



Avoiding drowning in the mobile data tide

Wireless Backhaul Market from an Intermodal Perspective, 2nd edition

BY:

Esteban Monturus

Backhaul Market Analyst

Avoiding drowning in the mobile data tide: Wireless Backhaul Market from an Intermodal Perspective, 2nd edition

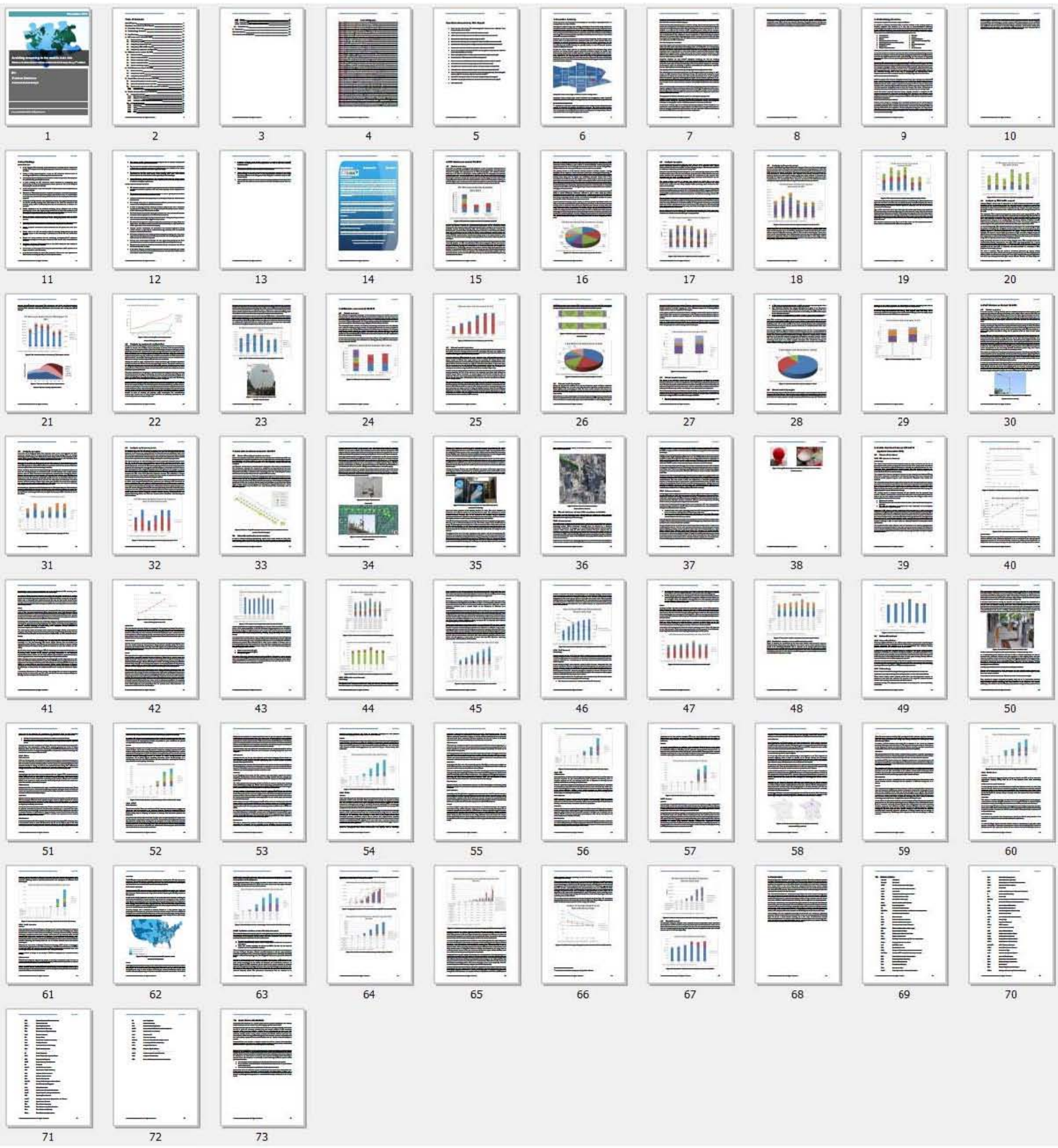


Table of Contents

List of Figures	4
Questions Answered by This Report	5
1. Executive Summary	6
2. Methodology Overview	9
3. Key Findings	11
4. PtP microwave market 1H 2013	15
4.1 Market overview	15
4.2 Analysis by region	17
4.3 Analysis by frequency band	18
4.4 Analysis by TDM traffic support	20
4.5 Analysis by equipment configuration	22
5. Millimeter wave market 1H 2013	24
5.1 Market overview	24
5.2 E-band market overview	25
5.3 E-band market by region	26
5.4 V-band market overview	27
5.5 V-band market by region	28
6. PmP Microwave Market 1H 2013	30
6.1 Market overview	30
6.2 Analysis by region	31
6.3 Analysis by frequency band	31
7. Sub-6 GHz backhaul market in 1H 2013	33
7.1 Macrocell backhaul market overview	33
7.2 Metrocell backhaul market overview	33
7.3 Trends in the use of sub-6 GHz spectrum worldwide	36
7.3.1 Licensed bands	36
7.3.2 Unlicensed bands	37
8. Mobile Backhaul Forecast 2013-2018 (updated November 2013)	39
8.1 Macrocell backhaul	39
8.1.1 PtP microwave forecast	39
8.1.2 Millimeter wave forecast	44
8.1.3 PmP forecast	46
8.1.4 Worldwide wireless macrocell backhaul market	48
8.2 Metrocell backhaul	49
8.2.1 Metrocell definition	49
8.2.2 Methodology	49
8.2.3 Africa	51
8.2.4 APAC	52
8.2.5 CALA	54
8.2.6 CIS	56

8.2.7	Europe	57
8.2.8	Middle East	60
8.2.9	North America	61
8.2.10	Worldwide wireless metrocell backhaul market	63
8.3	Global forecast	67
9.	Conclusion	68
10.	Abbreviations	69
11.	About Maravedis-Rethink	73

List of Figures

Figure 1 PtP Microwave equipment revenue evolution 2012-2013	15
Figure 2 PtP microwave market share by revenue 1H 2013.....	16
Figure 4 PtP microwave equipment revenue by region 1H 2013	17
Figure 5 PtP microwave unit sales by frequency (low bands) 1H 2013.....	18
Figure 6 PtP microwave unit sales by frequency (mid bands) 1H 2013	19
Figure 7 PtP microwave unit sales by frequency (high bands) 1H 2013	20
Figure 8 PtP wireless backhaul unit sales by TDM support 1H 2013.....	21
Figure 9 Telekom Austria's backhaul connections. September 2013.....	21
Figure 10 E-Plus Germany's backhaul connections. September 2013	22
Figure 11 PtP wireless backhaul unit sales by configuration 1H 2013	23
Figure 12 Example of long haul antenna size	23
Figure 13 Millimeter wave equipment revenue evolution 2012-2013	24
Figure 14 Millimeter wave unit sales by band 1H 2013	25
Figure 15 Ofcom's proposal to review E-band spectrum management.....	26
Figure 16 E-band market share by units shipped 1H 2013.....	26
Figure 17 E-band equipment revenue by region 1H 2013	27
Figure 18 V-band market share by units shipped 1H 2013.....	28
Figure 19 V-band equipment revenue by region 1H 2013	29
Figure 20 CCS radio installed in a lamppost in Cambridge (UK)	30
Figure 21 PmP microwave equipment revenue by region 1H 2013	31
Figure 22 PmP microwave equipment revenue by frequency 1H 2013.....	32
Figure 23 TUCAN3G Project's deployment plans for isolated communities in Peru	33
Figure 24 EE sub-6 GHz trial in UK	34
Figure 25 Vodafone Spain sub-6 GHz trial in Barcelona	34
Figure 26 Telecom New Zealand phone box with WiFi access point	35
Figure 27 Tarana sub-6 GHz trial in Manhattan	36
Figure 27 Google's Loon Project subscriber antenna (outside and inside)	38
Figure 28 Wireless vs wireline macrocell backhaul by region 2013-2018 (% cell sites).....	40
Figure 29 PtP radio shipments to verticals 2013-2018	40
Figure 30 E-Plus Germany's fiber backhaul evolution. September 2013	42
Figure 31 PtP microwave macrocell backhaul unit sales 2013-2018	43
Figure 32 PtP microwave macrocell backhaul unit sales by region 2013-2018	44
Figure 33 PtP macro microwave backhaul equipment revenue 2013-2018.....	44
Figure 34 Macro backhaul millimeter wave unit sales 2013-2018.....	45
Figure 35 Macro backhaul millimeter wave equipment revenue 2013-2018.....	46
Figure 36 PmP microwave macro backhaul unit sales 2013-2018.....	47
Figure 37 PmP macro wireless backhaul revenue forecast 2013-2018.....	48
Figure 38 Wireless macro backhaul equipment revenue 2013-2018	49
Figure 39 Installation of FTTx street cabinet in Spain.....	50
Figure 40 Metrocell shipments by backhaul type Africa 2013-2018 (BS units).....	52
Figure 42 Metrocell shipments by backhaul type APAC 2013-2018 (BS units)	54
Figure 43 Metrocell shipments by backhaul type CALA 2013-2018 (BS units).....	56
Figure 44 Metrocell shipments by backhaul type CIS 2013-2018 (BS units).....	57
Figure 46 Microwave links deployed in France (26 and 38 GHz).....	58
Figure 47 Metrocell shipments by backhaul type Europe 2013-2018 (BS units).....	60
Figure 48 Metrocell shipments by backhaul type Middle East 2013-2018 (BS units).....	61
Figure 49 Straight Path Communications' spectrum assets	62
Figure 50 Metrocell shipments by backhaul type North America 2013-2018 (BS units).....	63
Figure 51 Aggregated evolution of metrocell forecast (April'13 vs. November'13).....	64
Figure 52 Worldwide metrocell shipments by backhaul type 2013-2018	64
Figure 53 Evolution of metrocell forecast per backhaul type (April'13 vs. November'13).....	65
Figure 54 Evolution of average selling price per metrocell backhaul radio (2013-2018).....	66
Figure 55 Wireless metrocell backhaul radio unit sales per technology (2013-2018)	67
Figure 56 Macro+Metro wireless backhaul equipment revenue 2013-2018	67

Questions Answered by This Report

- What was the size of the PtP microwave, PmP microwave and millimeter wave backhaul markets in 1H 2013?
- What is the current state of the sub-6 GHz backhaul market?
- Which were the leading vendors in the different wireless backhaul markets?
- What market shares did they achieve during 1H 2013?
- What were the frequency bands in highest demand in the PtP microwave market?
- What were the frequency bands in highest demand in the PmP microwave market?
- What was the evolution of E-band and V-band shipments in 1H 2013?
- What was the regional breakdown for PtP microwave, PmP microwave and millimeter wave radio shipments in 1H 2013?
- Do the Africa, Middle East and CIS regions show similar behavior to Europe?
- How quickly is the TDM-to-packet evolution taking place?
- What was the share of all-outdoor radios in the global wireless backhaul market?
- Is all-outdoor microwave market growing quicker than E-band radio?
- What will be the market size of the wireless macrocell backhaul in 2013-2018?
- What will be the market size of the wireless metrocell backhaul in 2013-2018?
- What will be the breakdown of metrocells by backhaul type, including Sub-6 GHz, PtP microwave, PmP microwave, millimeter wave and wireline?
- What will be the regional pattern of metrocell deployment by backhaul type?
- What facts are going to determine the metrocell backhaul trends in each region?
- ***And much more!***

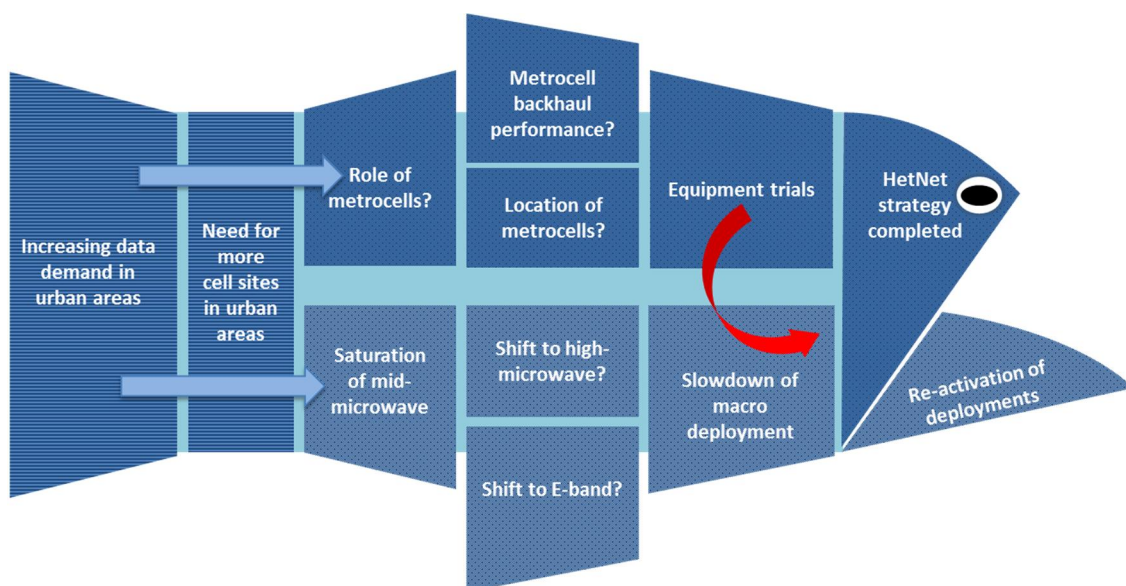
1. Executive Summary

Mobile operators are in the process of managing the data tide, as a young fish learns to manage the power of its caudal fin

Managing the surge of mobile data demand, particularly in dense urban areas, continues to cause headaches to carriers. The nature of cellular networks means the only way forward is the densification of the network. As the number of cells multiplies, the probability of having easy access to fiber when building each new site decreases. Well-proven microwave technology has conveniently solved such challenges in the past, but the typical 15 to 23 GHz bands have begun to saturate. On the other hand, mobile operators wonder whether it is the time to make use of metrocells¹ to overcome the situation.

Conscious of the long-term implications of their strategic decisions, mobile operators have realized 2013 is the year when those existential doubts need to be resolved. Given the complexity of metrocell deployment, its coexistence with the existing macro layer and the challenges of its backhaul, extensive trials are being developed. Fortunately, most operators are not discarding any technical options, but generally testing all sorts of metrocell backhaul solutions available in the market.

In order not to lose control and end up swimming in circles like disoriented fish, mobile operators are slowing down their macro deployments until their strategies are clearer. As a consequence, during 1H 2013 the PtP microwave equipment market registered 9% and 17% lower revenue than 1H 2012 and 2H 2012 respectively. The most important slowdown (-44% QoQ shipments in Q1 2013) has taken place in the 15, 18 and 23 GHz bands, which traditionally account for roughly 50% of the total microwave shipments. The issue of increasing saturation of those bands has been discussed for years in the industry, but only now are the first real consequences being seen.



Dissipation of the metrocell hype reinforces caution among carriers

Awareness of the excessive hype around metrocells has strengthened mobile operators' caution. During 2013 mobile operators have quietly been adding a bit of reality to their metrocell deployment plans after realizing the challenges that still need to be overcome to put them into

¹ A metrocell is an all-outdoor small cell deployed in urban areas to provide additional cellular capacity in hot-spots and additional coverage in non-spots. The typical spacing between metrocells is 50 to 300 meters, being installed at lower heights compared to macrocells (usually 3 to 8 meters above street level). Metrocells feature an open group of users, allowing access to any subscriber from the owning/managing mobile operator.

operation. Consequently, our forecast for metrocell deployment, and its related backhaul, for the coming five years has been updated with this more realistic understanding of HetNets and the time it will take to address all their challenges.

Despite this temporary slowdown, 2014 is expected to bring revenue increase back to the PtP microwave market, provided that mobile operators have done their homework before the end of this year. However, the increase will be slow until 2016, when sharp market growth of 17% is expected as a result of full execution of LTE deployment plans. Making use of strategies developed during 2013, mobile operators will increasingly shift their deployment efforts from the macro to the metro layer, causing a wireless macro backhaul equipment revenue decrease of 19% in 2017, followed by subsequent market stabilization in 2018. Following the pattern outlined in the previous edition of this report, the wireless metrocell backhaul market will offset the revenue decrease, reaching US\$ 18.5 million revenues in 2013 and an accumulated US\$ 4.84 billion in the 2013-2018 timeframe.

The effect of regional constraints

In the market, there are no better or worse backhaul technologies, only more or less suitable options for each carrier depending on its existing assets and ecosystem. As a consequence, backhaul technologies cannot be analyzed individually, but must be considered in conjunction with the other pieces of the puzzle within which they need to fit. Varying national and local regulations have strong influence on how mobile operators address the backhaul issue. Strict regulations for approval of new macro sites in the city of Moscow and the existence of 250 different local cellular network legislations in Brazil are just two examples of the challenges faced by mobile operators worldwide.

Regulators influence not only carriers' deployment strategies, but also the eventual development of the backhaul industry as a whole. Regulators should not only attend to carriers' demands, but also proactively develop proper regulation that enables sustainable and smart solutions to better serve citizens. For instance, the lack of support from regulators is not helping the industry to exploit the availability of precious backhaul-suitable block-allocated spectrum that was once auctioned but eventually poorly used.

The growing millimeter wave market gradually aligns technology and use cases

The millimeter wave market (including V-band and E-band) managed to grow during 1H 2013 despite the PtP microwave market shrinkage. During the most recent months, the target applications of E-band and V-band have been clearly differentiated. With a few exceptions related to particular regulatory decisions, E-band targets macro backhaul applications as the natural substitute for all-outdoor microwave. On the other side, V-band is increasingly becoming the de facto millimeter wave variant for metrocell backhaul applications, thanks to the reduced size of radios and the balance between spectrum cost (free) and interference risk (relatively low).

Since the two bands have now become well differentiated, this report includes for the first time a separate analysis of E-band and V-band markets for 1H of 2013. The shipment of first owned (not re-sold) E-band radios by big players such as Huawei, NEC and Siae and the expected release of innovative V-band products by vendors such as Siklu and BridgeWave confirms the eventual take-off of the market.

Changing role of unlicensed frequency bands in carrier-grade deployments

Although everybody agrees metrocell availability requirements can be relaxed when they are deployed within the coverage of a macrocell, there is no global consensus yet about the target number of nines forming the availability figure. Backhaul spectrum scarcity and propagation challenges are bringing the benefits of unlicensed spectrum back on top of the table.

In spite of the relatively high risk of suffering interference, unlicensed 5 GHz continues to be proposed for metrocell backhaul. Supporters claim the ability of the latest generation radios to adapt to changing environmental radio conditions can work around the well-known interference from end-user WiFi devices avoiding severe service degradation.

However, concerns about risk of interference have invaded the territory of millimeter wave technologies. V-band, whose interference immunity was taken for granted in the past, is now analyzed in more detail. Vendors are currently discussing what radio features will make the promised ease of deployment a reality. Some national regulators' decisions to manage E-band in an unlicensed way are also contributing to focusing attention on interference issues.

2. Methodology Overview

Quantitative analysis: based on leading vendors' input

In addition to providing information about the recent evolution of the market, analysis of historical shipments and revenues is the first step in Maravedis-Rethink forecasting methodology. Such analysis is based on the hard data that has been generously shared by the leading equipment vendors in each market segment. Information is then processed in order to obtain breakdowns by region, frequency band, equipment architecture and TDM traffic support. The vendors that contributed shipment information for this report are:

- Alcatel-Lucent
- Aviat Networks
- Bluwan
- BridgeWave Communications
- Cambridge Broadband Networks (CBNL)
- Ceragon Networks
- DragonWave
- E-Band Communications
- Ericsson
- Huawei
- Intracom Telecom
- Japan Radio Company (JRC)
- NEC
- Siae Microelettronica
- Siklu
- Sub10 Systems

IMG-40, an improved model to forecast the evolution of the cellular infrastructure market

As the second edition of *Wireless Backhaul Market from an Intermodal Perspective*, this report leverages and improves on the models previously developed. Analysis of the market, previously based on the top-37 international mobile groups (IMG-37), has been widened to 40 groups, increasing from 78% to 80% the percentage of the global mobile subscriber base reflected in the model.

By covering 212 national network operators, Maravedis-Rethink's integrated RAN and backhaul IMG-40 model allows tracking the deployment strategies developed by the largest and most influential international carrier groups. Transnational analysis of each group helps to understand the strategies they follow to find a balance between their respective corporate cultures and regional constraints. The subscriber mix served by the selection of operators covered by IMG-40 accurately reflects the contribution of each region to the world's population. This approach has additional benefits, such as the ability to disaggregate the heterogeneous EMEA conglomerate into the more homogeneous regions of Europe, CIS, Middle East and Africa.

IMG-40 macrocell backhaul forecast

IMG-40 macrocell RAN forecast distinguishes between new sites deployed and "refreshed" sites, where RAN equipment is replaced. On top of that, IMG-40 macrocell backhaul forecast begins with the estimation of the breakdown between wireless and wireline backhaul for the operations of each mobile operator group in each country in 2013. In order to forecast the evolution of the backhaul mix, information provided by operators as well as regional backhaul and fixed broadband deployment trends is taken into account. The effects of shipments to verticals, wireless backhaul repeaters and co-location are considered by the model, as well.

Within the wireless macrocell backhaul market, a separate forecast is developed for PtP microwave (separately for short haul and long haul), PmP microwave and millimeter wave. Regional breakdown is provided for each technology, as well, building both on the historic shipments and on the expected changes for each market. Both unit and equipment revenue forecasts are developed.

IMG-40 metrocell backhaul forecast

Because of the novelty of metrocells, there is no historic reference that can be leveraged to develop its backhaul forecast. IMG-40 metrocell backhaul forecast starts by determining which backhaul technologies will be preferred by each mobile operator in each country. Because of the huge influence of local regulations and local deployment trends, there are very relevant differences between regions as far as metrocell backhaul breakdown. For a clearer explanation, the forecast is presented by region, providing justification for the operators that back the uptake of each backhaul technology.

Besides wireline, IMG-40 covers the following metrocell backhaul technologies: sub-6 GHz, PtP microwave, PmP microwave and millimeter wave. Once regional breakdowns are obtained, they are consolidated by technology to provide a grasp of the global success of each backhaul technology. Like the macrocell backhaul forecast, the metrocell backhaul includes both units and equipment revenue versions. In the latter case, assumptions about average selling price evolution for each technology are particularly relevant, due to the quick evolution that is expected for this market compared to the macrocell backhaul market.

Backhaul**Research****Service****About the author:**

With over ten years of experience in the wireless industry, Esteban Monturus holds an MSc degree in Telecommunications Engineering from the University of Zaragoza (Spain) and is following an Executive MBA in IESE Business School (Barcelona, Spain). He started his professional career at the R&D Department of Teltronic SAU, one of the leading professional radio communications equipment manufacturers in the world. For five years, Esteban developed and tested wireless broadband equipment, including Bluetooth, WLAN and especially Mobile WiMAX. Technical and analytical skills acquired at Teltronic allowed him to join Maravedis as market analyst for 4G operators and backhaul. During this stage, he contributed to 4GCounts service in Europe and authored several research reports on mobile backhaul. In 2011, Esteban decided to start an IT services business targeted at SMEs in Spain. Taking advantage of such a great experience, he is now back at his analyst position, now fully focused on mobile backhaul, one of the hottest topics in the mobile industry.

All data contained in this research material is proprietary to Maravedis-Rethink . and may not be distributed in either original or reproduced form to anyone outside the client's internal organization within five years of the research material date without prior permission of Maravedis-Rethink.

The research material contained herein is for individual use of the purchasing Licensee and may not be distributed to any other person or entity by such Licensee including, without limitation, to persons with the same corporate or other entity as such Licensee, without the express written permission of the Licensor.

Disclaimer:

Maravedis-Rethink makes no warranties express or implied as to the results to be obtained from use of this research material and makes no warranties expressed or implied of merchantability or fitness for a particular purpose. Maravedis-Rethink shall have no liability to the recipient of this research material or to any third party for any indirect, incidental, special or consequential damages arising out of use of this research material.

Maravedis-Rethink Return Policy

Downloaded or sent research materials in any format are not refundable, nor credited under any circumstances. It is the sole responsibility of the buyer to verify through the Table of Contents and the Executive Summary that the research material fits the buyer's information needs.

To subscribe to the service, please contact Adlane Fellah at
sales@Maravedis-BWA.com or call + 1 305 865 1006