GSM and its initial spectrum allocation

By Hans Hauser

One of the mysteries of GSM is the question of the spectrum allocation in the 900 MHz range for the initial configurations in the early 1990's. While the spectrum related decisions taken by the CEPT in 1982 ff. are well documented it is little known why, according to the Final Acts of the World Administrative Radio Conference in 1979 (WARC'79), the 890 to 960 MHz range has been allocated for mobile services not only for ITU region 1[1] but for all three ITU regions, although not exclusively:

MHz
890 — 960

Allocation to Services		
Region 1	Region 2	Region 3
890 — 942 FIXED MOBILE except aeronautical mobile BROADCASTING 703 Radiolocation	**890 — 902** FIXED MOBILE except aeronautical mobile Radiolocation 705	**890 — 942** FIXED MOBILE BROADCASTING Radiolocation
	902 — 928 FIXED Amateur Mobile except aeronautical mobile Radiolocation 705 707	
	928 — 942 FIXED MOBILE except aeronautical mobile Radiolocation 705	
704		706
942 — 960 FIXED MOBILE except aeronautical mobile BROADCASTING 703 699 704	**942 — 960** FIXED Mobile 708	**942 — 960** FIXED MOBILE BROADCASTING 701

Fig. **WARC'79 Frequency Allocations for the 890 – 960 MHz range**[2]

[1] F. Hillebrand, GSM and UMTS – The creation of global mobile communication, Wiley 2002, p. 11
[2] WARC'79 Final Acts

It must be borne in mind that the WARC'79 met from September to Sept 9 to Dec 5, 1979 with 894 plenary and WG meetings plus an unknown number of additional meetings[3]. Thus it is not easy to trace both proposed and agreed changes to the Table of Frequency Allocations without accessing the ITU archives which is anything but straightforward. But anyway, the WARC'79 committee responsible for the 890 to 960 MHz range was Working Group 5C, chaired by Klaus Olms of Deutsche Bundespost. A report about WARC'79 published by the Telecommunication Journal in 1980[4] states that "[t]he results of the work in Working Group 5C could not completely satisfy all divergent requirements. They should be considered as a compromise to different problems in different areas in the world. It will be up to future conferences to adapt the Regulations to cover changed requirements."

Three more publications shed some partial light on the allocation mystery:

The memories of Rudolf Binz of the German Federal Ministry of Posts and Telecommunications in Bonn are highligthing these problems. They touch on WARC'79 briefly and without going into too much detail: *"I myself had a special problem with my friend Badalov[5], whom I have been doing for 20 years now. It was about their military air traffic control frequencies in the range of 1000 MHz. He had in the Enforcement Regulations only secondary rights and now demanded full protection, here too over a protective distance of about 500 kilometers from their area of operation. That but was the border to the GDR and Czechoslovakia! I couldn't do that in any case, we in the West wanted to accommodate the land radio here - today the so-called D-network - ... The problem went on until the plenary assembly, where in a night session at about 2 o'clock in the morning, the chairman asked both of us fighting cocks to go into an adjoining room and - similar to the papal election - not to come back until we had come to an agreement! Each of us had his companion's tail, here the Westerners, there his vassals with a corresponding number of votes! It was a hard struggle, I was able to remain victorious! "Eta plocha!" he scolded, he could no longer be seen at home, he was being lynched by the military! Unfortunately, I couldn't help him here!"*

A U.S. Congress Publication Radiofrequency Use and Management[6] published in 1982 contains a section about Land-Mobile Service indicating that the allocation for primarily mobile use was proposed by the US delegation: *"The United States has already added land mobile to portions of the UHF television band 470 to 890 MHz in the U.S. domestic table of allocations, an action permitted under the ITU's radio regulations, provided no interference is caused to stations of other countries operating in those frequencies. The United States proposed at WARC-79 that most of the band 470 to 960 MHz be allocated to the land-mobile service, sharing on a primary basis with broadcasting in the lower part, and with fixed and radiolocation services in the upper part. This would permit each country in region 2 to determine which of the internationally allocated primary services would be implemented in their own areas.*
WARC only partially accepted these proposals. The mobile service was added to the bands 806 to 902 MHz on a primary basis, but on a secondary basis in the bands 470 to 512 MHz and 614 to 806 MHz. A footnote raises mobile to primary status in the United States, with the provision that such use is subject to the coordination procedures of article 14 of the radio regulations. The United States submitted a protocol statement rejecting the article 14 procedure, however, the requirement for coordination, coupled with the continued use of 470 to 512 MHz in Canada for broadcasting, and the use of band 614 to 806 MHz in both Canada and Mexico for the same

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[3] Telecommunication Journal Vol. 47, Jan 1980, p. 4 f. According to the February 1980 Radio Communication Journal of the Radio Society of Great Britain Committee 5 (frequency allocation) and its seven working groups had to consider 12,832 proposals for alteration to the frequency table!
[4] op. cit., p. 8
[5] A. L. Badalov, Deputy Minister, Ministry of Posts and Telecommunications of the USSR
[6] US Congress: Radiofrequency Use and Management – Impacts from the World Administrative Radio Conference 1979

purpose, makes our use of these bands for the mobile service problematic. A similar situation prevails regarding U.S. proposals for the 902- to 960-MHz band where the United States, Canada, and Mexico use the same segments for competing services and where coordination in border regions may be difficult."

Klaus Olms, the working group 5C chairman, provided his view by an IEEE publication on *The Post-WARC Frequency Situation in Central Europe*[7]:

"B. The Frequency Bands Between 30 and 1000 MHz
In this part of the spectrum, the demands of the Mobile services, especially of the Land-Mobile service, for additional allocations collided with the increasing requirements of the Broadcasting service. In Europe and Africa, the use of the VHF and UHF bands for sound and television broadcasting is governed by agreements some of which date back to 1961. These agreements are based on systems and standards which are even older. Improvements seem possible, but the introduction of more frequency-economic frequency plans must take into account the enormous investments made by the public for the receiving equipment. Long transfer periods, therefore, require early decisions. We think that all existing coverage requirements could be met in the frequency band 470-790 MHz, if an advanced technology and improved planning methods were applied. To that end, it is necessary to have the whole band available without gaps. This need was satisfied by an exclusive primary allocation to the Broadcasting service in Region 1. All existing other services maintained only time-limited allocations or were downgraded to lower than primary status (secondary or permitted). With this decision, the introduction of the Land-Mobile service on a "permitted" basis into 47-68 MHz and 174-230 MHz was adopted making possible the start of a long-term transfer. Shared use of the same frequency bands by the Broadcasting and the Land-Mobile services is difficult, if not impossible in Central Europe. This is due to the fact that the spectrum is fully occupied by the Broadcasting service and stations are operated in accordance with concise rhombic network planning principles, which leave no space for Land-Mobile operations. Nevertheless, investigations are planned within the CEPT to find whether limited shared use is possible, and under what conditions. The WARC was able to agree on an important improvement for the sound-broadcasting service by extending the allocation around 100 MHz upwards to 108 MHz. Use of the band 87.5-100 MHz in the European broadcasting area is governed by an agreement dating to 1961. An agreement for the band 100-104 MHz was worked out in 1971 for 16 European countries but there is no plan for the band 104-108 MHz. It is therefore now necessary to replan the whole band 87.5-108 MHz in Europe in order to satisfy demands for its early use. The WARC resolved that a planning conference should be held to revise the existing plans in Region 1, the first session of which will begin in August 1982. Some countries in Central Europe will, to a certain extent, be forced to an earlier usage of this band, but such use however, cannot prejudge the conclusions of the 1982 planning conference.
In Central Europe, the "classical" frequency bands for Land-Mobile service (68-87 MHz, 146-174 MHz, 440-470 MHz) are presently seldom used for the Fixed service. It is envisaged that the frequency demand for civilian applications within the Land-Mobile service will be met in these bands through 1990. From that time on, frequency bands in the 900 MHz range will be necessary for the Land-Mobile service. Unfortunately, it was not possible for the WARC to allocate the band 790-862 MHz to the Land- and Maritime-Mobile services in all European countries. Nevertheless, it succeeded in allocating the band 862-960 MHz to these services on a primary basis, while ensuring protection to Broadcasting services in Africa. Thus the necessary provisions for an orderly expansion of Mobile activities have been made. In order to direct these activities and with the aim of standardization, preliminary discussions were held in Europe concerning the Mobile services at 900 MHz. The departure point for this discussion was a plan, in which land-mobile and maritimemobile applications would be integrated and which would comprise up to 1000 channels,

[7] Klaus Olms, The post-WARC frequency situation in Central Europe, IEEE Transactions on Communications, Vol. COM-29, No. 8, p.1098 f.

each 25 kHz wide, for duplex operation (dx = 45 MHz). At least parts of such a plan should be internationally harmonized as well. Initial views forsee two times 12 MHz out of two times 25 MHz for such an internationally standardized system. In addition, up to 2 MHz between 933 and 935 MHz should be earmarked for low-power personal radio applications with very reduced service ranges. It is expected that the provisions of the Radio Regulations will permit the orderly development of other national Land-Mobile services besides those described in the frequency band between 862 and 960 MHz. It must be noted, however, that this implies the transfer of existing stations in the Fixed service, now operating in the 900 MHz band, into higher frequency bands. In conclusion, the WARC has largely responded positively to the needs of services in the bands between 30 and 960 MHz. Long-time evolution and transfer procedures have been initiated, which, in general, meet the requirements of administrations in Central Europe."

In summary: It's probably not wrong **not** to attribute the allocations of the early GSM bands to a miraculously grand and far-sighted vision of a single person or committee, even though WARC '79 participants from all regions expressis verbis wanted this; it was so-to-speak "in the air". Apparently, overall military interest in this frequency range was somehow already less demanding; this is all the more surprising given that it wasn't until Ronald Reagan began pursuing a serious policy of détente not earlier than 1982/83.