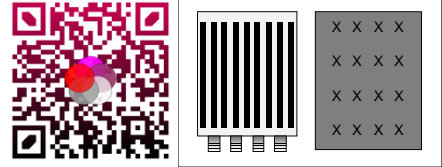


Earl J. Lum  
+1-650-430-2221  
elum@ejlwireless.com



3rd Edition

## Global Macrocell RRU/ARS Market Analysis and Forecast, 2019-2023

August 2019



Entire contents © 2019 Ejl Wireless Research LLC. All Rights Reserved. Reproduction of this publication in any form without prior written permission is strictly forbidden and will be prosecuted to the full extent of US and International laws. The transfer of this publication in either paper or electronic form to unlicensed third parties is strictly forbidden. The information contained herein has been obtained from sources Ejl Wireless Research LLC deems reliable. Ejl Wireless Research disclaims all warranties as to the accuracy, completeness, or adequacy of such information. Ejl Wireless Research LLC shall bear no liability for errors, omissions, or inadequacies in the information contained herein or for the interpretation thereof. The reader assumes sole responsibility for the selection of these materials to achieve their intended results. The opinions expressed herein are subject to change without notice.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	6
2018 Review: ROAP, China, and Europe holding up the RRU boat.....	7
RRU/ARS Forecast 2019-2023.....	9
Demand Drivers for Our Forecast .....	10
Summary.....	12
RESEARCH METHODOLOGY .....	14
CHAPTER 1: OVERALL MARKET PERFORMANCE.....	18
1.1 2018: Weakness due to transition to 5G NR and U.S. Export Ban on ZTE.....	18
1.2 OEM Analysis –Huawei Continued to Gain Share.....	22
1.3 The Chinese Factor .....	23
1.4 RRU/ARS Forecast 2019-2023 .....	24
1.5 Demand Drivers for Our Forecast .....	25
CHAPTER 2: 5G NR RRU/ARS .....	32
2.1 5G NR RRU/ARS Forecast 2019-2023 .....	38
CHAPTER 3: 4.9G MASSIVE MIMO ARS .....	42
CHAPTER 4: 4G/4.5G/5G RRU .....	46
4.1 4G/4.5G/5G RRU Vendor Market Share.....	49
4.2 Low Band FDD still gaining share due to NB-IoT as High Band TDD Soars .....	52
4.3 The Chinese Factor .....	53
CHAPTER 5: 1T2R RFM/RRU .....	58
CHAPTER 6: MULTI-BAND RRU .....	60
CHAPTER 7: GEOGRAPHICAL MARKET SHARE .....	63
SE Asia: The bright spot in a down year .....	63
CHAPTER 8: NORTH AMERICA .....	67
8.1 United States .....	69
8.2 Canada .....	72
CHAPTER 9: LATIN AMERICA/CARIBBEAN .....	74
9.1 Mexico .....	76
CHAPTER 10: EUROPE .....	78
CHAPTER 11: AFRICA.....	82
CHAPTER 12: THE MIDDLE EAST.....	85
CHAPTER 13: ASIA PACIFIC .....	88
13.1 Japan.....	90
13.2 South Korea.....	92
13.3 China .....	93
13.4 India.....	97
CHAPTER 14: RRU/ARS OEM COMPANY PROFILES.....	100
14.1 Ericsson .....	101
14.2 Huawei Technologies .....	104
14.3 Nokia Networks .....	107
14.4 Samsung Networks .....	111
14.5 ZTE .....	114

## TABLES

Table 1: Global RRU/ARS Market Share by OEM, 2017-2018 (Units) .....	8
Table 2: Global Non-Massive MIMO RRU Market Share by Air Interface/Frequency Cluster, 2017-2018 (Units).....	20
Table 3: Global Massive MIMO ARS Market Share by Air Interface/Frequency Cluster, 2017-2018 (Units).....	20
Table 4: Global RRU/ARS Market Share by OEM, 2017-2018 (Units).....	22
Table 5: Global RRU/ARS Market Share, Chinese vs. ROW, 2017-2018 (Units).....	23
Table 6: Global RRU/ARS Forecast by Air Interface, 2019-2023 (Units).....	28
Table 7: Global RRU/ARS Forecast by Air Interface, 2019-2023 (% Market Share) .....	28
Table 8: Global RRU/ARS Forecast by Air Interface, 2019-2023 (% YoY Growth).....	28
Table 9: Global RRU/ARS Forecast, Non-MM vs. MM, 2019-2023 (Units) .....	30
Table 10: Global RRU/ARS Forecast, Non-MM vs. MM, 2019-2023 (% Market Share) .....	30
Table 11: Global RRU/ARS Forecast, Non-MM vs. MM, 2019-2023 (% Growth) .....	30
Table 12: Global RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units).....	31
Table 13: Global RRU/ARS Forecast by xTyR Configuration, 2019-2023 (% Market Share) .....	31
Table 14: Global RRU/ARS Forecast by xTyR Configuration, 2019-2023 (% YoY Growth).....	31
Table 15: Global 5G Massive MIMO ARS Shipments Vendor Market Share, 2017-2018 (Units) .....	35
Table 16: Global 5G Massive MIMO ARS Market Share, Chinese vs. ROW, 2017-2018 (Units) .....	36
Table 17: Global 5G Massive MIMO ARS Shipments by Frequency Cluster, 2017-2018 (Units) .....	37
Table 18: Global 5G RRU/ARS Forecast by Frequency Cluster, 2019-2023 (Units) .....	40
Table 19: Global 5G RRU/ARS Forecast by Frequency Cluster, 2019-2023 (% Market Share).....	40
Table 20: Global 5G RRU/ARS Forecast by Frequency Cluster, 2019-2023 (% Growth YoY) .....	40
Table 21: Global 4.9G MM ARS Shipments by Frequency Cluster, 2017-2018 (Units) .....	44
Table 22: Global 4.9G MM ARS Market Share, 2017-2018 (Units).....	44
Table 23: Global 4.9G MM ARS Forecast by Duplex Mode, 2019-2023 (Units) .....	45
Table 24: Global 4.9G MM ARS Forecast by Duplex Mode, 2019-2023 (% Market Share) .....	45
Table 25: Global 4.9G MM ARS Forecast by Duplex Mode, 2019-2023 (% Growth YoY) .....	45
Table 26: Global 4G/4.5G/5G RRU Shipments by Duplex Mode, 2017-2018 (Units) .....	46
Table 27: Global 4G/4.5G/5G RRU Shipments by xTyR Configuration, 2017-2018 (Units).....	47
Table 28: Global 4G/4.5G/5G Dual Band RRU Shipments by xTyR Configuration, 2017-2018 (Units) .....	48
Table 29: Global 4G/4.5G/5G RRU Market Share, 2017-2018 (Units).....	49
Table 30: Global 4G/4.5G/5G FDD RRU Market Share, 2017-2018 (Units) .....	50
Table 31: Global 4G/4.5G/5G TDD RRU Market Share, 2017-2018 (Units).....	51
Table 32: Global 4G/4.5G/5G RRU Shipments by Frequency Cluster, 2017-2018 (Units) .....	52
Table 33: Global 4G/4.5G/5G RRU Market Share, Chinese vs. ROW, 2017-2018 (Units).....	53
Table 34: Global 4G/4.5G/5G RRU Forecast by xTyR Configuration, 2019-2023 (Units).....	55
Table 35: Global 4G/4.5G/5G RRU Forecast by xTyR Configuration, 2019-2023 (% Market Share) .....	55
Table 36: Global 4G/4.5G/5G RRU Forecast by xTyR Configuration, 2019-2023 (% YoY Growth) .....	55
Table 37: Global 4G/4.5G/5G RRU Forecast by Frequency Cluster, 2019-2023 (Units) .....	57
Table 38: Global 4G/4.5G/5G RRU Forecast by Frequency Cluster, 2019-2023 (% Market Share) .....	57
Table 39: Global 4G/4.5G/5G RRU Forecast by Frequency Cluster, 2019-2023 (% Growth YoY) .....	57
Table 40: Global 2G/3G 1T2R RRU Shipments, 2017-2018 (Units) .....	58
Table 41: Global 4G/4.5G FDD Multi-Band RRU Forecast, 2019-2023 (Units) .....	61
Table 42: Global 4G/4.5G FDD Multi-Band RRU Forecast, 2019-2023 (% Market Share) .....	61
Table 43: Global 4G/4.5G FDD Multi-Band RRU Forecast, 2019-2023 (% YoY Growth).....	61
Table 44: Global RRU/ARS Shipments by Region, 2017-2018 (Units).....	63
Table 45: Global RRU/ARS Shipments by Region, Forecast vs. Actual, 2018 .....	64
Table 46: Global RRU/ARS Shipment Forecast by Region, 2019-2023 (Units) .....	65
Table 47: Global RRU/ARS Shipment Forecast by Region, 2019-2023 (% Market Share) .....	65
Table 48: Global RRU/ARS Shipment Forecast by Region, 2019-2023 (% YoY Growth) .....	65
Table 49: North America RRU/ARS Forecast by Type, 2019-2023 (Units) .....	68
Table 50: North America Non-Massive MIMO RRU Forecast, 2019-2023 (Units).....	68
Table 51: North America <6GHz Massive MIMO ARS Forecast, 2019-2023 (Units).....	68
Table 52: North America >6GHz Massive MIMO ARS Forecast, 2019-2023 (Units).....	68
Table 53: North America RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units) .....	69
Table 54: Latin America RRU/ARS Forecast by Type, 2019-2023 (Units) .....	75
Table 55: Latin America Non-Massive MIMO RRU Forecast, 2019-2023 (Units) .....	75
Table 56: Latin America <6GHz Massive MIMO ARS Forecast, 2019-2023 (Units).....	75
Table 57: Latin America >6GHz Massive MIMO ARS Forecast, 2019-2023 (Units).....	75
Table 58: Latin America RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units) .....	75
Table 59: Europe RRU/ARS Forecast by Type, 2019-2023 (Units).....	79
Table 60: Europe Non-Massive MIMO RRU Forecast, 2019-2023 (Units).....	79

Table 61: Europe <6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	79
Table 62: Europe >6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	79
Table 63: Europe RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units).....	79
Table 64: Africa RRU/ARS Forecast by Type, 2019-2023 (Units) .....	83
Table 65: Africa Non-Massive MIMO RRU Forecast, 2019-2023 (Units).....	83
Table 66: Africa <6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	84
Table 67: Africa >6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	84
Table 68: Africa RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units) .....	84
Table 69: The Middle East RRU/ARS Forecast by Type, 2019-2023 (Units) .....	86
Table 70: The Middle East Non-Massive MIMO RRU Forecast, 2019-2023 (Units).....	86
Table 71: The Middle East <6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	86
Table 72: The Middle East >6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	86
Table 73: The Middle East RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units) .....	86
Table 74: Rest of Asia Pacific RRU/ARS Forecast by Type, 2019-2023 (Units) .....	89
Table 75: Rest of Asia Pacific Non-Massive MIMO RRU Forecast, 2019-2023 (Units) .....	89
Table 76: Rest of Asia Pacific <6GHz Massive MIMO ARS Forecast, 2019-2023 (Units).....	89
Table 77: Rest of Asia Pacific >6GHz Massive MIMO ARS Forecast, 2019-2023 (Units).....	89
Table 78: Rest of Asia Pacific RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units) .....	90
Table 79: China RRU/ARS Forecast by Type, 2019-2023 (Units) .....	95
Table 80: China Non-Massive MIMO RRU Forecast, 2019-2023 (Units).....	96
Table 81: China <6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	96
Table 82: China >6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	96
Table 83: China RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units) .....	96
Table 84: India RRU/ARS Forecast by Type, 2019-2023 (Units) .....	99
Table 85: India Non-Massive MIMO RRU Forecast, 2019-2023 (Units).....	99
Table 86: India <6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	99
Table 87: India >6GHz Massive MIMO ARS Forecast, 2019-2023 (Units) .....	99
Table 88: India RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units) .....	99
Table 89: Ericsson Non-Massive MIMO RRU Shipments by Frequency Bands/Air Interface, 2017-2018 (Units).....	102
Table 90: Ericsson Massive MIMO ARS Shipments by Frequency Bands/Air Interface, 2017-2018 (Units) .....	102
Table 91: Ericsson RRU/ARS Shipments by xTyR Configuration, 2017-2018 (Units).....	102
Table 92: Huawei Non-Massive MIMO RRU Shipments by Frequency Bands/Air Interface, 2017-2018 (Units).....	105
Table 93: Huawei Massive MIMO ARS Shipments by Frequency Bands/Air Interface, 2017-2018 (Units) .....	105
Table 94: Huawei RRU/ARS Shipments by xTyR Configuration, 2017-2018 (Units) .....	105
Table 95: Nokia Networks Non-Massive MIMO RRU Shipments by Frequency Bands/Air Interface, 2017-2018 (Units).....	109
Table 96: Nokia Networks Massive MIMO ARS Shipments by Frequency Bands/Air Interface, 2017-2018 (Units).....	109
Table 97: Nokia Networks RRU/ARS Shipments by xTyR Configuration, 2017-2018 (Units) .....	109
Table 98: Samsung Networks Non-Massive MIMO RRU Shipments by Frequency Bands/Air Interface, 2017-2018 (Units).....	112
Table 99: Samsung Networks Massive MIMO ARS Shipments by Frequency Bands/Air Interface, 2017-2018 (Units).....	112
Table 100: Samsung Networks RRU/ARS Shipments by xTyR Configuration, 2017-2018 (Units).....	112
Table 101: ZTE Non-Massive MIMO RRU Shipments by Frequency Bands/Air Interface, 2017-2018 (Units) .....	114
Table 102: ZTE Massive MIMO ARS Shipments by Frequency Bands/Air Interface, 2017-2018 (Units)...	115
Table 103: ZTE RRU/ARS Shipments by xTyR Configuration, 2017-2018 (Units) .....	115

## EXHIBITS

Exhibit 1: Historical Global RRU Shipments, 2010-2019 (Units) .....	6
Exhibit 2: Global RRU/ARS Market Share by OEM, 2018 (% Market Share).....	9
Exhibit 3: Global RRU/ARS Forecast 2019-2023, (% YoY Growth) .....	10
Exhibit 4: Global RRU/ARS Shipments, 2017-2018 (Units) .....	18
Exhibit 5: Global RRU/ARS Shipments, Actual vs. Forecast, 2018 (Units) .....	19
Exhibit 6: Global RRU/ARS Market Share by Technology Generation, 2018 (% Market Share).....	21
Exhibit 7: Global RRU/ARS Market Share by Air Interface, 2017-2018 (Units).....	21
Exhibit 8: Global RRU/ARS Market Share by OEM, 2018 (% Market Share).....	22
Exhibit 9: Global RRU/ARS Market Share, Chinese vs. ROW, 2017-2018 (Units).....	23
Exhibit 10: Global RRU/ARS Forecast 2019-2023, (% YoY Growth).....	24
Exhibit 11: Global RRU/ARS Forecast, 2019-2023 (Units).....	26
Exhibit 12: Global RRU/ARS Forecast by Technology Generation, 2019-2023 (Units) .....	26
Exhibit 13: Global RRU/ARS Forecast by Technology Generation, 2019-2023 (% Market Share).....	27
Exhibit 14: Global RRU/ARS Forecast Prior vs. Current, 2018-2023 (Units).....	27
Exhibit 15: Global RRU/ARS Forecast, 2019-2023 (Units).....	28
Exhibit 16: Global RRU/ARS Forecast, 2019-2023 (% Market Share) .....	29
Exhibit 17: Global RRU/ARS Forecast, Non-MM vs. MM, 2019-2023 (Units) .....	29
Exhibit 18: Global RRU/ARS Forecast by xTyR Configuration, 2019-2023 (Units).....	30
Exhibit 19: Timing of 5G NR Specifications and 3GPP Timeline.....	32
Exhibit 20: Global 5G Massive MIMO ARS Shipments, Actual vs. Forecast, 2018 (Units).....	34
Exhibit 21: Global 5G Massive MIMO ARS Shipments, 2017-2018 (Units) .....	34
Exhibit 22: Global 5G Massive MIMO ARS Shipments Vendor Market Share, 2018 (Units).....	35
Exhibit 23: Global 5G Massive MIMO ARS Market Share, Chinese vs. ROW, 2017-2018 (Units) .....	36
Exhibit 24: Global 5G Massive MIMO ARS Shipments by Frequency Cluster, 2017-2018 (Units) .....	37
Exhibit 25: Global 5G RRU/ARS Forecast by Frequency Cluster, 2019-2023 (Units) .....	39
Exhibit 26: Global 5G RRU/ARS Forecast by <6GHz vs. >6GHz, 2019-2023 (Units).....	41
Exhibit 27: Global 4.9G MM ARS Shipments, Actual vs. Forecast, 2018 (Units) .....	43
Exhibit 28: Global 4.9G MM ARS Shipments, 2017-2018 (Units) .....	43
Exhibit 29: Global 4.9G MM ARS Market Share, 2018 (% Market Share) .....	44
Exhibit 30: Global 4.9G MM ARS Forecast by Duplex Mode, 2019-2023 (Units) .....	45
Exhibit 31: Global 4G/4.5G RRU Shipments by Duplex Mode, 2017-2018 (Units) .....	46
Exhibit 32: Global 4G/4.5G/5G RRU Shipments by xTyR Configuration, 2018 (% Market Share) .....	47
Exhibit 33: Global 4G/4.5G/5G Dual Band RRU Shipments by xTyR Configuration, 2017-2018 (Units) ....	48
Exhibit 34: Global 4G/4.5G/5G RRU Market Share by OEM, 2018 (% Market Share).....	49
Exhibit 35: Global 4G/4.5G FDD RRU Market Share by OEM, 2018 (% Market Share) .....	50
Exhibit 36: Global 4G/4.5G/5G TDD RRU Market Share by OEM, 2018 (% Market Share).....	51
Exhibit 37: Global 4G/4.5G/5G RRU Shipments by Frequency Cluster, 2018 (% Market Share).....	52
Exhibit 38: Global 4G/4.5G/5G RRU Market Share, Chinese vs. ROW, 2017-2018 (Units).....	53
Exhibit 39: Global 4G/4.5G/5G RRU Forecast, 2019-2023 (Units).....	54
Exhibit 40: Global 4G/4.5G/5G RRU Forecast by xTyR Configuration, 2019-2023 (Units).....	56
Exhibit 41: Global 4G/4.5G//5G RRU Forecast by Frequency Cluster, 2019-2023 (Units).....	56
Exhibit 42: Global 4G/4.5G/5G RRU Forecast by Duplex Mode, 2019-2023 (Units) .....	57
Exhibit 43: Global 2G/3G 1T2R RRU Shipments, 2017-2018 (Units) .....	58
Exhibit 44: Global 2G/3G 1T2R RRU Forecast, 2019-2023 (Units) .....	59
Exhibit 45: Global RRU/ARS Market Share by Region, 2018 (% Market Share).....	66
Exhibit 46: North America RRU/ARS Forecast by Type, 2019-2023 (Units) .....	67
Exhibit 47: AT&T Wireless 5G Evolution Smartphone Icon .....	69
Exhibit 48: Latin America RRU/ARS Forecast by Type, 2019-2023 (Units) .....	74
Exhibit 49: Europe RRU/ARS Forecast by Type, 2019-2023 (Units).....	78
Exhibit 50: Africa RRU/ARS Forecast by Type, 2019-2023 (Units) .....	83
Exhibit 51: The Middle East RRU/ARS Forecast by Type, 2019-2023 (Units) .....	85
Exhibit 52: Rest of Asia Pacific RRU/ARS Forecast, 2019-2023 (Units) .....	88
Exhibit 53: Japanese Mobile Operator CAPEX, FY15-FY19e .....	90
Exhibit 54: Korean Mobile Operator CAPEX, FY14-FY19e .....	92
Exhibit 55: China Mobile CAPEX 2017-2019.....	93
Exhibit 56: China RRU/ARS Shipment Forecast 2019-2023 (Units) .....	95
Exhibit 57: India RRU/ARS Shipment Forecast 2019-2023 (Units) .....	98
Exhibit 58: Ericsson RRU Shipments by Mobile Generation, 2018 (% Market Share).....	103
Exhibit 59: Ericsson RRU Shipments by xTyR Configuration, 2018 (% Market Share).....	103
Exhibit 60: Huawei RRU Shipments by Mobile Generation, 2018 (% Market Share) .....	106
Exhibit 61: Huawei RRU Shipments by xTyR Configuration, 2018 (% Market Share).....	106
Exhibit 62: Nokia Networks RRU Shipments by Mobile Generation, 2018 (% Market Share).....	110

Exhibit 63: Nokia Networks RRU Shipments by xTyR Configuration, 2018 (% Market Share) ..... 110  
Exhibit 64: Samsung Networks RRU Shipments by Mobile Generation, 2018 (% Market Share)..... 113  
Exhibit 65: Samsung Networks RRU Shipments by xTyR Configuration, 2018 (% Market Share) ..... 113  
Exhibit 66: ZTE RRU Shipments by Mobile Generation, 2018 (% Market Share) ..... 116  
Exhibit 67: ZTE RRU Shipments by xTyR Configuration, 2018 (% Market Share)..... 116