

Fixed Wireless Access 2023



Kyung Mun

| MOBILE EXPERTS |

October 2023

This report provides:

- **A clear view of future trends in Fixed Wireless Access technology;**
- **A five-year forecast for APs and CPEs, broken down by region, technology, band group, etc.**
- **Cost analysis of 3GPP and 802.11-based FWA options**
- **High level insight on why operators are investing.**

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY..... 10

2 MARKET UPDATE 12

SETTLING IN FROM THE PANDEMIC DISRUPTION 13

STATUS OF FIBER PENETRATIONS AND FWA BROADBAND OPPORTUNITIES 15

BROADBAND IS A REGIONAL BUSINESS, AND SO IS FWA 17

GOVERNMENT PROGRAMS TO CLOSE THE “DIGITAL DIVIDE” 18

BROADBAND PREFERENCE – WIRELINE VS. FIXED WIRELESS VS. MOBILE 19

OPTIMISM (AND PESSIMISM) ABOUT THE FWA OPPORTUNITY IN INDIA 24

COMPETITIVE LANDSCAPE OF 5G FWA, PURPOSE-BUILT FWA, AND SATELLITE BROADBAND 25

3 SPECTRUM FOR FIXED WIRELESS ACCESS 27

LICENSED VS. UNLICENSED 27

LICENSED MID-BANDS (2.5-4.0 GHz) 29

UNLICENSED MID-BANDS (5.8-7.0 GHz)..... 30

LICENSED HIGH BANDS (24-39 GHz) 33

UNLICENSED HIGH BAND (60 GHz) 34

4 FIXED WIRELESS TECHNOLOGY CHOICES AND ENABLERS 35

PURPOSE-BUILT FWA FOR REGIONAL WISP OPERATORS 36

6 GHz PURPOSE-BUILT FWA 38

60 GHz PURPOSE-BUILT FWA 39

24-40 GHz PURPOSE-BUILT FWA 40

5G MID-BAND FWA 41

5G MILLIMETER-WAVE FWA 42

HYBRID INDOOR/OUTDOOR CPEs 43

5 ECONOMICS OF FIXED WIRELESS ACCESS 45

UNIT ECONOMICS OF “COST TO PASS” AND “COST TO CONNECT” 45

COMPARATIVE ECONOMICS OF PURPOSE-BUILT AND LTE & 5G FWA 47

CONSIDERATIONS FOR RURAL VS. URBAN FWA 49

6	PURPOSE-BUILT FIXED WIRELESS ACCESS SHIPMENT FORECAST	51
	PURPOSE-BUILT FWA INFRASTRUCTURE SHIPMENTS BY SPECTRUM BAND	51
	PURPOSE-BUILT FWA INFRASTRUCTURE SHIPMENTS BY OPERATOR TYPE	55
	PURPOSE-BUILT FWA INFRASTRUCTURE SHIPMENTS BY MARKET DENSITY	56
	PURPOSE-BUILT FWA INFRASTRUCTURE SHIPMENTS BY REGION	57
	PURPOSE-BUILT FWA CPE SHIPMENTS BY REGION	58
	PURPOSE-BUILT FWA CPE SHIPMENTS BY SPECTRUM BAND	59
7	3GPP-BASED FIXED WIRELESS ACCESS SHIPMENT FORECAST	61
	3GPP-BASED FWA INFRASTRUCTURE SHIPMENTS BY SPECTRUM BAND	61
	3GPP-BASED FWA INFRASTRUCTURE SHIPMENTS BY OPERATOR TYPE	63
	3GPP-BASED FWA INFRASTRUCTURE SHIPMENTS BY MARKET DENSITY	64
	3GPP-BASED FWA INFRASTRUCTURE SHIPMENTS BY REGION	65
	3GPP-BASED FWA CPE SHIPMENTS BY REGION	66
	3GPP-BASED FWA CPE SHIPMENTS BY TECHNOLOGY	67
	3GPP-BASED FWA CPE SHIPMENTS BY SPECTRUM BAND	68
	SUB-6 GHz AND MILLIMETER-WAVE 5G FWA CPE SHIPMENTS	69
8	FIXED WIRELESS ACCESS EQUIPMENT REVENUE FORECAST	71
	PURPOSE-BUILT FWA INFRASTRUCTURE AND CPE REVENUE FORECAST	71
	3GPP-BASED FWA INFRASTRUCTURE AND CPE REVENUE FORECAST	72
	OVERALL FWA EQUIPMENT REVENUE FORECAST	74
9	FIXED WIRELESS ACCESS EQUIPMENT MARKET SHARE	76
	PURPOSE-BUILT FWA EQUIPMENT MARKET SHARE	76
	3GPP-BASED FWA EQUIPMENT MARKET SHARE	77
10	FIXED WIRELESS ACCESS CONNECTIONS FORECAST	80
11	COMPANY PROFILES	82
	AIRSPAN	82
	ARCAYDIAN	82
	AT&T	82
	BAICELLS	82
	BLINQ NETWORKS	82
	CAMBIUM NETWORKS	83
	CAMBRIDGE BROADBAND NETWORK LTD (CBNL)	83
	CASA SYSTEMS	83
	COMMSCOPE	83
	ERICSSON	84
	FUJITSU	84
	GCT SEMICONDUCTOR	84
	GEMTEK	84
	HUAWEI	84
	INSEGO	85
	INTRACOM TELECOM	85
	MARVELL	85
	MEDIA TEK	85

	MIKROTIK	86
	MOVANDI	86
	NEXTLINK	86
	NOKIA	86
	NXP	86
	ON SEMICONDUCTOR	87
	PERASO	87
	PIVOTAL COMMWARE	87
	QUALCOMM	87
	RADWIN	87
	REDLINE COMMUNICATIONS (AVIAT NETWORKS)	88
	RISE BROADBAND	88
	SAMSUNG	88
	SIKLU	88
	STARRY	88
	TARANA WIRELESS	89
	TELRAD	89
	T-MOBILE USA	89
	TOZED KANGWEI	89
	UBIQUITI	90
	WE LINK	90
	VERIZON	90
	WISTRON NEWEB CORPORATION	90
	ZTE	91
	ZYXEL	91
12	ACRONYMS	92
13	METHODOLOGY	95
	APPENDIX A: MARKET DEFINITION OF FIXED WIRELESS ACCESS	96

CHARTS

Chart 1: Purpose-Built FWA AP Shipments by Spectrum Band	50
Chart 2: Purpose-Built Millimeter-Wave FWA AP Shipments.....	52
Chart 3: Purpose-Built FWA AP Shipments by Operator Type	53
Chart 4: Purpose-Built FWA AP Shipments by Market Density.....	55
Chart 5: Purpose-Built FWA AP Shipments by Region.....	56
Chart 6: Purpose-Built FWA CPE Shipments by Region.....	57
Chart 7: Purpose-Built FWA CPE Shipments by Spectrum Band.....	58
Chart 8: 3GPP-based FWA AP Shipments by Sub-6 GHz and Millimeter Wave Band.....	60
Chart 9: 3GPP-based FWA AP Shipments by Operator Type	61
Chart 10: 3GPP-based FWA AP Shipments by Market Density	63
Chart 11: 3GPP-based Fixed Wireless AP Shipments by Region	63
Chart 12: 3GPP-based Fixed Wireless CPE Shipments by Region	65
Chart 13: 4G and 5G Fixed Wireless CPE Shipments	66
Chart 14: 3GPP-based FWA CPE Shipments by Frequency Band.....	67
Chart 15: 5G FWA CPE Shipments, Sub-6 GHz and Millimeter Wave Units.....	68
Chart 16: Purpose-Built FWA Equipment Revenue Forecast.....	70
Chart 17: 3GPP-based FWA Equipment Revenue Forecast.....	71
Chart 18: Overall FWA Equipment Revenue Forecast	72
Chart 19: Overall FWA CPE Revenue Forecast by Technology	73
Chart 20: Purpose-Built FWA Equipment Revenue Share, 2022	75
Chart 21: 4G and 5G FWA CPE Revenue Share, 2022.....	76
Chart 22: Fixed Wireless Access Connections by Technology.....	78

FIGURES

Figure 1. 5G will lead the doubling of FWA connections to over 250 million by 2028	8
Figure 2. Fixed Broadband Penetration by Region at Year-End 2022.....	10
Figure 3. More than 430 (LTE) and 100 (5G) Operators Offer FWA Broadband Services	12
Figure 4. Fixed Broadband Subscriptions by Region	12
Figure 5. Fiber-to-the-Home (FTTH) Penetration by Region.....	14
Figure 6. U.S. Fixed Broadband Connections by Downlink Speed and Technology	15
Figure 7. U.S. Government Broadband Infrastructure Grant Programs Since 2019	16
Figure 8. Fixed and Mobile Broadband Coverage and Penetration at the Year-End 2022.....	18
Figure 9. FWA Can Be Tailored for Different Broadband Market Segments	19
Figure 10. FWA Makes Sense in Low-Density Markets.....	21
Figure 11. Spectrum Choices for Fixed Wireless Access	26
Figure 12. 5 GHz Unlicensed U-NII Bands	29
Figure 13. 6 GHz Unlicensed Channel Map.....	30
Figure 14. 5G Spectrum Bands	31
Figure 15. Technology and Spectrum to Optimize FWA Speed and Range	33
Figure 16. Fixed Wireless Broadband Technology Options	34
Figure 17. Impact of AP and CPE Antenna Placement on FWA Cell Range	41
Figure 18. Hybrid Indoor and Outdoor FWA CPE.....	42
Figure 19. Cost Optimization Based on Expected Market Penetration.....	44
Figure 20. Purpose-built vs. LTE/5G FWA Cost per Subscriber Home	45
Figure 21. Purpose-Built vs. LTE FWA Network Cost vs. Market Penetration in Rural	46
Figure 22. Purpose-Built vs. 5G FWA Network Cost vs. Market Penetration in Sub/Urban	47
Figure 23. Fixed Wireless Access Market Definition.....	94

METHODOLOGY

To create estimates and forecasts for Fixed Wireless Access (FWA) equipment shipments, Mobile Experts relied on direct input from more than 20 industry sources, including input from multiple wireless ISPs, wireline telcos, fixed wireless access infrastructure and CPE vendors, chipset suppliers, etc. – contributing to the overall analysis to give a detailed global view of the market. Mobile Experts built a “top-down” forecast based on direct input from operators, as well as overall trends in end-user demand for mobile services. Then, Mobile Experts built a “bottom-up” forecast through discussions with the supply chain, including vendor suppliers, top-tier OEMs, and component suppliers. Mobile Experts also used financial disclosures from publicly traded companies to assemble a quantitative view of the equipment market.

Mobile Experts has defined market segments in a new way to achieve more clarity than other analysts in this area. Mobile Experts distinguishes the FWA equipment market in this report between 3GPP fixed wireless access and 3GPP mobile access. Fixed users are defined as those with a CPE in a set location at a home or office. Since almost all mobile operators share their mobile networks for FWA and mobile broadband services, we are not counting base station infrastructure equipment sales associated with 3GPP (LTE and 5G). However, we still track purpose-built access point infrastructure sales.

Hence, the FWA equipment market is comprised of 1) purpose-built FWA access point and CPE sales and 2) LTE and 5G CPE sales.

APPENDIX A: MARKET DEFINITION OF FIXED WIRELESS ACCESS

In this market study, Mobile Experts is defining the Fixed Wireless Access (FWA) equipment market to denote base station access point (AP) and *fixed* customer premise equipment (CPE) located at a subscriber’s home or business location. We do not consider mobile devices such as “MiFi” in our CPE definition. The wireless backhaul equipment is excluded from our FWA equipment definition – though it is a significant part of the overall “Wireless Broadband” equipment market.

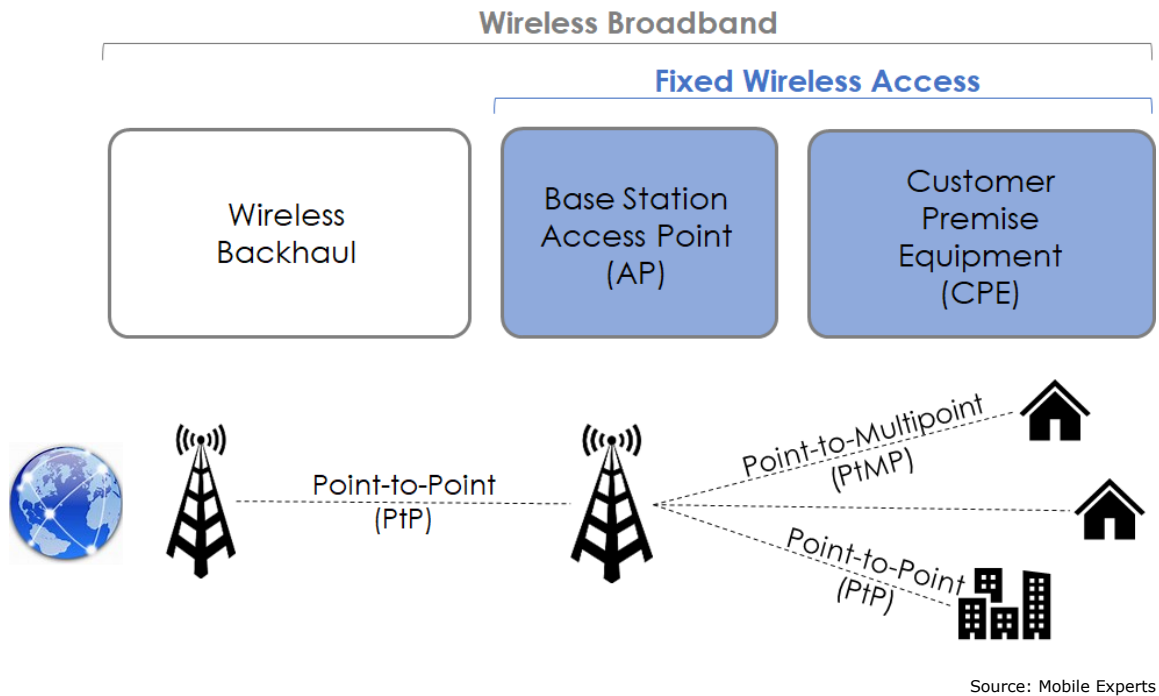


Figure 1. Fixed Wireless Access Market Definition

As depicted in the illustration of what’s included in our FWA market definition, some portions of point-to-point radio equipment share are included in our FWA market definition if it is used for access. For example, a certain “high-end” segment of the market—demanding hundreds of Mbps or even 1 Gbps service -- can only be handled using point-to-point systems today. In such cases, we include this aspect of point-to-point radio equipment in our AP and CPE equipment count.

In this forecast, Mobile Experts tracks the base station infrastructure that is dedicated for fixed-wireless use. In the case of purpose-built equipment, 100% of product shipped is ‘dedicated’ in this way, but in the 3GPP market, a great deal of FWA traffic is carried over mobile networks whose primary function is serving mobile customers. Our forecast indicates the 3GPP infrastructure that is deployed solely to service fixed broadband customers (e.g., NBN in Australia, etc.) is relatively small but growing.