add per-unit of measurement.
5.24.16	Microwave relocation during construction (per site)	Revised cost subcategory description to add per-unit of measurement.
5.26.00	<b>Equipment Rental</b>	

Index	Cost Category/Subcategory Description	Description of Change
5.26.8	Snow Removal Equipment – per vehicle	Revised cost subcategory description to add per-unit of measurement.
5.26.9	Prime Mover or Similar for Towing - per vehicle	Revised cost subcategory description to add per-unit of measurement.
5.26.10	Straight Truck or Similar for Counterweight - per vehicle	Revised cost subcategory description to add per-unit of measurement.
5.26.11	Forklift of Similar for Component Transport - per vehicle	Revised cost subcategory description to add per-unit of measurement.
5.28.00	<b>Virtual/Cloud Core Deployment</b>	
5.28.5	Cloud - Virtual IMS (CTAS, IMS Core, MRF, AGW, A-SBC, HSS, ePDG, I-SBC, DRA, PCRF, 4G EPC, E-CSCF, LI interface, SMSC, MMSC, VM), up to 100k subscribers	Revised cost subcategory description to add "up to 100k subscribers."
5.29.00	<b>GPON/XGS (FTTH) Deployments</b>	
5.29.1	Backbone WDM/optical transport networking equipment – (per network)	Revised cost subcategory description to add per-unit of measurement.
5.29.2	Deployment - Cloud Computing – (per network)	Revised cost subcategory description to add per-unit of measurement.
5.29.3	Deployment - Optical Transmission – (per network)	Revised cost subcategory description to add per-unit of measurement.
5.29.4	Deployment - Data Transmission – (per network)	Revised cost subcategory description to add per-unit of measurement.
5.29.5	Deployment - GPON/XGS EMS – FTTH – (per network)	Revised cost subcategory description to add per-unit of measurement.
5.29.6	RAN EMS Deployment – (per network)	Revised cost subcategory description to add per-unit of measurement.
5.33.0	<b>Lab Testing - Interoperability Testing and Compliance for New Equipment</b>	
NA	FOA Testing, E2E Network Interoperability Testing, VoLTE testing, E911 testing, Troubleshooting, Security Validation	Deleted cost subcategory and range of estimated costs by consolidating cost subcategory and cost estimates into line item Index 5.33.1.
5.33.1	Engineering consulting for network planning & scenario analysis (remote per week)	Added new cost subcategory and range of estimated costs.
5.38.0	<b>Disposal Costs/Logistics</b>	
5.38.8	Decommission - remove waveguide, fiber, CAT5/6, coaxial cable up to 1 5/8" (per foot)	Revised the range of cost estimates to decrease the low-end cost estimate from \$104.00 to \$1.04 and decrease the high-end cost estimate from \$675.00 to \$6.75.
5.41.0	<b>Tariff Filings</b>	

Index	Cost Category/Subcategory Description	Description of Change
5.41.1	Tariff Filing Fee (per transmittal or cover letter)	Revised the range of cost estimates to include a high-end cost estimate of \$925.00.
5.41.2	Application for Special Permission Filing (request for waiver of any rule in Part 61)	Revised the range of cost estimates to include a high-end cost estimate of \$925.00.
5.41.3	Waiver of Part 69 Tariff Rules (per request)	Revised the range of cost estimates to include a high-end cost estimate of \$925.00.
5.42.0	<b>Accounting</b>	
5.42.2	Each Additional State	Revised the range of cost estimates to include a high-end cost estimate of \$1,285.00.
5.43.0	<b>Security - onsite</b>	
5.43.1	Fence/Compound Work (per site)	Revised cost subcategory description to add per-unit of measurement.
5.47.0	<b>Drive Testing - Signal Strength Verification</b>	
5.47.2	Single site verification drive testing (per site)	Revised the range of cost estimates by decreasing the low-end cost estimate from \$1,800.00 to \$1,570.00.
5.47.5	Mobility or FWA (non M-MIMO) Ground services base integration, cut over support, call / data test package for site with shelter (per site)	Added new cost subcategory and range of estimated costs.
5.47.6	Cluster Optimization (Drive based) for FWA or Mobility (Per Technology (LTE or UMTS)), 10-Site Cluster)	Added new cost subcategory and range of estimated costs.
5.47.7	Single site verification stationary testing for FWA (per site)	Added new cost subcategory and range of estimated costs.
5.48.0	<b>911 &amp; E911 Services and Drive Test Services (47 CFR § 9.10(i)(2)(i)(B)(4)) (50m x/y)</b>	
5.48.6	Mobilization fee (Charge each time tester is moved to a new state or carrier market area)	Revised the range of cost estimates by adding a high-end cost estimate of \$1,000.00.
5.48.8	Hosted SMLC Location Server License and Set-up- One Time Fee ("OTF") (per project)	Revised the range of cost estimates by adding a high-end cost estimate of \$40,000.00 and revised the cost category description of the per-unit of measurement as "per project."

Index	Cost Category/Subcategory Description	Description of Change
5.48.10	Project Management Set-up - One Time Fee ("OTF") (per site dependent on complexity)	Revised cost subcategory description to add per-unit of measurement as "per site dependent on complexity."
5.49.0	<b>End-User Location - Truck roll or self-install (per end-user)</b>	Description changed from "Customer Premise Equipment (CPE) - Truck roll or self-install"
5.51.0	<b>Services Specific to: Alaska, American Samoa, Hawaii, Puerto Rico and Virgin Islands</b>	
5.51.1	Mobilization Costs - Virgin Islands (per site)	Revised cost subcategory description to add per-unit of measurement as "per site."
NA	<b>Other - Highly Variable Costs</b>	Added new cost category for highly variable costs that could not be quantified for a range of cost estimates.
2.17.7	Ancillary Tower/Site Material (hangers, grips, hoists, adapters, jumpers, grounding kit, bolts, nuts, washers, ties, lugs, wire, heat shrink, single fiber and power runs, etc.)	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
2.37.3	3G/UMTS MSC, Mobile Switching Center, 3G/UMTS MGC, MGW (up to 50K subs)	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
3.5.11	Network Security Equipment	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
4.1.10	Network Automation	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.14.11	Network Integrator Services	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.27.00	<b>Special Access Sites - Varies by Site/Region</b>	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.50.0	<b>Taxes - Dependent on location and or exemption</b>	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.51.2	Hawaii: 40' Flat - 100' Monopoles in Sections   2 Pieces per Platform, Non-Stackable   Max 48' Length, 3.5' Diameter (5 Sites @ 8 Pallets - container(s) needed)	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.

Index	Cost Category/Subcategory Description	Description of Change
5.51.3	Hawaii: 20' Container High Cube - Palletized Outdoor Cabinets with BBU, RRHs, Antenna, EPCs (5 Sites @ 1 Container)	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.51.4	Hawaii: Fuel Surcharge - subject to the rate in effect at the time of shipment.	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.51.5	Seattle to Dutch Harbor: 1-20' Container Concrete	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.51.6	Seattle to Dutch Harbor: 20' Flat - 15K pounds minimum (Rated at \$41.02 per 100 pounds, subject to a minimum of \$34.88 per square foot plus transfer fee)	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.51.7	Dutch Harbor: Fuel Surcharge - subject to the rate in effect at the time of shipment	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.
5.51.8	Dutch Harbor to Adak: 2-20' Container Concrete and 1-20' Flat	Cost category moved to this section to consolidate highly variable costs that could not be quantified for a range of costs estimates.