Vilicom

UMTS Network Design & Cost

Estimation for National UMTS900, UMTS1800 & UMTS2100 Networks

9 June 2008

15 January 2009

1. Executive Summary

A design exercise was carried out in order to assess the deployment cost of national UMTS networks in the 900 MHz, 1800 MHz and 2100 MHz bands. The design was carried out to provide voice & data coverage to 95% of the population and 80% of the geographic area of the Republic of Ireland. The number of base-station sites required for a 900 MHz network was found to be 533, 1013 for an 1800 MHz network and 1243 for a 2100MHz network.

Dimensioning was then carried out for an assumed subscriber profile giving a requirement for seven RNC's to switch 4.28Gbps of traffic. The core network was then also dimensioned.

In estimating the cost of network deployment, the following network model was taken into account.

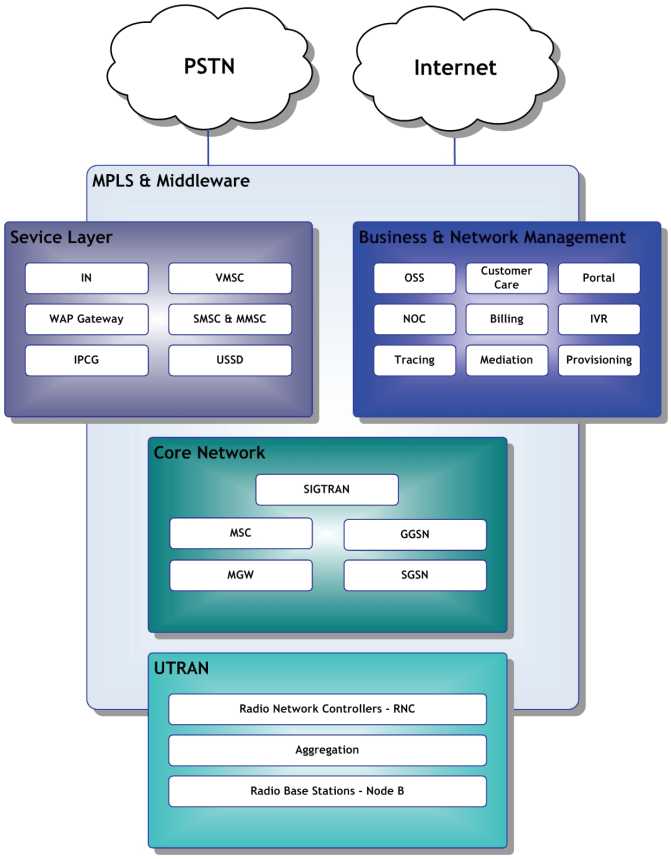

Figure 1-1 High level UMTS network model

Detailed pricing was examined for turnkey rollout, the Radio Access Network (RAN), the core network, the service layer, mediation, provisioning, middleware & applications, network management and customer management.

All hardware pricing are estimates. Vendors do not publish pricing, and hardware costs are generally blended into turnkey packages including services and O&M. Vilicom has estimated pricing based on the projects on which it has worked internationally. The following costs were calculated based on recent network deployment costs for UMTS networks internationally.

The table below shows the total deployment cost of a 900MHz, 1800MHz and 2100MHz network to cover 95% of the Irish population.

System	900MHz Cost	1800MHz Cost	2100MHz Cost
UTRAN	€xxx,xxx,xxx	€xxx,xxx,xxx	€xxx,xxx,xxx
Core Network	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx
Service Layer	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx
Mediation, Provisioning, Network and Customer Management	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx
Total	€xxx,xxx,xxx	€xxx,xxx,xxx	€xxx,xxx,xxx

Table 1-1 Estimated network deployment costs

The table shows that for the dimensioning assumptions, the deployment cost of a UMTS1800 network is 88.5% of the cost of deploying a UMTS2100 network. The deployment cost of a UMTS900 network is 65.6% of the cost of deploying a UMTS2100 network.

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Glossary

ADC	Acquisition, Design & Construction
BH	Busy Hour
DED	District Electoral Division, the smallest geographic area for census data
DNS	Domain Name System
E1	European carrier, type 1. A transmission standard with a line rate of 2.048Mbps
Erl	Erlang - unit of tele-traffic
GB	Giga *Bytes*
Gbps	Giga *bits* per second
GGSN	Gateway GPRS support node
GPRS	General Packet Radio Service
H/W	Hardware
HLR	Home Location Register
IN	Intelligent Networking
IPCG	Internet Protocol (data) Charging Gateway
Iu	Logical link between the radio network controller and the core network
Iub	Logical link between the radio network controller and radio base-stations (NodeB's)
IuCS	An Iu dedicated to circuit switched traffic, e.g. voice
IuPS	An Iu dedicated to packet switched traffic
IVR	Interactive voice response
kbps	Kilobits per second
LAN	Local Area Network
MAPL	Maximum Allowed Path Loss
MB	Mega *Bytes*
Mbps	Mega *bits* per second
mErl	One thousandth of an Erlang
MGW	Media Gateway
MMSC	Multimedia Message Service Centre
MPLS	Multi-Protocol Label Switching
MSC	Mobile Switching Centre
NOC	Network Operations Centre, also known as Service Management Centre
NodeB	A 3g base-station
O&M	Operations and Maintenance
OSS	Operations Sub-System
PSTN	Public Switched Telephone Network
RAN	Radio Access Network
RF	Radio Frequency
RNC	Radio Network Controller
SAN	Storage Area Network
SDH	Synchronous Digital Hierarchy
SGSN	Serving GPRS Support Node
SIGTRAN	An extension of SS7 to carry signalling over IP
SMSC	Short Message Service Centre
STM-1	Synchronous Transport Module, a transmission rate of SDH with a line rate of 155.52 Mbps
STM-4	Synchronous Transport Module, a transmission rate of SDH with a line rate of 622.08 Mbps
UMTS	Universal Mobile Telephony System
USSD	Unstructured Supplementary Service Data
UTRAN	UMTS Terrestrial Radio Access Network
VAS	Value Added Services
VMSC	Voice Mail Service Centre
WAN	Wide Area Network
WAP	Wireless Application Protocol

2. Cellular Design Methodology

The design was carried out using a hexagonal cell plan. The following steps were carried out:

- Definition of the radio link budget
- Definition of the radio propagation model
- Calculation of cell range and area
- Analysis of census data to create the coverage target area required to deliver the required population and geographic coverage
- Analysis of target areas for indoor coverage
- Creation of cellular design

2.1. UMTS900 Link Budgets

System Parameters	Value	Units	Notes
Operating Frequency	900	MHz	Specified by ComReg
Duplex	FDD		Specified by ComReg
Target DL bit rate	384	kbps	From ComReg
Target UL bit rate	64	kbps	From ComReg

Table 2-1 Assumptions and inputs used in the UMTS900 link budget

2.2. UMTS1800 LINK BUDGETS

System Parameters	Value	Units	Notes
Operating Frequency	1800	MHz	Specified by ComReg
Duplex	FDD		Specified by ComReg
Target DL bit rate	384	kbps	From ComReg
Target UL bit rate	64	kbps	From ComReg

2.3. Link Budget Results

2.3.1. Calculated Maximum Allowed Path Losses

The table below contains a summary of the calculated maximum allowed path losses for each design scenario.

Freq. (MHz)	Urban MAPL (dB)	Suburban MAPL (dB)	Rural MAPL (dB)
900	126.9	134.5	140.5
1800	126.9	134.5	140.5
2100	126.9	134.5	140.5

Table 2-2 - Summary of Maximum Allowed Path Losses (MAPL)

2.4. Hexagonal Network Designs

2.4.1. Cell Size and Range

The link budgets and propagation models were combined together to calculate the cell ranges for each type of environment. These are shown in the table below.

Freq (MHz)	Urban Cell Range (km)	Suburban Cell Range (km)	Rural Cell Range (km)
900	1.0329	1.697	16.198
1800	0.558	0.918	10.949
2100	0.470	0.772	9.753

Table 2-3 - Cell range summary

These cell sizes formed the basis of the hexagonal design to determine the site count.

2.4.2. *Hexagonal Design Templates*

Using the cell ranges calculated a hexagonal template was generated in the radio network-planning tool. A template was automatically generated by the radio network-planning tool for each cell type.

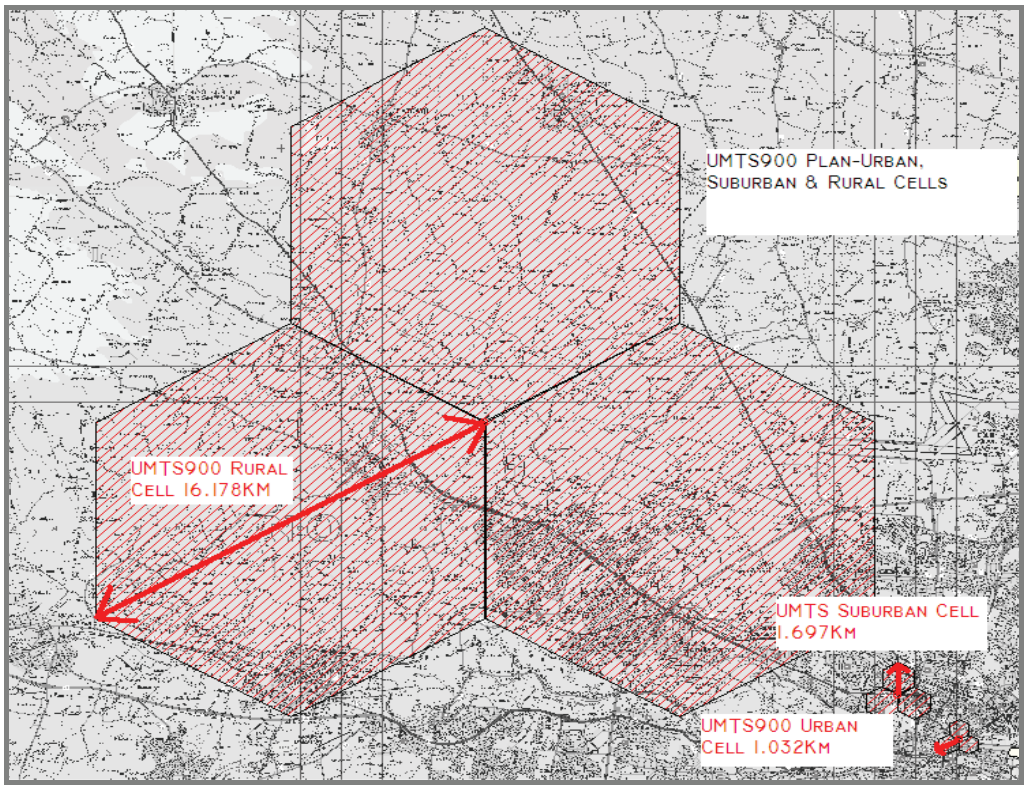

Figure 2-1 Hexagonal site templates for UMTS 900

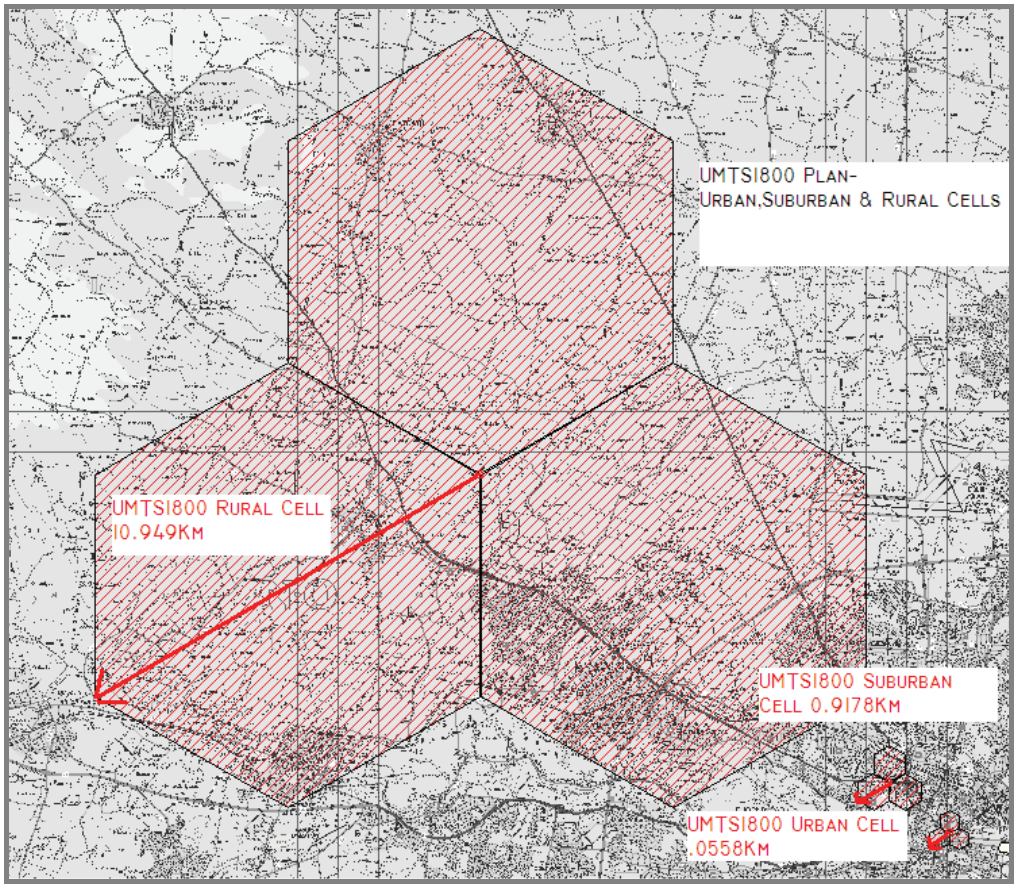

Figure 2-2 Hexagonal site templates for UMTS 1800

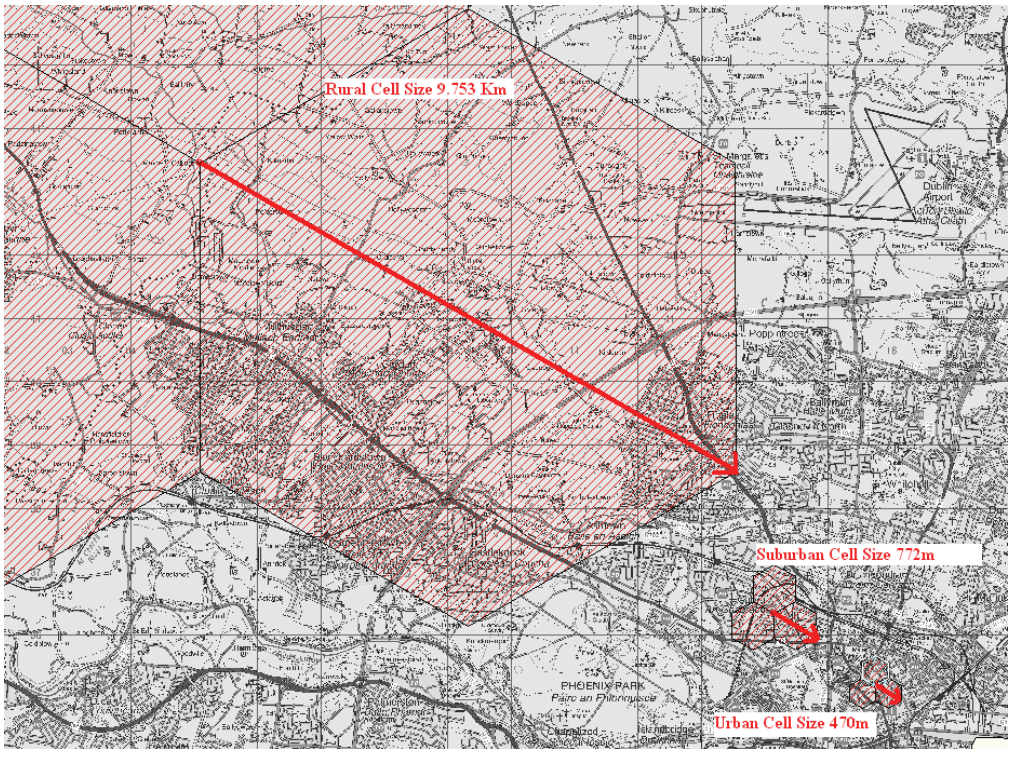

Figure 2-3 Hexagonal site templates for UMTS 2100

2.4.3. Coverage Target Area

The design requirement all three networks was 95% population coverage and 80% geographical coverage, with both criteria fulfilled. Using the census 2006 data, a coverage target polygon was created to give 95% population coverage. This percentage coverage was calculated using a proportional sum of the area of each District Electoral Division covered by the polygon. The final polygon provided 95.03% population coverage and 87.76% geographic coverage. This is shown in Figure 2-4 below.

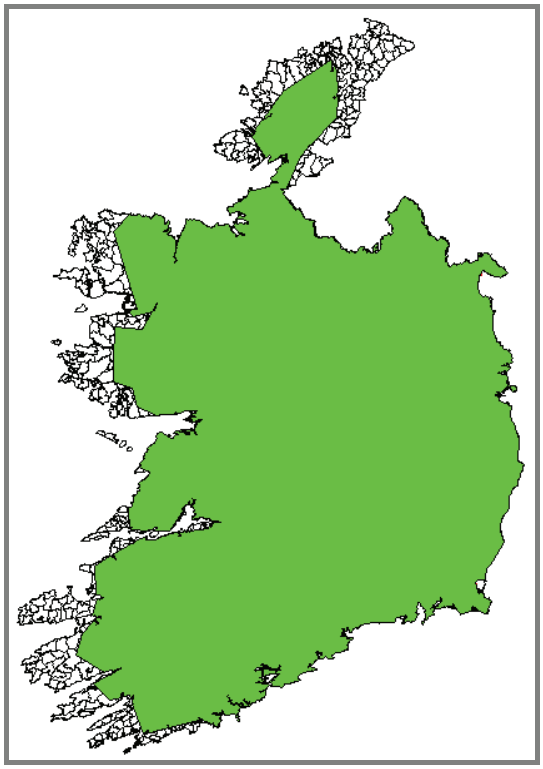

Figure 2-4 Map showing the 95.03% population coverage polygon

2.4.4. Radio Network Design Methodology

For all three designs, the 95% coverage polygon described was used as a boundary for the designs. The area inside this polygon was then divided up into 3 categories, Urban, Suburban & Rural. Each of these areas was populated with the appropriate site templates. It was ensured that each area type overlapped with the adjacent area types.

Five areas were considered to be of the urban environment type; Dublin, Cork, Limerick, Galway and Waterford city centres. These cities also had large suburban areas.

Using the Census 2006 data [2], all towns with a population of over 1500 people were examined individually and additional sites were deployed as appropriate to ensure adequate indoor coverage.

The remainder of the country inside the 95% population coverage polygon was populated with rural sites.

2.4.5. UMTS900 Radio Network Design

Using the urban, suburban and rural UMTS900 hexagonal site templates, a network was designed to cover the 95% polygon. This network design is shown in the figures below.

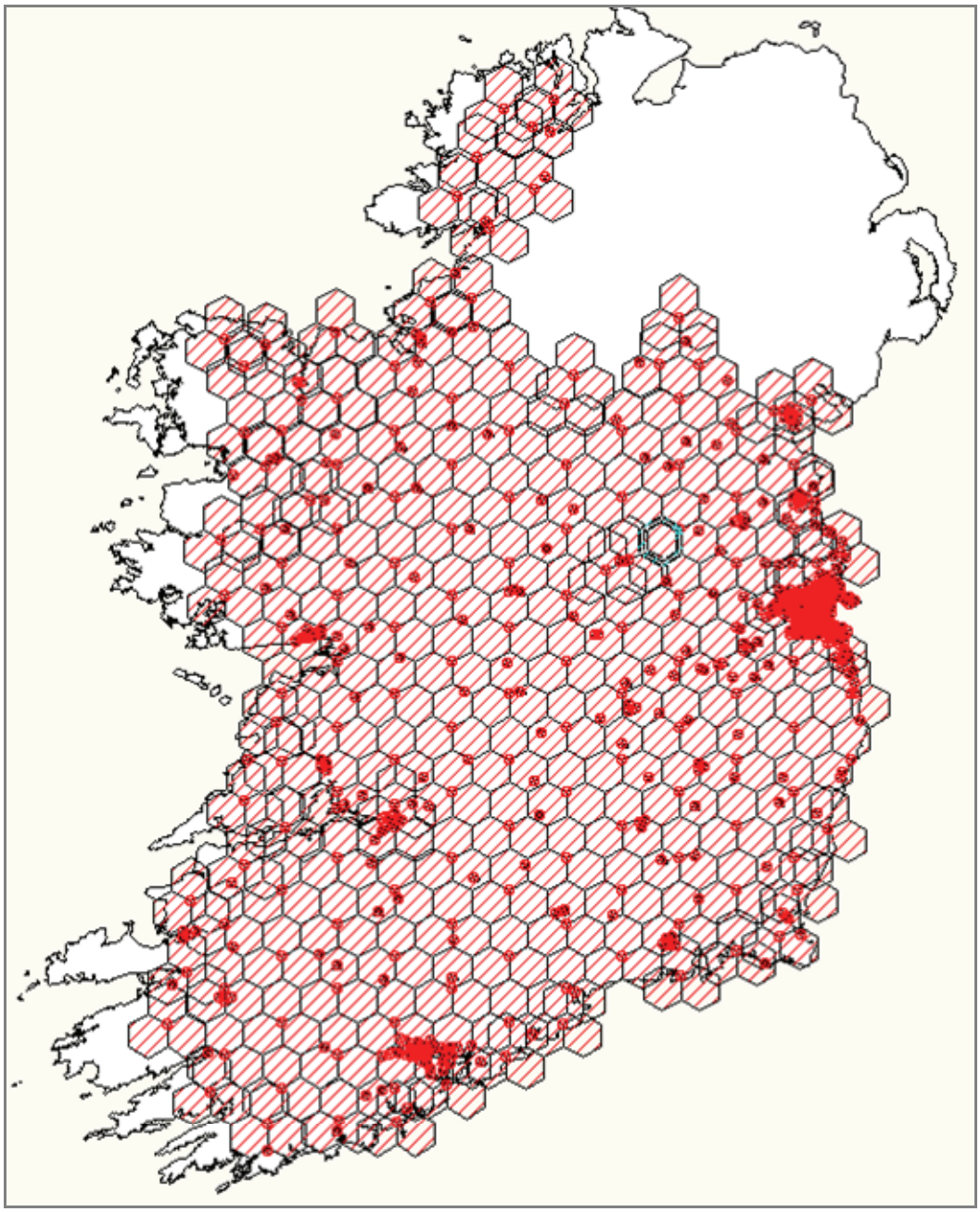

Figure 2-5 National view of the UMTS900 radio design

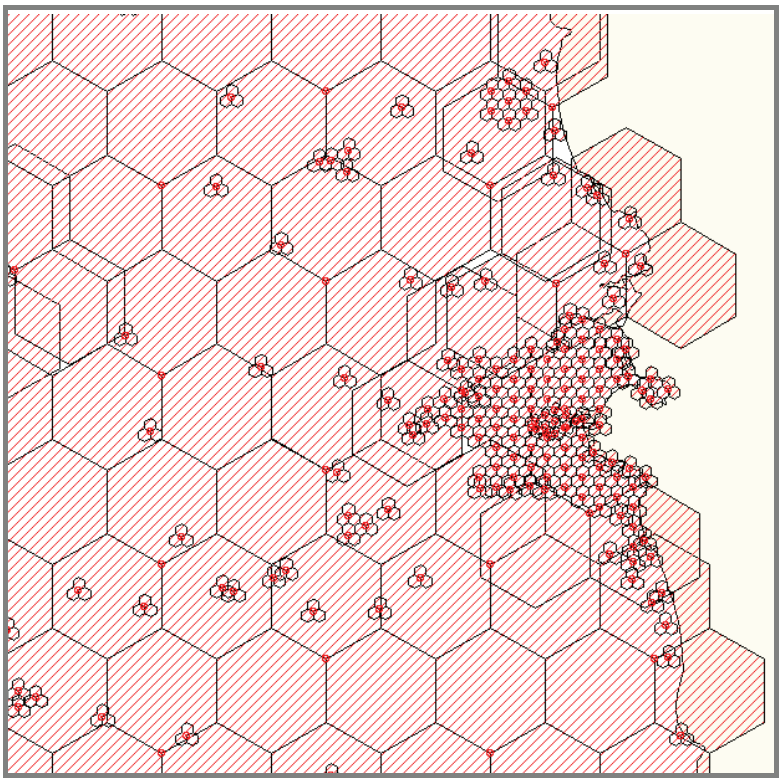

Figure 2-6 Greater Dublin area view of the UMTS900 radio design

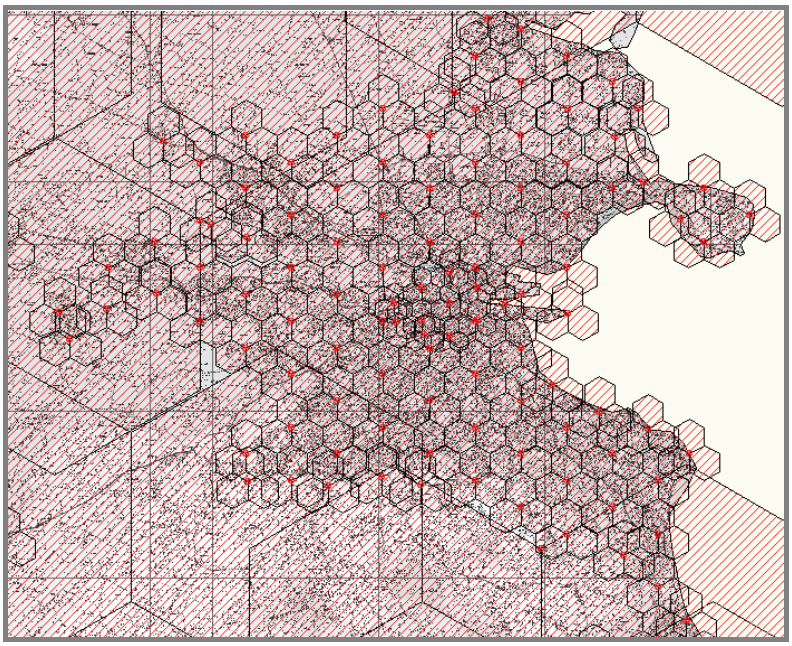

Figure 2-7 Dublin area view of the UMTS900 radio design

The design of the UMTS 900 network resulted in a requirement for 533 NodeB's to fulfil the 95% population and 80% geographical coverage objectives.

2.4.6. UMTS1800 Radio Network Design

Using the urban, suburban and rural UMTS1800 hexagonal site templates, a network was designed to cover the 95% polygon. This network design is shown in the figures below.

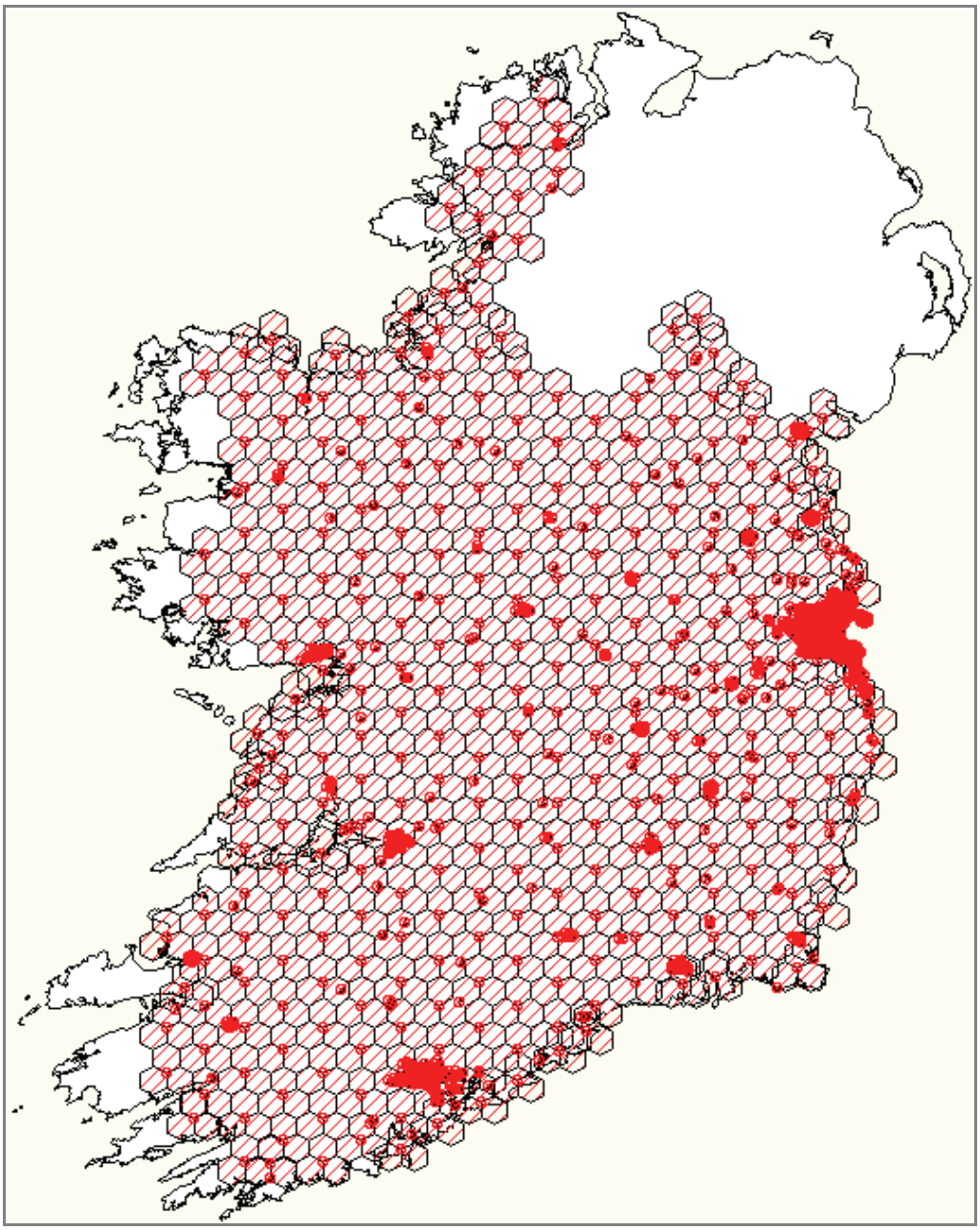

Figure 2-8 National view of the UMTS1800 radio design

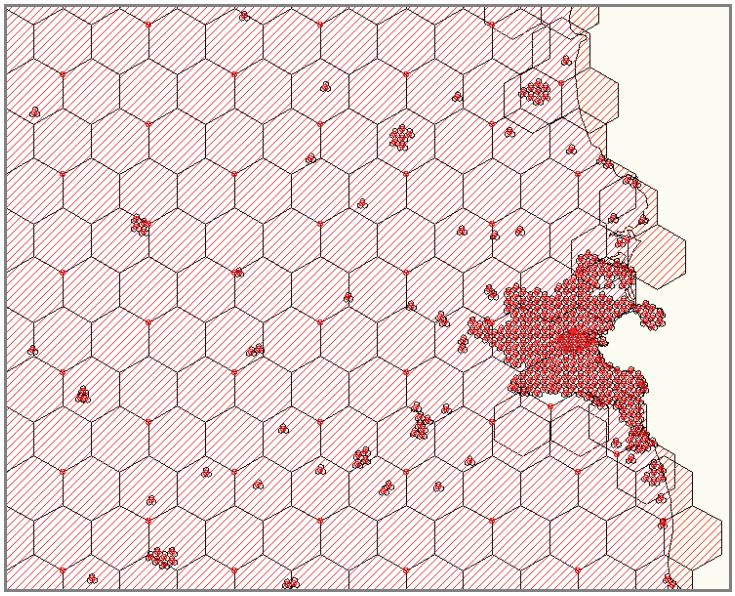

Figure 2-9 Greater Dublin area view of the UMTS1800 radio design

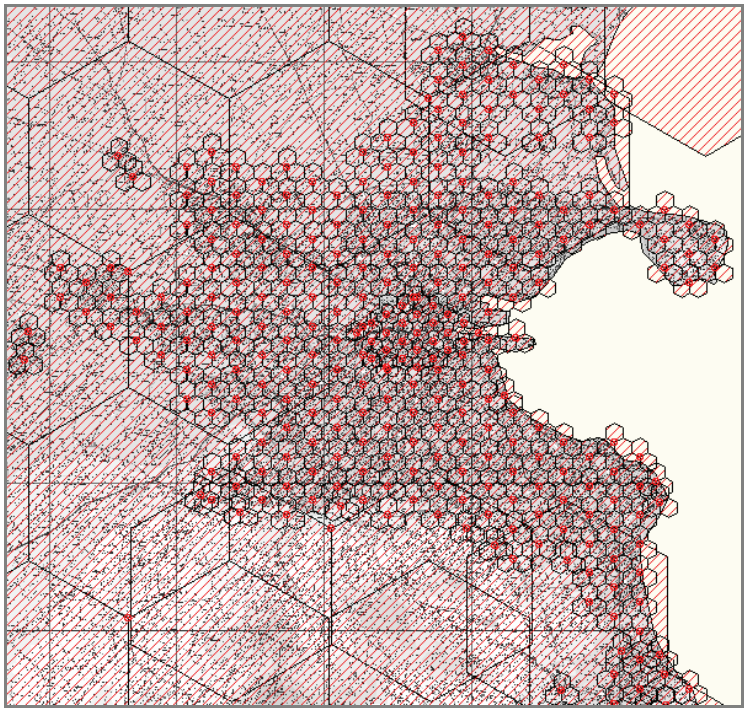

Figure 2-10 Dublin area view of the UMTS1800 radio design

The design of the UMTS 1800 network resulted in a requirement for 1013 NodeB's to fulfil the 95% population and 80% geographical coverage requirements.

2.4.7. UMTS2100 Radio Network Design

Using the urban, suburban and rural UMTS2100 hexagonal site templates, a network was designed to cover the 95% polygon. This network design is shown in the figures below.

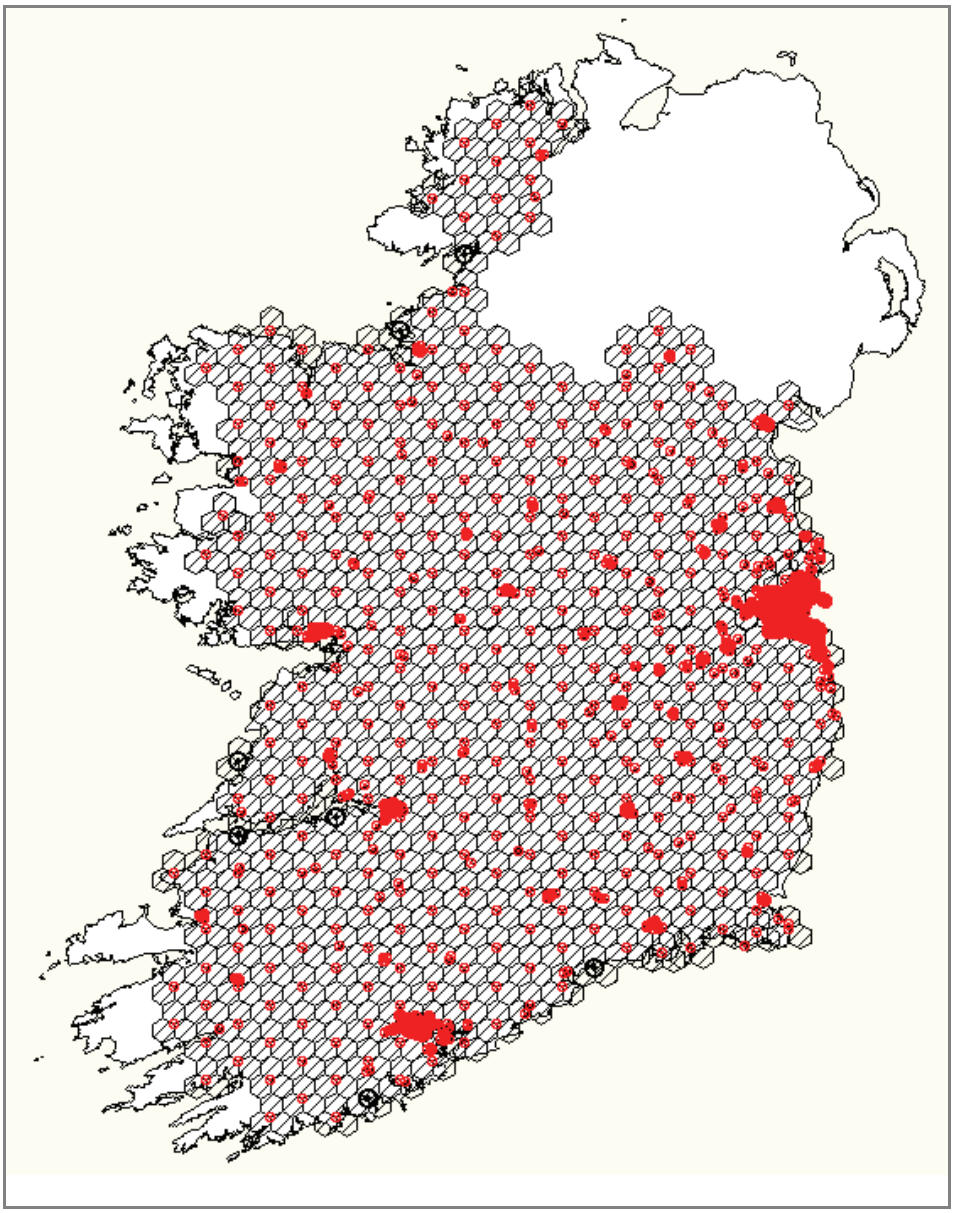

Figure 2-11 National view of the UMTS2100 radio design

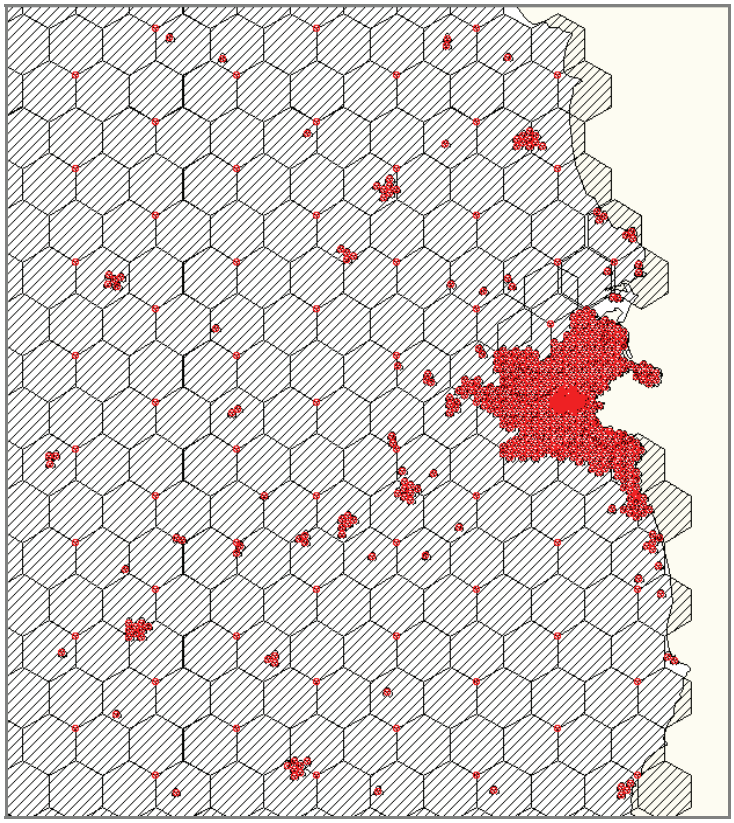

Figure 2-12 Greater Dublin area view of the UMTS1800 radio design

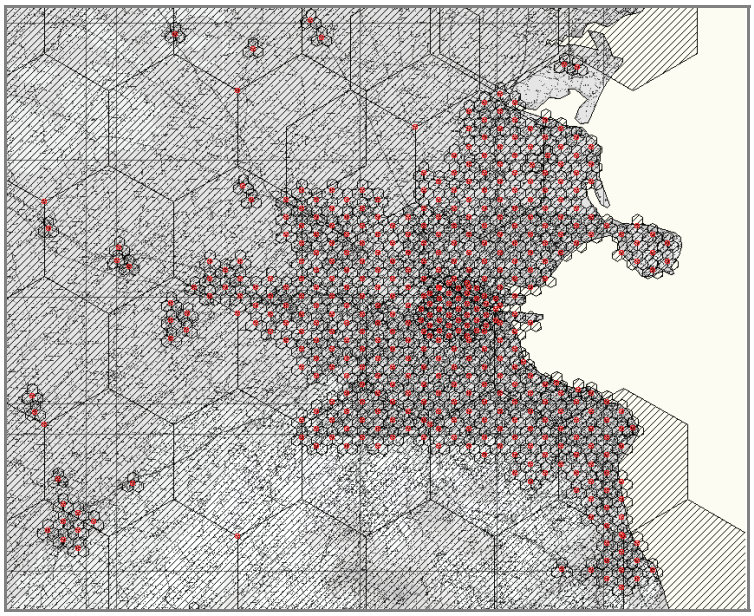

Figure 2-13 Dublin area view of the UMTS1800 radio design

The design of the UMTS 2100 network resulted in a requirement for 1243 NodeB's to fulfil the 95% population and 80% geographical coverage requirements.

3. Network Dimensioning

3.1. Logical Network Structure

The radio access network (RAN) model defines a system consisting of the RNC and NodeB functional network elements. Each Node B is connected to only one RNC via Iub interface, whereas an RNC can be connected to a number of other RNC's via Iur interface. Each RNC is also connected to the core network via Iu interface. These interfaces can be seen below. Many of the logical interfaces can be implemented using various transport technologies, e.g. Ethernet or ATM, which require extra equipment such as routers and switches for additional concentration and circuiting.

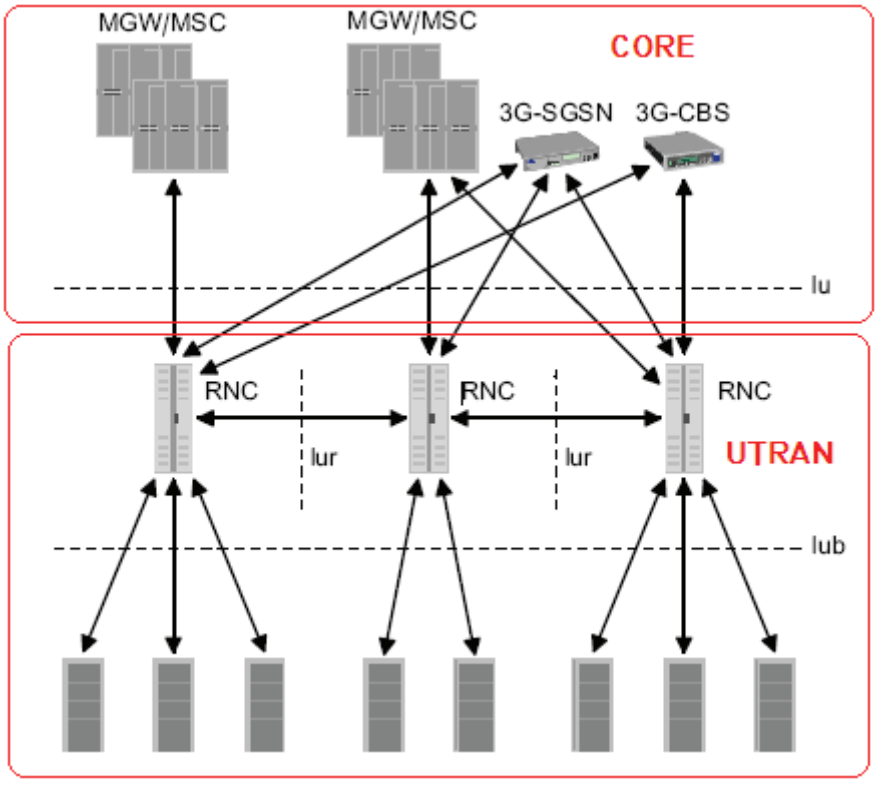

Figure 3-1 Overview of the network architecture

3.2. DIMENSIONING ASSUMPTIONS

The network was designed to carry the estimated volumes of voice and data traffic generated by 2,000,000 voice and 200,000 data subscribers. Sites will need to be upgraded to a 2+2+2 or a 3+3+3 configuration if the number of users per cell exceeds the maximum number permitted on that cell. The limiting factor may not be cell capacity, but rather capacity on the Iub.

When dimensioning the network, the following assumptions were made:

- Traffic is spread evenly over each cell in the network
- 2,000,000 Voice and 200,000 Data Subscribers
- Typical RNC can process 675 Mbps
- Voice Traffic 25mErl per subscriber in the busy hour
- Data Traffic 1GB per subscriber per month
- 1GB is a blended average per subscriber
- 1GB per subscriber is a bundled data package
- Circuit-switched data is negligible

3.3. UTRAN DIMENSIONING

3.3.1. Voice Dimensioning Calculations

Total BH network traffic = (Erlangs per subscriber busy-hour) x (number of subs)
= 0.025 x 2,000,000
= 50,000 Erlangs, busy-hour

Convert to Gbps = 50,000 x 12.2kbps
= 0.61 Gbps

3.3.2. Data Dimensioning Calculations

Monthly data usage per subscriber = 1 GB
Daily data usage per subscriber = 33.333 MB
Daily BH usage per subscriber (20%) = 6.666 MB

Convert to bits (X8)	= 53.33 Mb
Convert to kbps per subscriber	= 14.8148 kbps
Total BH data traffic (200,000 subs)	= 14.8148 x 200,000
	= 2.9629 Gbps

3.3.3. Voice and Data Traffic

0.61 + 2.9629	= 3.57296 Gbps, busy-hour
Include a 20% overhead	= 4.287552 Gbps busy-hour
Total network busy-hour traffic	= 4.287552 Gbps
Number of RNC's required	= 4.287552 /0.675
	= 6.35

Total number of RNC's required = 7

3.4. IUB DIMENSIONING

The total network traffic busy hour per second for 2 million voice and 200,000 data subscribers is calculated to be 4.29 Gbps.

3.4.1. UMTS 900 Iub Dimensioning

The UMTS 900 network was designed with 533 sites. With the busy hour traffic evenly distributed over the network, each site will have to carry 8.048 Mbps. This equates to five E1's per site and 2665 E1's in total for the network.

3.4.2. UMTS 1800 Iub Dimensioning

The UMTS 1800 network was designed with 1013 sites. With the busy hour traffic evenly distributed over the network, each site will have to carry 4.23 Mbps. This equates to an average of three E1's per site and 3039 E1's in total for the network.

3.4.3. UMTS 2100 Iub Dimensioning

The UMTS 1800 network was designed with 1243 sites. With the busy hour traffic evenly distributed over the network, each site will have to carry 3.45Mbps. This equates to an average of two E1's per site and 2486 E1's in total for the network.

3.5. Core Network Dimensioning

3.5.1. UMTS 900 Network

For a UMTS Network with 533 sites the following core network will be required.

Core Node	Quantity
HLR	2
SGSN	2
GGSN	2
MSC's	2
MGW's	2
Signalling-Sigtran/MPLS	1

Table 3-1 UMTS900 core network

3.5.2. UMTS 1800 Network

For a UMTS Network with 1013 sites the following core network will be required.

Core Node	Quantity
HLR	2
SGSN	2
GGSN	2
MSC's	3
MGW's	3
Signalling-Sigtran/MPLS	1

Table 3-2 UMTS1800 core network

3.5.3. UMTS 2100 Network

For a UMTS Network with 1243 sites the following core network will be required.

Core Node	Quantity
HLR	2
SGSN	2
GGSN	2
MSC's	4
MGW's	4
Signalling-Sigtran/MPLS	1

Table 3-3 UMTS2100 core network

4. Deployment Cost Analysis

4.1. UTRAN COSTS

The following assumptions were inputs to the model:

- 35% of sites deployed on rooftops
- 35% of sites deployed on an existing tower
- 30% of sites deployed at a greenfield location
- The acquisition, design and construction of the network will be a turnkey implementation by a subcontractor

4.1.1. UMTS 900 NodeB & UTRAN Costs

	Rooftop	Greenfield	Co-Location
Acquisition	€xx,xxx	€xx,xxx	€xx,xxx
Design (RF, TX & Construction)	€xx,xxx	€xx,xxx	€xx,xxx
Construction	€xx,xxx	€xx,xxx	€xx,xxx
H/W (Cabin, Racks, Tower, Antenna.. etc)	€xx,xxx	€xx,xxx	€xx,xxx
Programme Management & Handling	€x,xxx	€x,xxx	€x,xxx
Total per Site	€xxx,xxx	€xxx,xxx	€xx,xxx
Total Number of Sites	533		
Percentage Split of Site types	35%	30%	35%
Number of Sites of Type	187	160	187
Total Cost per Site Type	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx

Table 4-1 UMTS900 Turnkey rollout costs

	Number	Each	Total
Total Acquisition, Design and Construction Cost	533	-	€xx,xxx,xxx
NodeB Hardware S111	533	€xx,xxx	€xx,xxx,xxx
Microwave Hop Equipment	586	€xx,xxx	€x,xxx,xxx
SDH Mgd Backhaul - STM1 Local Hubs to RNC	10	€xxx,xxx	€x,xxx,xxx
SDH Mgd Backhaul - STM4 Local Hubs to RNC	5	€xxx,xxx	€x,xxx,xxx
RAN Aggregation Switches	7	€xxx,xxx	€x,xxx,xxx
RNC Hardware	7	€xxx,xxx	€x,xxx,xxx
RNC Software	7	€xxx,xxx	€x,xxx,xxx
RNC Installation	-	-	€xxx,xxx
UTRAN Software	1	€xx,xxx,xxx	€xx,xxx,xxx
OSS System	1	€x,xxx,xxx	€x,xxx,xxx
Total UTRAN Cost			€xxx,xxx,xxx

Table 4-2 UMTS900 UTRAN deployment costs

4.1.2. UMTS 1800 NodeB & UTRAN Costs

	Rooftop	Greenfield	Co-Location
Acquisition	€xx,xxx	€xx,xxx	€xx,xxx
Design (RF, TX & Construction)	€xx,xxx	€xx,xxx	€xx,xxx
Construction	€xx,xxx	€xx,xxx	€xx,xxx
H/W (Cabin, Racks, Tower, Antenna.. etc)	€xx,xxx	€xx,xxx	€x,xxx
Programme Management & Handling	€x,xxx	€x,xxx	€x,xxx
Total per Site	€xxx,xxx	€xxx,xxx	€xx,xxx
Total Number of Sites	1,013		
Percentage Split of Site types	35%	30%	35%
Number of Sites of Type	355	304	355
Total Cost per Site Type	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx

Table 4-3 UMTS1800 turnkey rollout costs

	Number	Each	Total
Total Acquisition, Design and Construction Cost	1013	-	€xxx,xxx,xxx
NodeB Hardware S111	1013	€xx,xxx	€xx,xxx,xxx
Microwave Hop Equipment	1114	€xx,xxx	€xx,xxx,xxx
SDH Mgd Backhaul - STM1 Local Hubs to RNC	10	€xxx,xxx	€x,xxx,xxx
SDH Mgd Backhaul - STM4 Local Hubs to RNC	5	€xxx,xxx	€x,xxx,xxx
RAN Aggregation Switches	7	€xxx,xxx	€x,xxx,xxx
RNC Hardware	7	€xxx,xxx	€x,xxx,xxx
RNC Software	7	€xxx,xxx	€x,xxx,xxx
RNC Installation	-	-	€xxx,xxx
UTRAN Software	1	€xx,xxx,xxx	€xx,xxx,xxx
OSS System	1	€x,xxx,xxx	€x,xxx,xxx
Total UTRAN Cost			€xxx,xxx,xxx

Table 4-4 UMTS1800 UTRAN deployment costs

4.1.3. UMTS 2100 NodeB & UTRAN Costs

	Rooftop	Greenfield	Co-Location
Acquisition	€xx,xxx	€xx,xxx	€xx,xxx
Design(RF, Tx & Construction)	€xx,xxx	€xx,xxx	€xx,xxx
Construction	€xx,xxx	€xx,xxx	€xx,xxx
H/W (Cabin, Racks, Tower, Antenna.. etc)	€xx,xxx	€xx,xxx	€x,xxx
Program Mgt. & Handling	€x,xxx	€x,xxx	€x,xxx
Total per Site	€xxx,xxx	€xxx,xxx	€xx,xxx
Total Number of Sites	1,243		
Percentage Split of Site types	35%	30%	35%
Number of Sites of Type	435	373	435
Total Cost per Site Type	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx

Table 4-5 UMTS2100 turnkey rollout costs

	Number	Each	Total
Total Acquisition, Design and Construction Cost	1243	-	€xxx,xxx,xxx
NodeB Hardware S111	1243	€xx,xxx	€xx,xxx,xxx
Microwave Hop Equipment	1367	€xx,xxx	€xx,xxx,xxx
SDH Mgd Backhaul - STM1 Local Hubs to Core	12	€xxx,xxx	€x,xxx,xxx
SDH Mgd Backhaul - STM4 Local Hubs to Core	7	€xxx,xxx	€x,xxx,xxx
RAN Aggregation Switches	7	€xxx,xxx	€x,xxx,xxx
RNC Hardware	7	€xxx,xxx	€x,xxx,xxx
RNC Software	7	€xxx,xxx	€x,xxx,xxx
RNC Installation	-	-	€xxx,xxx
UTRAN Software	1	€xx,xxx,xxx	€xx,xxx,xxx
OSS System	1	€x,xxx,xxx	€x,xxx,xxx
Total UTRAN Cost			€xxx,xxx,xxx

Table 4-6 UMTS2100 UTRAN deployment costs

Assumptions:

1. RNC and core network equipment is co-located
2. RAN aggregators used for concentration and RNC port expansion
3. 10% overhead in microwave hops to cover topologies configured for some redundancy and protection

4.1.4. Carrier Upgrade Costs

Carrier upgrade costs are presented in the tables below. It is important to note that adding second and subsequent carrier is more expensive than deployment of multiple carriers from the beginning of the network rollout.

	Number	Each	Total
Hardware for 2nd Carrier Upgrade	533	€xx,xxx	€xx,xxx,xxx
Software for 2nd Carrier Upgrade	533	€xx,xxx	€xx,xxx,xxx
Total 2nd Carrier Upgrade Cost			€xx,xxx,xxx
Hardware for 3rd Carrier Upgrade	533	€xx,xxx	€xx,xxx,xxx
Software for 3rd Carrier Upgrade	533	€xx,xxx	€xx,xxx,xxx
Total 3rd Carrier Upgrade Cost			€xx,xxx,xxx

Table 4-7 UMTS900 carrier upgrade costs

	Number	Each	Total
Hardware for 2nd Carrier Upgrade	1013	€xx,xxx	€xx,xxx,xxx
Software for 2nd Carrier Upgrade	1013	€xx,xxx	€xx,xxx,xxx
Total 2nd Carrier Upgrade Cost			€xx,xxx,xxx
Hardware for 3rd Carrier Upgrade	1013	€xx,xxx	€xx,xxx,xxx
Software for 3rd Carrier Upgrade	1013	€xx,xxx	€xx,xxx,xxx
Total 3rd Carrier Upgrade Cost			€xxx,xxx,xxx

Table 4-8 UMTS1800 carrier upgrade costs

	Number	Each	Total
Hardware for 2nd Carrier Upgrade	1243	€xx,xxx	€xx,xxx,xxx
Software for 2nd Carrier Upgrade	1243	€xx,xxx	€xx,xxx,xxx
Total 2nd Carrier Upgrade Cost			€xx,xxx,xxx
Hardware for 3rd Carrier Upgrade	1243	€xx,xxx	€xx,xxx,xxx
Software for 3rd Carrier Upgrade	1243	€xx,xxx	€xx,xxx,xxx
Total 3rd Carrier Upgrade Cost			€xxx,xxx,xxx

Table 4-9 UMTS2100 carrier upgrade costs

4.2. Core Network Costs

4.2.1. UMTS 900 Core Network

The table below shows the core network requirements and pricing for the UMTS 900 network. It is assumed that all core network equipment is located at the same site. Property rental costs are not included in the pricing below.

Node	No. of units	Unit Cost	Total
HLR	2	€x,xxx,xxx	€x,xxx,xxx
SGSN	2	€x,xxx,xxx	€x,xxx,xxx
GGSN	2	€x,xxx,xxx	€x,xxx,xxx
MSC	2	€x,xxx,xxx	€x,xxx,xxx
MGW	2	€x,xxx,xxx	€x,xxx,xxx
Signalling-Sigtran/MPLS	1	€x,xxx,xxx	€x,xxx,xxx
Total Cost			€xx,xxx,xxx

Table 4-10 UMTS900 core network costs

4.2.2. UMTS1800 Core Network

The table below shows the core network requirements and pricing for the UMTS 1800 network. It is assumed that all core network equipment is located at the same site.

Node	No. of units	Unit Cost	Total
HLR	2	€x,xxx,xxx	€x,xxx,xxx
SGSN	2	€x,xxx,xxx	€x,xxx,xxx
GGSN	2	€x,xxx,xxx	€x,xxx,xxx
MSC	3	€x,xxx,xxx	€x,xxx,xxx
MGW	3	€x,xxx,xxx	€x,xxx,xxx
Signalling-Sigtran/MPLS	1	€x,xxx,xxx	€x,xxx,xxx
Total Cost			€x,xxx,xxx

Table 4-11 UMTS1800 core network costs

4.2.3. UMTS2100 Core Network

The table below shows the core network requirements and pricing for the UMTS 2100 network. It is assumed that all core network equipment is located at the same site.

Node	No. of units	Unit Cost	Total
HLR	2	€x,xxx,xxx	€x,xxx,xxx
SGSN	2	€x,xxx,xxx	€x,xxx,xxx
GGSN	2	€x,xxx,xxx	€x,xxx,xxx
MSC	4	€x,xxx,xxx	€x,xxx,xxx
MGW	4	€x,xxx,xxx	€x,xxx,xxx
Signalling-Sigtran/MPLS	1	€x,xxx,xxx	€x,xxx,xxx
Total Cost			€x,xxx,xxx

Table 4-12 UMTS2100 core network costs

4.3. VAS/IN, Service Layer and Other Supplementary Service Costs

4.3.1. Service Layer

Node	No. Nodes	Unit Cost	Total
IN - Service Data Point - SDP	5	€x,xxx,xxx	€x,xxx,xxx
Voicemail Service Centre - VMSC	2	€x,xxx,xxx	€x,xxx,xxx
Multimedia Message Centre - MMSC	2	€x,xxx,xxx	€x,xxx,xxx
Short Message Centre - SMSC	2	€x,xxx,xxx	€x,xxx,xxx
IP Data Charging Gateway	2	€x,xxx,xxx	€x,xxx,xxx
WAP Gateway	1	€x,xxx,xxx	€x,xxx,xxx
USSD Platform	1	€x,xxx,xxx	€x,xxx,xxx
Total Cost			€xx,xxx,xxx

Table 4-13 Service layer costs

4.3.2. Mediation and Provisioning

Node	Total
Billing System	€xx,xxx,xxx
Mediation System - Hardware	€xxx,xxx
Mediation Software	€x,xxx,xxx
Variable Charging System	€x,xxx,xxx
Provisioning System	€xxx,xxx
Total Cost	€xx,xxx,xxx

Table 4-14 Mediation and provisioning costs

4.3.3. Middleware, Infrastructure and Applications

Item	Total
Middleware	€x,xxx,xxx
Infrastructure	€x,xxx,xxx
SAN Storage	€x,xxx,xxx
Applications	€x,xxx,xxx
IP and MPLS	€x,xxx,xxx
LAN/WAN	€xxx,xxx
Firewalls	€x,xxx,xxx
DNS	€x,xxx,xxx
Total Cost	€xx,xxx,xxx

Table 4-15 Middleware, infrastructure and application costs

4.3.4. Customer and Network Management Systems

Item	Total
OSS	€x,xxx,xxx
Customer Care Management System	€x,xxx,xxx
IVR	€x,xxx,xxx
Enterprise Application Delivery System	€x,xxx,xxx
Call Tracing System	€x,xxx,xxx
Network Operations Centre	€xx,xxx,xxx
Dealer & Commission Handling System	€x,xxx,xxx
Portal & Online Shop	€x,xxx,xxx
Business Intelligence System	€x,xxx,xxx
Total Cost	€xx,xxx,xxx

Table 4-16 Customer and network management system costs

4.4. PRICING SUMMARY

The table below shows the total deployment price for each network type.

System	900MHz Cost	1800MHz Cost	2100MHz Cost
UTRAN	€xxx,xxx,xxx	€xxx,xxx,xxx	€xxx,xxx,xxx
Core Network	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx
Service Layer	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx
Mediation, Provisioning, Network and Customer Management	€xx,xxx,xxx	€xx,xxx,xxx	€xx,xxx,xxx
Total	€xxx,xxx,xxx	€xxx,xxx,xxx	€xxx,xxx,xxx

Table 4-17 Summary costs of UMTS900, UMTS1800 & UMTS2100 network deployments

5. References

[1] Laiho, Wacker & Novosad- Radio Networks Planning and Optimisation for UMTS, Wiley2002, Pg. 104

[2] Census 2006 Volume 1 – Population Classified By area CSO April 2007