UMTS FORUM
WHITE PAPER

Deployment of UMTS in 900 MHz band

1. Introduction

IMT-2000/UMTS service was launched in the core band (1920-1980 MHz/2110-2170 MHz) during the year 2001, and by mid-2006 there are more than 75 million IMT-2000/UMTS subscriptions worldwide in more than 110 IMT-2000/UMTS networks launched commercially. IMT-2000/UMTS encounters a faster success than GSM since its launch.

However, there are still sparsely populated and remote areas where there are difficulties to provide IMT-2000/UMTS services in a cost-efficient way. UMTS deployment in 900 MHz band can facilitate the provision of the expected IMT-2000/UMTS services to users in those areas.

The 900 MHz band is identified for IMT-2000/UMTS at ITU and from a regulatory point of view it can be used for IMT-2000/UMTS.

This document deals with the deployment of IMT-2000/UMTS in 900 MHz band, although the technical considerations are also valid and applicable to IMT-2000/UMTS in 850 MHz band. UMTS in 900 MHz band is a short term solution for the UMTS coverage. Other coverage solutions like UMTS500, as studied in the Forum Report #38[1] are longer term issues and frequency bands need to be agreed in ITU level in WRC before the planning for the implementation can be started.

2. Benefits of UMTS900 deployment

The most significant benefit comes from the fact that, compared to 2 GHz band, radio wave propagation path-loss in 900 MHz frequency band is much smaller. So, for the offering of the same service (data rates) and same coverage, the required number of base station sites in 900 MHz band is reduced by 60% compared to that at 2 GHz, as shown by table 1.

Table 1. The required number of base station sites (UMTS Forum Report #38)

Service	2 GHz band	900 MHz band	Site Number Reduction
Circuit switched, 64 kbit/s	224	90	60 %
Packet switched, 384 kbit/s	468	181	61 %

In addition, the use of the 900 MHz band can significantly improve indoor coverage in urban areas. The economic benefit of the 900 MHz band on UMTS operators' investments makes it possible to propagate benefits to the end-users in terms of wider coverage and possibly lower level of usage costs. Improved indoor coverage is important because more and more mobile

[1] UMTS Forum Report 38: Coverage Extension Bands for UMTS/IMT-2000 in the bands between 470-600 MHz

voice and data services are used in the indoor environment. This is of particularly interesting when considering the increasing use of the mobile phones as a replacement or a complement to fixed phone, PC and TV usage.

UMTS900 will be deployed by reusing the GSM sites within the existing service area, and benefits will also be gained because of:

- reuse of the existing base station sites
- reuse of the existing antenna systems and feeders

From a practical implementation point of view, operators only need either to add a new base station cabinet or to replace the existing GSM base station by a multimode GSM+UMTS base station subject to site situation or manufacturer's design. It should be noted that the base station equipment cost represents only a small portion of the total site cost.

3. Status of standards and regulations

3.1. Technical specifications and standards availability

3GPP has developed technical specifications for nine frequency bands, one of which is UMTS900 (Band VIII, 3GPP Rel-7 Technical Specification TS25.104 and TS25.101). The technical specifications of UMTS900 have been completed in December 2005 and are available at http://www.3gpp.org/. The developed 3GPP technical specifications are forwarded to regional or national standard body for regional or national adoption.

In Europe, UMTS900 has been included in the Release 3 European harmonised standards EN301908 by ETSI. European harmonised standards are published at ETSI web site http://www.etsi.org/.

3.2. Regulatory status

In Europe, the paired 900 MHz band 880-915 MHz / 925-960 MHz was harmonised by CEPT for GSM900, and it is currently heavily in use. CEPT-ECC (Electronic Communications Committee) decision regarding the deployment of UMTS in GSM 900 MHz and 1800 MHz bands is planned to be approved and published by end of 2006.

Related to the UMTS usage in GSM frequency bands, ECC has prepared three sharing and compatibility study reports:

i) the compatibility between UMTS and GSM operating in 900 MHz and 1800 MHz bands;

ii) the compatibility between UMTS900/1800 and adjacent band systems;

iii) Border coordination when both GSM and UMTS are deployed in the same frequency band.

The ECC decision and related ECC compatibility study reports are available once approved at http://www.ero.dk/ .

This UMTS900/1800 ECC decision will assist in the harmonised implementation of UMTS in the existing GSM900/1800 frequency bands. Based on the national decisions, mobile operators can decide in what timeframe to deploy UMTS in GSM 900 MHz band in line with their business plans.

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4. UMTS90

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- Deploym

Deploying UMTS900 with HSPA (High Speed Packet Access) in rural area by reusing the existing GSM sites allows mobile operators to offer UMTS services, such as high data rate multimedia services to the benefits of the consumers. When there is a hot spot, e.g. tourist places, train stations, etc, where more capacity is needed, higher frequency bands, such as 2 GHz band, can be used to offer additional capacity, as shown in figure 1 below.

As recommended in ECC report 82, the frequency arrangement for UMTS deployment within GSM band can be summarized as:

- When deploying macro cellular UMTS900 in urban area and rural area in co-existence with another UMTS900 network, the carrier separation between two UMTS networks should be 5 MHz or more, similar to the UMTS deployment in 2 GHz band.
- For deploying UMTS900 within existing GSM900 band, the suggested frequency plan is the so-called "sandwich" frequency arrangement as shown in figure 2. UMTS900 carrier may be introduced in this "sandwich" mode, surrounded by GSM carriers in order to minimize the possible interference impact on networks in the adjacent bands.

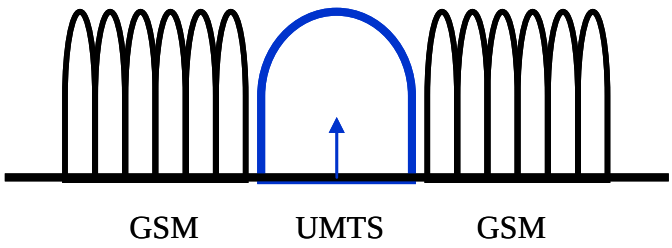

Figure 2. Sandwich frequency arrangement for deploying UMTS900 and GSM900

- Deployment of macro cellular UMTS900 in urban and rural area in co-existence with macro cellular GSM900
  - When UMTS900 and GSM900 base stations are co-located, the recommended carrier separation between UMTS carrier and the nearest GSM900 carrier should be 2.6 MHz or more. If an operator considers to have less carrier separation between UMTS and GSM, further study may be necessary.

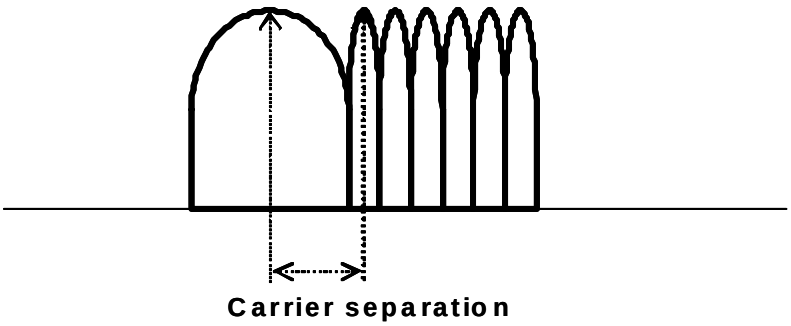

Figure 3 – Carrier separation between UMTS900 and GSM900

  - When UMTS900 and GSM900 base stations are not co-located, the recommended carrier separation between UMTS carrier and the nearest GSM carrier should be 2.8 MHz or more

  The above mentioned carrier separations in the cases of co-location and non co-location apply to both situations of an individual operator and between two operators.

- Deployment of UMTS900 as macro cellular solution in urban or sub-urban area in co-existence with GSM900 micro cells (outdoor) or pico cells (indoor).
  - The recommended carrier separation between UMTS900 carrier and the nearest GSM900 microcell/picocell carrier is 2.8 MHz or more. Here GSM900

micro/picocell carriers should be placed as far as possible from UMTS carrier frequency.

– One possible solution is to place GSM macrocell sub-band between microcell/picocell sub-band and the UMTS carrier, as shown in figure 4.

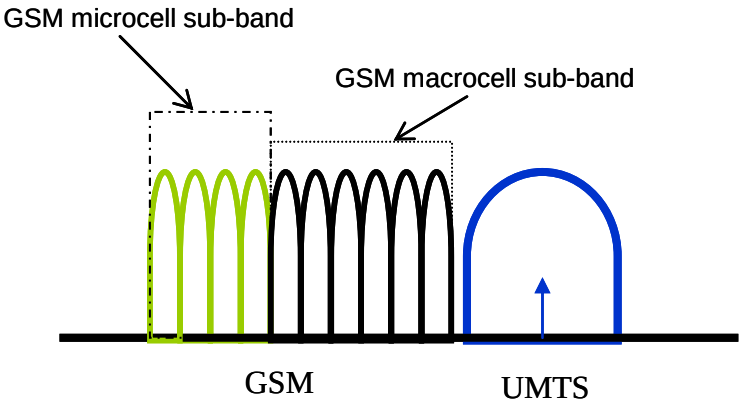

Figure 4. Carrier separation between UMTS900 and GSM900 macro/micro cells

5.2. Site engineering

For the existing GSM operator, it is believed that the most cost-effective solution is to reuse the existing GSM site for UMTS deployment. The existing antennae and feeders can be reused and the UMTS900 base station can be added. Below figure 5 gives an example of GSM900/UMTS900 radio site design with two 900 MHz vertical polarized antennae, figure 6 shows an example of GSM-UMTS900/GSM1800/UMTS2000 radio site design using a tri-band polarization antenna.

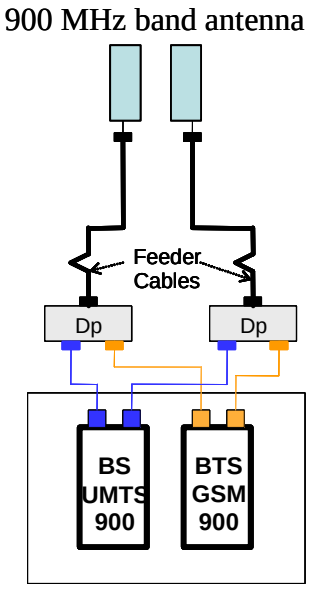

Figure 5: Radio site design example for GSM900/UMTS900 with two vertical polarized antennae (Dp=Diplexer)

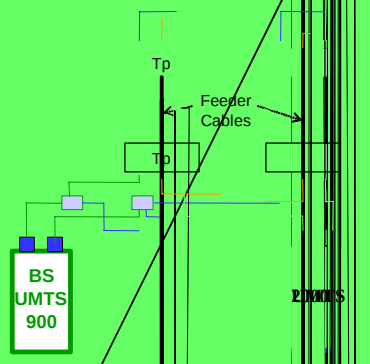

Figure 6: Radio site design example for GSM-UMTS900/GSM1800/UMTS2000 with a tri-band polarization diversity antenna (Tp=Triplexer)

5.3. Multi-band and multi-system mobility management

- **GSM load balancing between GSM900 and GSM1800**

When an operator decides to refarm part of its GSM900 frequency band for implementing UMTS900, the GSM900 network capacity will be reduced but UMTS900 network will offer new capacity. It is expected that more usage will move to UMTS900 network, as UMTS900 together with HSPA offers higher data rate multimedia services. In the beginning of refarming, many users have GSM only handsets, it is necessary to balance the traffic between GSM900 and GSM1800 in order to avoid congestion, as shown in figure 7.

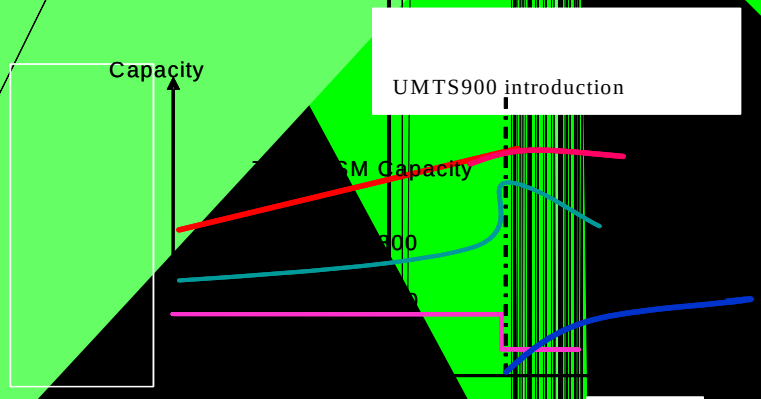

Figure 7

- **Traffic management between GSM and UMTS900**

These two mobile standards were originally specified and designed in an integral way so that consumers right away can move and hand-over between GSM and UMTS systems without experiencing disruptions.

It will be reasonable to balance low data rate traffic to GSM, and keep high data rate traffic at UMTS within the area covered by both GSM and UMTS.

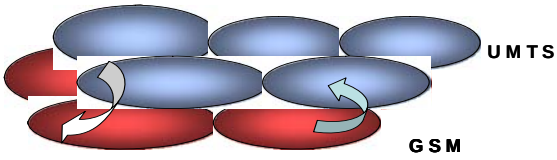

Figure 8: Traffic management between GSM and UMTS

6 Conclusions

The most significant benefit of deploying UMTS in 900 MHz frequency band comes from the fact that, compared to 2 GHz band, radio wave propagation pathloss at 900 MHz is much smaller. So for the offering of the same service (data rates) and same coverage, the required number of sites in 900 MHz band is reduced by 60% compared to that in 2 GHz band. This will bring economic benefit on UMTS operator's investments and makes it possible to propagate benefits to the end-users in terms of wider coverage and possibly lower level of usage costs.

UMTS900 will be deployed by reusing the GSM sites within the existing service area. Deploying UMTS900 with HSPA (High Speed Packet Access) in rural area by reusing the existing GSM sites is a cost-effective solution for mobile operators to offer UMTS services, such as high datarate multimedia services. Deploying UMTS in 900 MHz GSM band in urban area can improve indoor coverage.

The timely availability of UMTS900 standards and regulations is needed to facilitate the deployment of UMTS in GSM 900 MHz frequency band in line with operators' business plans.

This document presents also the UMTS900 deployment strategy as well as technical solutions such as channel arrangement, traffic management, site engineering, etc. for helping mobile operators to deploy UMTS900 with a minimum impact on GSM operation.

UMTS Forum Spectrum Aspects Group

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For further information, please contact:

UMTS Forum Secretariat
Tel.: +44 20 7331 2020
Fax: +44 20 7331 2040
email: info@umts-forum.org
www.umts-forum.org