

# **The Promise of Wireless IP Network Extension for “Fixed” WiMAX Operators**

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Mappiah Consulting

Michael Yaw Appiah is currently a senior consultant in Mappiah Consulting Denmark.

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RTX Telecom A/S,  
© 2008 RTX Network Systems.  
Stroemmen 6, 9400 Noerresundby, Denmark  
Email: info@rtx.dk

Michael Yaw Appiah  
Former Contributing Author at  
RTX Telecom A/S, Denmark  
Network Systems

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## Executive Summary

### Current Situation & Challenges

- Provide high quality telephony, broadband data and mobility solution extension to WiMAX networks as WiMAX network may never become globally widespread to achieve the desired economies of scale.
- Fully exploiting the advantages of WiMAX network and market segments by supplying telephony services and WiFi access built as a “add-on” to the network
- Maintain operation cost while managing increasing customer growth and service demands

### Business Opportunity: RTX Approach

Deploy complete suite of RTX Wireless IP Network solution as an extension to WiMAX network to deliver high quality telephony services and WiFi access.

### Business Benefits

- High Return of Investment: We forecast ROI of 80% for the residential market in the metropolitan areas and Average ROI of 110% for the residential and SME market in the Metro and Rural Areas.
- Very fast roll-out of high quality telephony/WiFi access to Urban, Suburban, Remote-urban and Rural consumers since it is simple and easy to deploy because this solution can be deployed in license free bands and without and specific radio planning. The WiMAX operator is effectively freed from crippling license fees.
- Other business results include Support for Mobility, Better time to market, Improved indoor /outdoor coverage, Greater flexibility in managing spectrum resources, and Wider range of cost efficient Handset Devices for telephony services.

## Introduction: Adding Telephony, Mobility and Value to WiMAX

It has been observed that WiMAX technology may never become truly globally spread, as other comparable wireless technologies quickly achieve greater economies of scale, but rather remain as a complement to other fixed and mobile networks.

While WiMAX operators have an excellent network reach to all market segments, the WiMAX network really lacks a cost efficient voice and WiFi access network with cost effective terminals, real voice mobility and high quality telephony solution as known and required by the Telecommunication Industry.

This paper presents a detailed business case analysis of a converged mobility telephony and WiFi access solution extension for fixed WiMAX Operators. By adding a quality telephony/WiFi solution, Fixed WiMAX operators can bring their service offerings a further step into the real telephony/data services for the residential, SMEs and large Enterprises in a cost effective way. Therefore telephony mobility on top of WiMAX network brings all mobility services to the customer and makes an efficient use of the network.

In this way, WiMAX Operators will significantly increase their business and revenue potentials.

## Definitions:

For the purpose of this present document the following terms and definitions holds:

<b>NPV</b>	Net Present Value - The future value of an investment depending on a particular cost of capital. 10% is assumed in the business case examples
<b>IRR</b>	Internal Rate of Return - The cost of capital that results in a NPV of zero at the end of the period, in this case, 2 years
<b>ARPU</b>	Average Revenue per User - The expected average customer revenue
<b>CPE</b>	Customer Premises Equipment - Equipment that resides at the customer or subscriber end of the network
<b>SME</b>	Small and Medium Enterprise - Small and medium sized businesses
<b>SOHO</b>	Small Office Home Office
<b>MAN</b>	Metropolitan Area Network - WiMAX, based on IEEE 802.16 is a wireless MAN technology
<b>LOS</b>	Line of Sight - Both ends of a wireless link are in visual sight of one another
<b>NLOS</b>	Non Line of Sight - Line of sight between ends of a wireless link is blocked by buildings or other obstacles
<b>CAPEX</b>	Capital Expenditure Transactions
<b>ROI</b>	Return on investment

## Current Situation & Challenges

Currently WiMAX networks are configured using point-to-multipoint architecture to deliver high speed data services over a radius up to several kilometers depending on frequency, transmit power and receiver sensitivity.

The range and NLOS capability means to provide wireless “last mile” broadband access in the Metropolitan Area Network (MAN) and Rural areas.

Despite the success of high speed data solutions from WiMAX operators, the delivery of high quality telephony and WiFi access network in front of their solution to customers require enhanced functionalities from a radio access technology that WiMAX cannot satisfy due to some of its inherent short comings and design points that is beyond the scope of WiMAX when it was first developed.

Further to make true telephony/WiFi and mobility WiMAX business case viable, then it requires that:

An ecosystem of cost efficient handsets must be available. The economy of scale is not ripe to permit cheap WiMAX handsets since there is no global approach to spectrum for these handsets. Even when spectrum is allocated, it will take widespread adaptation to bring down handset costs [1].

In addition to that, the window of opportunity is closing for WiMAX as a technology to be competitive since the economies of scale is very high and network cost is also significantly high [2].

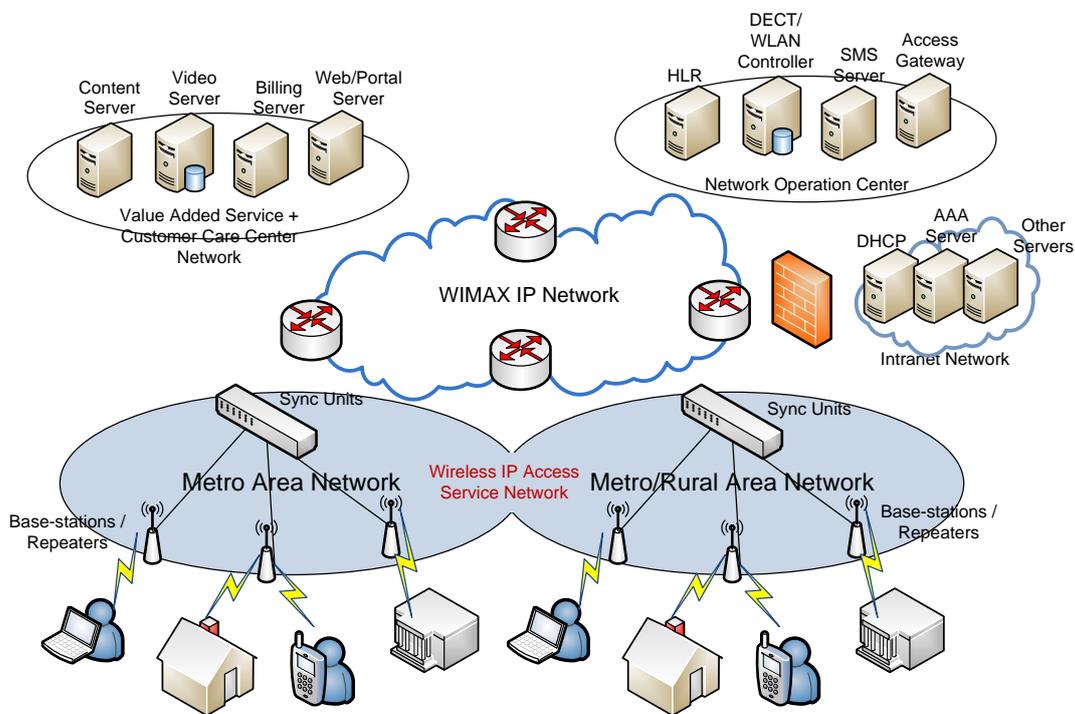
One viable solution to provide high quality telephony services and WiFi access through WiMAX network is by building an “add-on” to the WiMAX operator’s network.

## Business Opportunity: RTX Approach

Until recently, any customers that need quality telephony mobility and WiFi will have to depend on the traditional wireline and other mobile operators. However, the IP revolution and a well matured WiMAX network infrastructure brings a new player to the table: Telephony/WiFi over WiMAX.

Telephony/WiFi over WIMAX also known in this paper as Wireless IP Network provides a high quality telephony extension to WiMAX network, adding mobility for the telephony users.

The Telephony/WiFi extension solution to WiMAX from RTX is setup from an interconnection of Base stations, Ethernet Sync Units and Repeaters hosted together with WiMAX Base stations on a tower. The backbone of the Wireless IP Network is based on the existing WiMAX backhaul which can be used to connect other cells and clusters.



**Figure 1: Wireless IP Network deployed over WiMAX**

To increase WiMAX Operators business base, the following opportunities are worthy of mention as they represent potential revenue sources.

## **1. High Speed Internet Access (WiFi) for Residential/SOHO/SMEs:**

This market is largely dependent on wireline operators. In some areas the availability of the service may not meet customer expectations for performance and reliability and/or are too expensive.

In emerging economies/countries, there are many regions without means of internet access. In many rural areas of developed countries, residential customers are limited to low speed dial-up services. The analysis will reveal that Wireless IP Network will enable operators to economically address this market segment and have an attractive business case for various kinds of demographic conditions

## **2. Telephony to WiMAX market segments:**

WiMAX operators have built solid market segments (Residential, SOHO and SMEs) and supported fixed, nomadic, portable and mobile usage service model with high data access. These operators can expand their revenue base by providing high quality telephony solutions to their WiMAX customers through existing market segments and models.

## **3. Telephony Cellular Backhaul:**

One other business potential is that high quality telephony services can be leased to other Wireline and Mobile operators. Wireless IP Network built over WiMAX Backhaul can play a role in enabling mobile and wireline operators without network access to remote areas to provide high quality voice services even with mobility to these un-reached areas.

## **4. Telephony Public Safety Services and Private Networks:**

The ability to provide ubiquitous coverage in metropolitan and remote areas provides a tool for law enforcement, fire protection and other public safety organizations enabling them to maintain critical communications under a variety of adverse conditions. Private networks for industrial complexes, universities and other campus type environments also represent a potential business opportunity for Wireless IP Network over WiMAX Operators.

In summary, Wireless IP Network deployed over WiMAX brings WiFi access, mobility, roaming and handover features, low cost and high quality voice services for various market areas.

## Key Business Benefits

Many features and benefits can be derived in deploying a Wireless IP Network over WiMAX. A few of them are elaborated here:

- **High Return on Investment:** According to our assumptions, the revenue generated from the Wireless IP Network solution extension to WiMAX operator will yield a return on investment (ROI) of an average of 105% on all market segments of Residential, SMEs and Rural areas. This clearly demonstrates an attractive business model. Refer to section “Business Case Analysis” below for more detailed explanations.

- **Better time to market:** An extension of high quality telephony service and WiFi access to fixed WiMAX network will enable operators meet the pent-up demand for telephony services in underserved areas, and to start gaining market share ahead of traditional telephony competitors. Further these operators can tap into their existing market channels to reach out to their customers. This shortens the time the operators need to introduce the new telephony product.

- **Fast rollout of Telephony/WiFi access in License-exempt bands:** There is very fast roll-out of high quality telephony services to Urban, Suburban, Remote-urban and Rural consumers since it is simple and easy to deploy. The Wireless IP Network deployment does not need crippling frequency license fees, probably the most expensive and difficult part of establishing any WiMAX/fixed line telecoms network is the last mile through to the customer.

- **Better and wide network coverage:** The strategic placement of Base stations using point-to-multipoint architecture backhauled to the core network can be used to deliver telephony services over up to several kilometers over large urban and remote areas.

- **Wider range of cost efficient Handset Devices:** There is a mature ecosystem of cost efficient handsets available that can be deployed on the Wireless IP Network over WiMAX. This allows WiMAX operators to extend telephony services to their addressable markets in order to gain some market share from the traditional wireline and mobile operators.

There is also support for power-saving, sleep modes, long talk time and other advanced features for the mobile handsets – the technology behind the handsets is fully mature.

- **Quality Telephony Service and Support for Mobility:** The Wireless IP Network telephony services are optimized for mobility and will support handoffs at high speeds.

- **Reduces service implementation:** The Wireless IP Network offers value because operators are able to add new services (value added services) without having to re-configure the whole network each time.

- **Improves network availability:** Redundant system architecture and links within the network serves as a backup facility that transforms network recovery from noticeable minutes of other network architecture downtime to transparent sub-second recovery.

## Business Case Considerations and Assumptions

An accurate business case analysis must take into account a wide variety of variables. These will be described in this section along with the assumptions used in the business case analysis.

### Demographics

Demographics play a key role in determining the business viability of any telecom network. In our analysis, we identified that quality telephony/WiFi over WiMAX network will cover 4 main revenue generating demographics namely urban, suburban, remote-urban and rural areas.

Remote-urban areas are primarily residential and compared to suburban areas are further from the urban center with lower household densities. Typically, wireline/mobile operators offering telephony services or WiFi access in these areas are limited or non-existent due to the distance between the end-user, the switching center and cable in many cases is simply too expensive.

Rural areas for the purpose of the business case analysis are defined as small cities or towns that are located far from a metropolitan area. Customer densities can be fairly high in these areas but they tend to be underserved due to their remote location.

The following table summarizes the characteristics that will generally be encountered in each of the four geographical areas under consideration for deploying quality telephony services and WiFi access over WiMAX network.

Area	Characteristics
<b>Urban</b>	<ul style="list-style-type: none"> <li>• Highest density of potential “Telephony/WiFi” customers</li> <li>• Many multiple tenant office and residential buildings</li> </ul> <p><b>Due to the competitive environment an Integrated Telephony/ WiFi &amp; WiMAX operator can expect:</b></p> <ul style="list-style-type: none"> <li>• Slightly-High market penetration</li> <li>• Low marketing and sales expense because marketing channels have already been established by the operator through its WiMAX services.</li> </ul> <p><b>Other considerations:</b></p> <ul style="list-style-type: none"> <li>• Unlicensed spectrum would be desirable for fast roll out of the service.</li> </ul>
<b>Suburban</b>	<ul style="list-style-type: none"> <li>• Moderate density of potential “Telephony/WiFi” customers that have signed to WiMAX services</li> <li>• Higher percentage of single family residences</li> <li>• Business parks, strip malls, university campuses, etc</li> <li>• Other Telephony operators may not be available universally</li> </ul> <p><b>An integrated Telephony/WiFi &amp; WiMAX operator can expect:</b></p> <ul style="list-style-type: none"> <li>• Somewhat higher market penetration compared to urban</li> </ul>
<b>Remote-urban</b>	<ul style="list-style-type: none"> <li>• Upscale residential neighborhoods with moderate to low household density</li> <li>• Fewer business establishments</li> <li>• Other Telephony/WiFi operators may not universally available</li> <li>• Requirements of architectural boards, environmental impact studies, etc. that adds to Base station sites development costs may not be required</li> </ul>

	<ul style="list-style-type: none"> <li>• High percentage of commuters to suburban &amp; urban areas</li> <li>• Expect higher market penetration for moderate to low households and businesses</li> </ul>
<b>Rural</b>	<ul style="list-style-type: none"> <li>• Distant from major Metro Areas</li> <li>• Residential and small business</li> <li>• No or Very little if any, wireline and mobile operators</li> <li>• Demand for operator with combined advantages of quality telephony and high speed data service</li> <li>• Limited competition</li> </ul> <p><b>An integrated Telephony/WiFi &amp; WiMAX operator can expect:</b></p> <ul style="list-style-type: none"> <li>• Very high market penetration and rapid adoption rate for the Telephony/WiFi service</li> </ul> <p><b>Other considerations:</b></p> <ul style="list-style-type: none"> <li>• High capacity backhaul may not be a challenge, since its been deployed in the WiMAX network</li> </ul>

**Table 1: Demographic Characteristics**

## Services

The following is a description of the services used in the business case assumed with a typical year ARPUs (i.e. Average Revenue per User). These ARPU are competitive with and sometimes below current Telephony operators services.

In addition to telephony/WiFi access to residential and SME customers, it is assumed that the operator will also offer FAX and SMS services. Other revenue sources include activation fees and a low cost Wireless IP Network handset retails or sales. These fees are assumed to stay constant over the business case period.

Regulator imposed taxes and tariffs are not included in the analysis since these costs are generally passed through to the existing WiMAX end-customer and will therefore, have little or no impact on the business case.

Customer	Service Description	Monthly ARPU	Other Revenue Sources
<b>Residential Normal</b>	Basic Telephony/WiFi Services	€ 30-60	€ 10/month for Handset rentals or € 50 Handset purchase. Activation fees could vary
<b>Residential Premium</b>	Feature Rich Telephony/WiFi services + SMS	€ 80-120	€ 10/month for Handset rentals or € 50 Handset purchase. Activation fees could vary
<b>Small Business</b>	Normal PBX Telephony Features + SMS + FAX + WiFi	> € 120 Depends on use	€ 10/month for Handset rentals or € 50 Handset purchase. Activation fees could vary
<b>Business Premium</b>	Hosted PBX services + SMS + FAX + WiFi	> € 120 Depends on use	€ 10/month for Handset rentals or € 50 Handset purchase. Activation fees could vary

**Table 2: Services and ARPU**

## Frequency Band Choices

A key decision with regard to spectrum choice is whether to use licensed or unlicensed spectrum. The use of licensed spectrum has the obvious advantage of providing protection against interference from other wireless operators. The disadvantage is dealing with the licensing process. This process varies depending on local regulations from either being very simple and quick to complex and lengthy and in countries where auctions are used, it can be expensive in highly sought-after regions. The Wireless IP Network does not need to be deployed on a licensed band.

The use of licensed-exempt spectrum gives the wireless operator the advantage of being able to deploy immediately. Generally the use of unlicensed spectrum is desirable in all business demographics. In these demographics, interference mitigation is easily accomplished through frequency coordination or frequency reuse. This enables the use of automatic channel selection to enable auto-selection of channels that are not subject to interference from other wireless operators.

The three frequency bands that are of primary interest for deployment of high quality telephony services over fixed WiMAX network situation are:

- The unlicensed spectrum 1880 MHz–1900 MHz in Europe.
- The unlicensed 1900-1920 MHz or 1910 MHz–1930 MHz bands in other countries.
- The unlicensed 1920 MHz–1930 MHz band in the US.

## Geographic Scenarios for Business Case Analysis

For the business case analysis two different scenarios are analyzed, the characteristics of which are summarized in table 3.

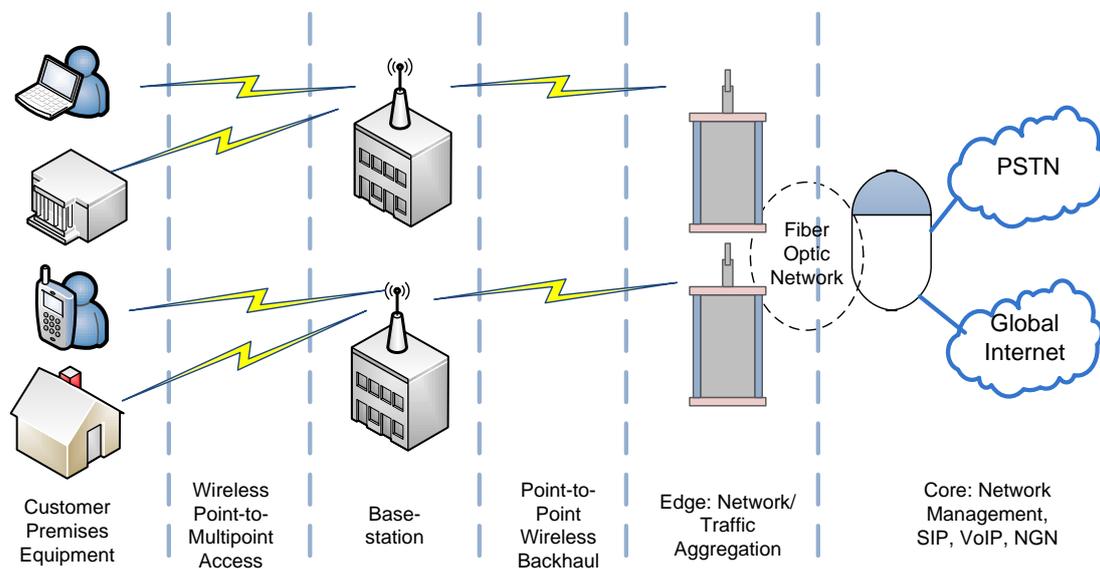
	Scenario 1	Scenario 2
<b>Geographical Area Description</b>	Huge City and Metropolitan Areas	Small Rurally Located City or Town
<b>Maket Segment</b>	Residential, SME and Large Businesses	Residential and SME
<b>Size</b>	Approx. 130 sq. km	Approx. 14 sq. km
<b>Residential Density</b>	5000 House-holds/sq-km in Urban Areas 1000 House-holds/sq-km in Suburban Areas 500 House-holds/sq-km in Remote-urban	500 House-holds/sq-km
<b>Total Households</b>	Very High (Approx.200,000)	Low (Approx.2,000)
<b>Total SME</b>	Approx. 20,000	Approx. 150
<b>Adoption Rate</b>	Very fast (within 2 years)	Very fast (within 1.5 years)
<b>Frequency Band</b>	Unlicensed band	

**Table 3: Summary of Business Case Scenarios**

## Suggested Capital Expenditure (CAPEX)

### Base station, Edge and Core Network

This business illustration assumes that deploying a network should include an allowance for core and edge network equipment (see figure 2). Most of this equipment must be in place prior to offering services. Base stations and it related equipment need not be installed in totality in the beginning, but can be deployed over a period of time to address specific market segments or geographical areas of interest to the operator. All the same, in a metro area, it is worth to install a sufficient number of Base stations to cover an addressable market large enough to quickly recover network infrastructure costs. It is also desirable to deploy Base stations in such way to minimize the possibility of having to insert other Base stations within the same coverage area to add capacity. This approach would generally require careful long range market analysis.



**Figure 2: Edge and Core Network Deployment**

In the business case analysis, it is assumed in scenario one that all the Base stations and Repeaters necessary to meet long term capacity requirements would be deployed prior to offering services. In scenario two, lower number of Base stations and Repeaters are deployed to cover the region and a number of Base-stations can be increased in later years to increase capacity.

In large metropolitan areas an operator may choose to deploy Base stations over several years to spread out the capital investment by dividing the area into smaller geographic regions and fully covering one region prior to moving on to the next. The business case also assumes that the deployment of a high capacity point-to-point wireless backhaul connection for each Base station to a fiber node for connection to the core network has already been deployed in the WiMAX setup. Therefore no capital expense is needed for the wireless backhaul connection.

Table 4 summarizes the Base station and infrastructure costs that have been assumed for the two business case scenarios. For scenario 1 and 2 it is assumed that a spectrum is unlicensed so the cost to the operator would be non-existent.

Description	Scenario 1	Scenario 2	Comments
<b>Base stations</b>	€ 2 K per Base station for 6 sector configuration		Covers all necessary cabinets and other network interface equipments
<b>Repeaters</b>	€ 500 for 5 channel configuration		N/A
<b>Backhaul Link</b>	€ 20 K, may vary depending on network architecture		50% already deployed within the WiMAX network
<b>Edge &amp; Core Network</b>	≈ € 200 K or more, depending on the network architecture	≈ € 50 K or more, depending on the network architecture	Routers, Ethernet Sync Units, Ethernet Sync Switches, HLR Servers, Configuration Servers, Maintenance & Monitoring, SNMP Agents, <b>Supplied in WiMAX network:</b> Border Controller, Media Gateway, Access Server, etc.
<b>Spectrum License</b>	N/A		There are no “crippling” license fees.
<b>Base station Installation Civil Works</b>	> € 50 K , may vary from country to country	> € 40 K, may vary	Some outdoor cabling, Install and commissioning, etc. <b>Note:</b> Base station site Leasing costs taken care during WiMAX deployment

Table 4: CAPEX for Network Infrastructure

## Wireless IP Network Handsets (CPE)

Cost effective Wireless IP Network Handsets with variety of features and functionalities will be available to address the needs of different market segments.

In the business case analysis a percentage breakdown of each is assumed in accordance with the frequency band, cell radius and propagation conditions that are likely to be encountered in the different geographical areas.

High-end handsets will be configured for SMEs and will be generally priced higher for the business case consistent with added performance and enhanced functionalities. For both the residential and SME market segment it is assumed that a high percentage of customers will opt to buy the Handset from the operator rather than pay a lease or rent fee. This has the effect of significantly reducing the Handset CAPEX and Handset maintenance expense, thereby increasing operator payback and revenues regarding lease and sales of Handsets.

The business case analysis assumes that the price of residential/SME terminals will be 50 € (it could be more).

## Operating Expenditures

It is assumed in this paper that the operating expenses such as Sales & Marketing, Network operations, Equipments Maintenance, Customer Site Lease etc. is subsumed within the operating expense of the existing WiMAX network. Therefore operating expense for the Wireless IP Network solution is not considered in this business case model.

## Business Cases

### Scenarios 1: Residential Market in Metropolitan Areas

A market financial summary for scenario 1 is provided in table 5. The spectrum available to the operator is assumed to be limited to 2x12 (Time slots). The Wireless IP Network uses Base station equipment that uses 1.728 MHz channels with Time Division Duplexing. A 6-sector Base station therefore can be deployed using a suitable frequency reuse policy. It is forecasted that it will take 2 year adoption plan to reach 75% of target market penetration. The contribution of operation expenses plays a lesser role because in the second year as annual rate of customer grows to offset all operational costs.

The CAPEX is dominated by low cost handsets since it is assumed that 80% of the handsets for this scenario are supplied by the operator. This is offset by the handset sales of 40€ and handset rentals of 10€.

With a return on investment (ROI) of 80% this is clearly an attractive business model.

<b>Spectrum (in MHz)</b>		<b>Deployment Telephony and Data</b>	
Frequency Band	1910-1930	# Base stations	1296
Channel Bandwidth	1.728	# Outdoor Repeaters	100
Spectrum Required	20	Coverage Area (sq-km)	81
		Population in Coverage Area	600,000
<b>Addressable Market</b>		<b>Estimated CPE Mix</b>	
Households covered	142,000	% Low Cost Handsets supplied by Operator	80%
		ARPU Price Erosion	4%
<b>Market Penetration (3<sup>rd</sup> year)</b>		<b>Avg # Subscribers per Tower (10-12 Base stations per Tower)</b>	<b>1320</b>
Market Adoption Curve	2 years	Total CAPEX per Subscriber	€ 50
Residential Market	24%	Total CAPEX (in €M)	3.9
Residential Voice /WiFi Services	55%		
<b>Net Present Value in €M (3 years)</b>	<b>€ 4.2</b>	<b>Return on Investment (ROI)</b>	<b>80%</b>

Table 5: Residential Market Segment Summary for Scenario 1

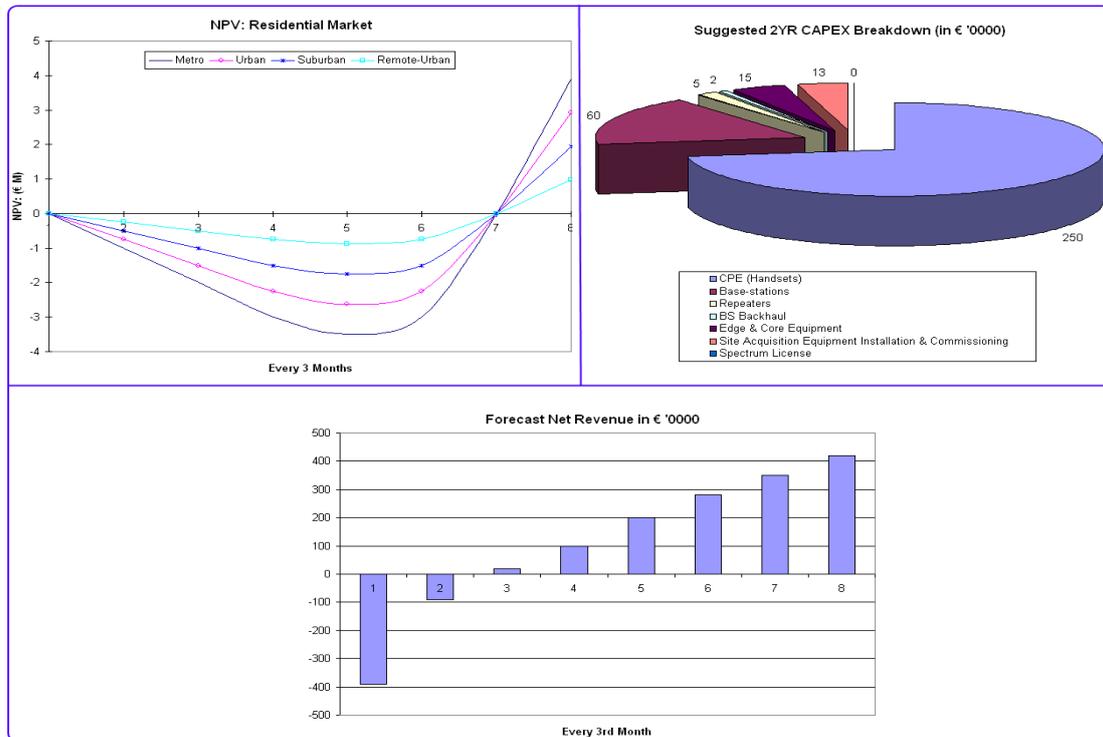


Figure 3: Financial Forecast Summary for Scenario 1

## Scenario 2: Residential, and SME Segment in a Metropolitan Environment

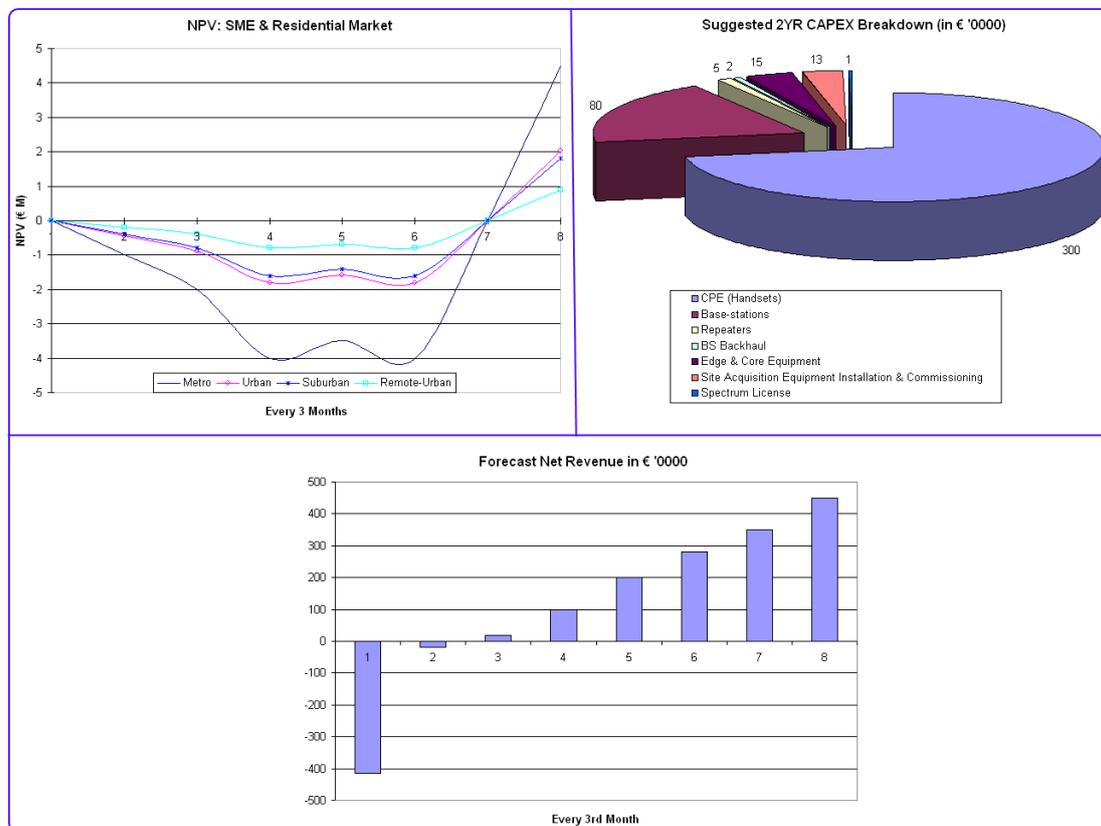
The business case for scenario 2 is summarized in table 6. This deployment scenario covers the same geographical area as scenario 1 but requires 400 additional Base station sites to provide the added capacity necessary to address the SME market in addition to the residential market segment. Even though the number of business customers is about one-tenth the number of residential customers the higher ARPU doubles the gross revenue (see graphs in figure 4) and improves the payback by more than six months as compared to a residential-only market segment.

With the resulting smaller average cell sizes an increased number of indoor/outdoor residential huge number of handsets can be supported as compared to scenario 1. These units being lower cost it is reasonable to conclude that more residential and business customers will choose to buy rather than rent their handsets.

Spectrum (in MHz)		Deployment Telephony and Data	
Frequency Band	1910-1930	# Base stations	1700
Channel Bandwidth	1.728	# Outdoor Repeaters	250
Spectrum Required	20	Coverage Area (sq-km)	81
		Population in Coverage Area	660,000
Addressable Market		Estimated CPE Mix	
Households covered	142,000	% Residential Low Cost Handsets supplied by Operator	80%
Businesses covered	35,000	% SME Low Cost Handsets	60%

		supplied by Operator	
		ARPU Price Erosion	4%
<b>Market Penetration (3<sup>rd</sup> year)</b>		<b>Avg # Sub. per Tower (Residential)</b> <b>Avg # Sub. per Tower (Business)</b> <b>(12 Base stations per Tower)</b>	<b>1320</b> <b>456</b>
Market Adoption Curve	2 years	Total CAPEX per Subscriber	€ 78
Residential Market	24%	Total CAPEX (in € M)	€ 4.15
Residential Voice/WiFi Services	55%		
SME Market	33%		
SME Voice/WiFi Services	65%		
<b>Net Present Value in €M (3 years)</b>	<b>4.5</b>	<b>Return on Investment (ROI)</b>	<b>98%</b>

**Table 6: Residential and SME Market Segment in Metropolitan Environment**



**Figure 4: Financial Forecast Summary for Scenario 2**

### Scenario 3: Residential Market Segment in a Rurally Located Small City or Town

Scenario 3, summarized in table 7 and figure 5, is representative of many small cities or towns throughout the world in developed as well as developing countries. Geographically distant from major metropolitan areas, a WiMAX operator should take advantage of its established presence in this geography to quickly achieve high market penetration for high quality telephony services in these areas. Therefore, a 2-

year market adoption rate is assumed for this case with a residential market penetration at 2 years reaching 44%.

The use of spectrum in one of the license-exempt bands together with a suitable frequency re-use plan is considered in this scenario. Therefore capacity is not an issue in this illustration.

One of the key challenges that have been taken care of in the remotely located deployment areas by the WiMAX network is the establishment of a suitable high capacity backhaul connection to a distant fiber node.

In the analysis it is assumed that a multi-hop point-to-point microwave link would be needed to connect the “master” Base station to a distant fiber node or switching center (which is already owned by the operator). A small CAPEX investment and an IRR of 125% make this a very attractive market opportunity.

<b>Spectrum (in MHz)</b>		<b>Deployment Telephony and Data</b>	
Frequency Band	1910-1930	# Base stations	70
Channel Bandwidth	1.728	# Outdoor Repeaters	10
Spectrum Required	20	Coverage Area (sq-km)	21
		Population in Coverage Area	20,000
<b>Addressable Market</b>		<b>Estimated CPE Mix</b>	
Households covered	5,000	% Residential Low Cost Handsets supplied by Operator	80%
Businesses covered	700	% SME Low Cost Handsets supplied by Operator	60%
		ARPU Price Erosion	4%
<b>Market Penetration (3<sup>rd</sup> year)</b>		<b>Avg # Sub. per Tower (Residential)</b>	<b>660</b>
		<b>Avg # Sub. per Tower (Business)</b>	<b>228</b>
		<b>(6 Base stations per Tower)</b>	
Market Adoption Curve	2 years	Total CAPEX per Subscriber	€ 75
Residential Market	44%	Total CAPEX (in €M)	€ 0.2
Residential Voice/WiFi Services	65%		
SME Market	8%		
SME Voice/WiFi Services	65%		
<b>Net Present Value in €M (3 years)</b>	<b>0.7</b>	<b>Return on Investment (ROI)</b>	<b>125%</b>

**Table 7: Residential and SME Market Segment Summary in Metro Environment**

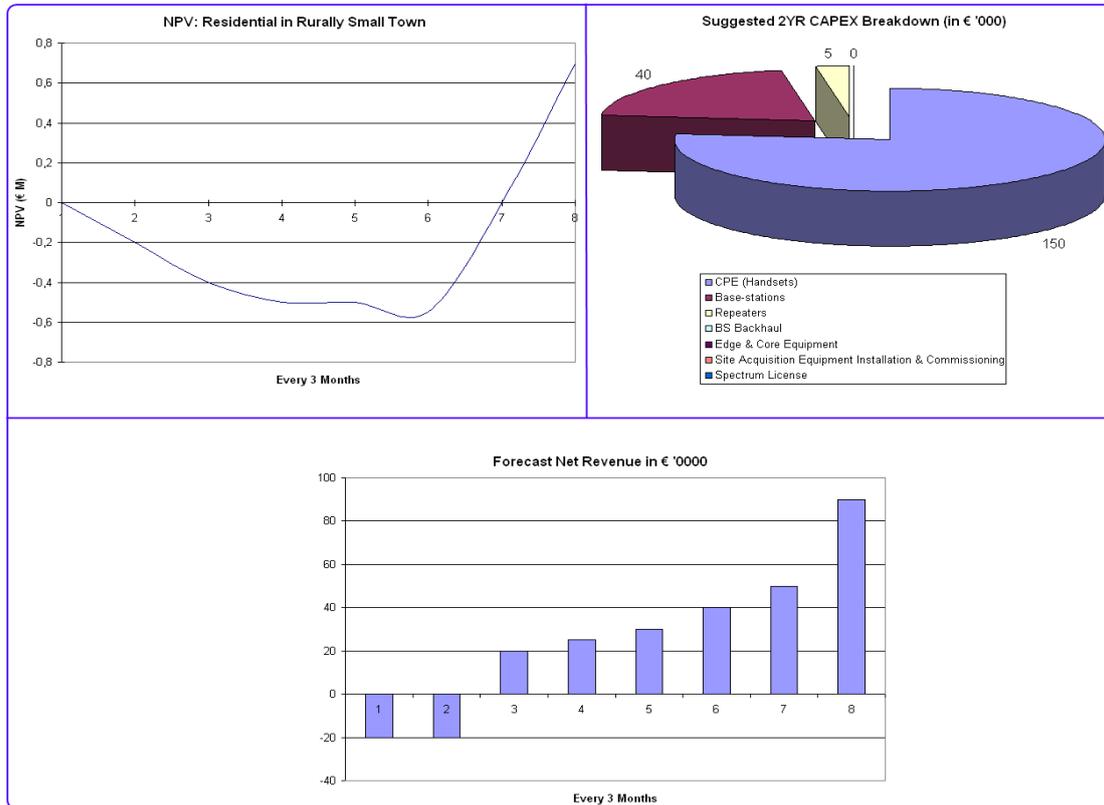


Figure 5: Financial Forecast Summary for Scenario 3

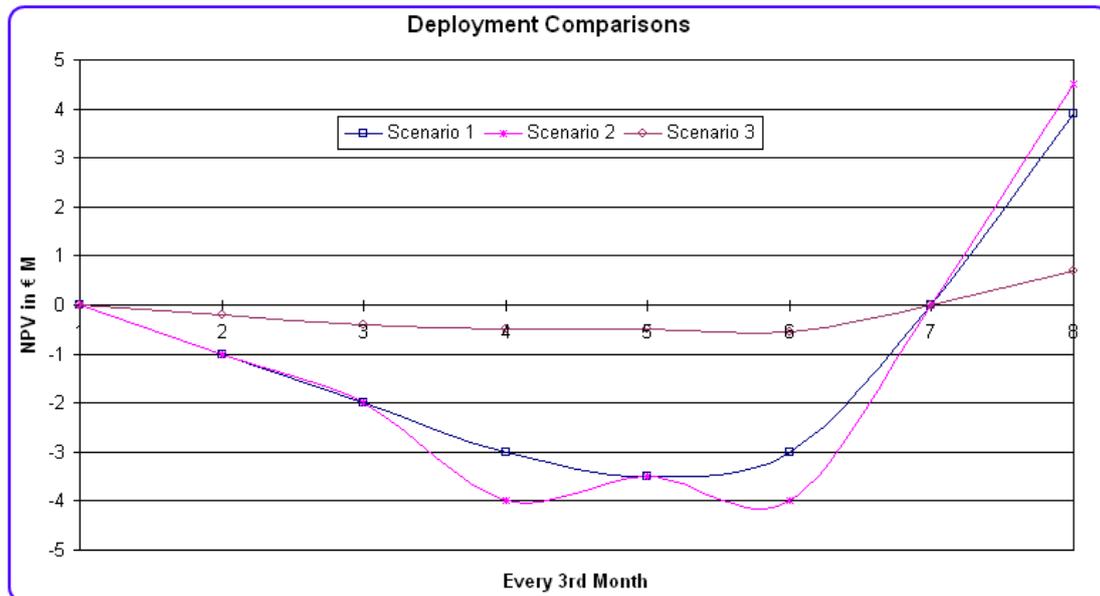
## Comparing the Three Business Case Scenarios

A NPV comparison of the three scenarios is shown in the graph in figure 6. The accompanying table in figure 6 provides a summary of the Wireless IP Network Base stations required to meet the capacity and coverage requirements in each of the three business case scenarios. The chart clearly shows the business advantage of adding the quality telephony extension to Fixed WiMAX market segment especially in the SME and residential market scenario.

Figure 6: Comparison of Scenarios 1, 2 and 3

Base station Deployment Summary				
Scenarios		# 1	# 2	# 3
Frequency Band		1910-1930 MHz		
Urban	# Base station	18	33	N/A
	# Repeaters	35	40	
	Range	1.3 km	1.1 km	
Suburban	# Base station	8	12	N/A
	# Repeaters	17	20	
	Range	1.9	1.5	
Remote-urban	# Base station	4	5	N/A
	# Repeaters	8	10	
	Range (approx)	2.8 km	2.0 km	

<b>Rural</b>	# Base station	<b>N/A</b>	2
	# Repeaters		8
	Range		3.2 km



## Conclusions and Summary:

There are many other demographic situations that can be analyzed and a host of alternative assumptions that can be made. We believe the scenarios and assumptions selected for the business case analysis in this paper will provide the WiMAX operators with a good perspective regarding the attributes and business opportunities that will be realized when deploying a Wireless IP Network over WiMAX.

Some conclusions that can be drawn from the analysis are:

**First:** A winning business case can be realized with high quality telephony/WiFi access over WiMAX based network in a wide variety of demographic environments.

**Second:** Addressing the SME market along with the residential market is a good business decision; it not only reduces the payback period but also reduces the investment risk since competitive forces in the two market segments are relatively independent.

**Third:** Leasing the telephony part of the network to wireline and mobile operators is a viable standalone business and does contribute significantly to the business case in conjunction with the residential and/or SME market.

In summary, deploying Wireless IP Network over WiMAX yields the following commercial benefits:

High Return on Investment, Better time to market, Fast rollout of telephony/WiFi access in License-exempt bands, Better and wide network coverage, Wider range of cheap Handset , High Quality Telephony/ WiFi access and Support for Mobility, Reduction of service implementation and Improvement of network availability:

## References:

- [1] Alcatel Lucent: Availability of spectrum, Handsets Key for Mobile WiMAX – Regional, Business News Americas, by P. Nixon, April 28, 2008,
- [2] Entel: WiMAX may never reach global scale- Chile Patrick Nixon, Business News Americas, May 19, 2008

## For More Information

RTX has helped Wireline/Mobile operators; and Hosted PBX service providers in both developed and emerging countries roll out scalable Wireless IP Network to their consumers while holding down operating costs. To learn more about how RTX Wireless IP Network can help your, contact our regional representative or visit <http://www.rtx.dk>

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This publication includes facts and ASSUMPTIONS describing the business viability and benefits of deploying RTX Wireless IP Network over WiMAX. It must be noted that many factors (not described in this document) will contribute to the results and benefits described.

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This publication should NOT be understood as a commitment by RTX.