European Radiocommunications Committee (ERC) within the
European Conference of Postal and Telecommunications Administrations (CEPT)

DSI PHASE II (900 MHz ISSUES)

GSM-UIC

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1 SUMMARY

Provision for UIC spectrum is included within the European Table of Frequency Allocations and Utilisations on page 178 of the DSI Phase II report.

The decision taken by the ERC to amend Recommendation T/R 25-09, coincides with placing the UIC uplink (mobile transmit) within 876-880 MHz and the downlink (base transmit) within 921-925 MHz.

The DSI Phase II study, conclusion (**Rec 23**) that CEPT ERC Recommendation T/R 75-02 should be revised and a new CEPT ERC Decision be prepared which designates the frequency bands 880-890 MHz paired with 925-935 MHz on a European basis, as extension bands for the GSM digital pan-European communication system. (Section 11.16), has been addressed within PT-FM25, but suspended until the DSI Phase II work within PT-SE7 is complete. See below:

23. CEPT ERC Recommendation T/R 75-02 should be revised and a new CEPT ERC Decision be prepared which designates the frequency bands 880-890 MHz paired with 925-935 MHz on a European basis, as extension bands for the GSM digital pan-European communication system. (Section 11.16)

The ERC response to the DSI Phase II Recommendation **23** has now been finalised and has been incorporated into this report as follows:

"The content of T/R75-02 is now reflected in the European Table of Frequency Allocations and Utilisations". See ERC Report 25.

An ERC Decision on EGSM, (ERC/DEC/(97)02), has been adopted.

The following WG-SE conclusions are to be noted;

- The principle of harmonised spectrum in the specified bands for GSM and UIC allocations are recognised, however, some countries with alternative public radiophone bands, would not necessarily need the full tranche of harmonised GSM spectrum. Therefore these allocations should not be made exclusive and should only be made where a need exists. In countries where that spectrum is currently used for defence services, an allocation to GSM would be on a military pre-emptive basis (possible within main conurbations) and provision should be made for this requirement.

- In some countries, where the bands proposed for EGSM and UIC are currently used for analogue cellular services, account must be taken of the need to protect existing services from adjacent band compatibility problems that may arise. In countries where this band is also allocated to Fixed services (Tactical Radio Relay), some national restrictions may be necessary on EGSM channels. This may enable geographical sharing with Tactical Radio Relay. This extension band is now located between two GSM bands (for public radiotelephone and Railways).

- The minimum frequency separations required for UIC with GSM are as follows;
  915 MHz - 6 MHz
  880 MHz - 200 kHz (one unused channel)
  925 MHz - 200 kHz (one unused channel).

2 INTRODUCTION

The second phase of the Detailed Spectrum Investigation (DSI-II) was launched by the European Radiocommunications Committee (ERC) of the Conference of European Postal Telecommunications Administrations (CEPT) in March 1993 with terms of reference as follows:

- to investigate the current and foreseen use of the radio spectrum in CEPT countries in the frequency range 29.7 MHz to 960 MHz,

- to investigate the way this spectrum is currently managed and administered,

- to produce a detailed document addressing the issues which shall include, as appropriate, recommendations to the CEPT/ERC.

A principle objective of the DSI process is to establish a European Table of Frequency Allocations and Utilisations, effectively a harmonised band plan for Europe. A proposed table covering this phase of the DSI is to be found at Annex A to the Results Document of the Detailed Spectrum Investigation report, pages 163 - 179 inclusive.

Although not subject to one of the main recommendations, the provision for GSM and UIC spectrum is included within the European Table of Frequency Allocations and Utilisations on page 178 of the DSI Phase II report.

The decision taken by the ERC to amend Recommendation T/R 25-09, coincides with placing the uplink (mobile transmit) at 876-880 MHz and the downlink (base transmit) at 921-925 MHz.

Furthermore, the ERC tasked WG-FM with revising T/R 75-02, the draft of which places the EGSM uplink (mobile transmit) at 880-890 MHz and downlink (base transmit) at 925-935 MHz as well as including the tranche of spectrum mentioned above for UIC.

This ERC report is based upon the earlier study on DSI-II carried out within CEPT WG-SE, entitled *DSI Phase II Examination of 900 MHz Issues*, see SE(96)21 Annex 8.

The report considers the spectrum engineering issues associated with the entry on UIC within the European Table of Frequency Allocations and Utilisations and lists recommendations for consideration by frequency managers.

Definitions of the following terms used within this report are shown within **Annex 1**;

- Minimum Carrier Separation,
- Minimum Frequency Separation,
- Co-exist.

3 STUDY

Although not subject to one of the main recommendations, the provision for GSM and UIC spectrum is included within the European Table of Frequency Allocations and Utilisations on page 178 of the DSI Phase II report.

The decision taken by the ERC to amend Recommendation T/R 25-09, places the uplink (mobile transmit) at 876-880 MHz and the downlink (base transmit) at 921-925 MHz. Furthermore, the current draft revision of Recommendation T/R 75-02, is likely to placæ the EGSM uplink (mobile transmit) at 880-890 MHz and downlink (base transmit) at 925-935 MHz which is coincident with the DSI Phase II Recommendation 23 - see below;

Rec 23.
CEPT ERC Recommendation T/R 75-02 should be revised and a new CEPT ERC Decision be prepared which designates the frequency bands 880-890 MHz paired with 925-935 MHz on a European basis, as extension bands for the GSM digital pan-European communication system. (Section 11.16)

As a result of this recommendation the following potential compatibility issues were considered;

a) UIC at 921 MHz with GSM at 915 MHz,
b) UIC at 880 MHz with E-GSM at 880 MHz,
c) UIC at 925 MHz with E-GSM at 925 MHz.

The UIC has decided its systems will use GSM technology and therefore in examining the compatibility issues, the mechanisms were GSM with GSM.

Case a), the compatibility of UIC at 921 MHz with GSM at 915 MHz, i.e. the UIC BS transmit to the GSM BS receive and the GSM MS transmit to the UIC MS receive, is the most serious case to be considered. This was explained in considerable detail in the previous report on UIC-GSM compatibility (CEPT SE(95)48).

In the GSM-UIC study, although *blocking* was agreed to be a serious problem, the dominant interference mechanism was *out-of-band emissions*, in particular transient-related components, from transmitters based on GSM technology. It is the noise from these transmitters which overlaps the wanted signal of the victim receiver as a co-channel interference.

Other mechanisms include;

Adjacent channel rejection.
Transmitter intermodulation.
Transmitter switching transients.
Receiver intermodulation.

The UIC-GSM compatibility study concluded that a 6 MHz spacing (uplink / downlink at 915 MHz), as proposed in the DSI Phase II was sufficient, but a reduction in this figure would lead to severe problems.

Cases b) and c), where the UIC and EGSM recommended bands adjoin, are the same as for two uncoordinated operators in the GSM bands.

The following interference scenarios were considered:

Scenario 1	-	880 MHz MS transmit to BS receive.
Scenario 2	-	925 MHz BS transmit to MS receive.

Scenario 1
Using the Minimum Coupling Loss Method (with the original SMG2 definition), not taking into account the antenna gains, the required isolation was computed for GSM MS interfering with GSM BS at 880 MHz.

It was noted that the MCL decreased rapidly up to approximately 400 kHz but that extending the minimum frequency separation further did not provide much more isolation.

Computing the MCL using an extended HATA propagation model with antenna gains of 0 dBi and 12 dBi and antenna heights of 1.5 and 50 metres, distances were derived. See footnote below.

The fact that public operators are currently operating satisfactorily with two channels separation on an uncoordinated basis (400 kHz frequency separation) and in many cases with only one channel (200 kHz frequency separation), would confirm a minimum frequency separation of one unused channel should be sufficient for UIC to EGSM at 880 MHz.

Scenario 2
The case at 925 MHz for UIC-EGSM is the reciprocal of that at 880 MHz and the same channel separation will therefore apply.

Note;
A preliminary propagation model is used for the calculation of the frequency separation, which has the advantage of easy computation of a wide range of input parameters.
It is based on the HATA model modified within CEPT WG-SE to carry out compatibility studies. ITU-R SG3 is studying this model to see if it is valid.
In this model free space path loss is used up to 40 metres, for distances greater than 100 metres, the HATA model is extended, and between 40 and 100 metres, a linear interpolation between the two (in dB) is used.

4 CONCLUSIONS

The ERC response to the DSI Phase II Recommendation 23 has now been finalised and has been incorporated into this report as follows:

"The content of Recommendation T/R75-02 is now reflected in the European Table of Frequency Allocations and Utilisations". See ERC Report 25.

An ERC Decision on EGSM, (ERC/DEC/(97)02), has been adopted.

The following frequency separations are required for UIC with GSM;

at 915 MHz	-	6 MHz
at 880 MHz	-	200 kHz (one unused channel)
at 925 MHz	-	200 kHz (one unused channel).

The principle and benefits of harmonised spectrum in the specified bands for GSM allocations are recognised, however these allocations should not be made exclusive and only where a need exists:

- Some countries with alternative public radiophone bands, would not necessarily need the full tranche of GSM spectrum.

- In countries where that spectrum is currently used for defence services, an allocation to GSM would be on a military pre-emptive basis (possible within main conurbations) and provision should be made for this requirement.

In some countries, where the bands proposed for EGSM and UIC are currently used for analogue cellular services, account must be taken of the need to protect existing services from adjacent band compatibility problems that may arise.

In some countries, where the bands proposed for EGSM and UIC are currently used for analogue cellular services, account must be taken of the need to protect existing services from adjacent band compatibility problems that may arise. In countries where this band is also allocated to Fixed services (Tactical Radio Relay), some national restrictions may be necessary on EGSM channels. This may enable geographical sharing with Tactical Radio Relay. This extension band is now located between two GSM bands (for public radio-telephone and Railways).

ANNEX 1

DEFINITIONS OF TERMS USED IN THIS REPORT:

MINIMUM CARRIER SEPARATION: -

The minimum separation (kHz) required between the nearest carriers of two adjacent band systems for them to co-exist.

MINIMUM FREQUENCY SEPARATION: -

The minimum separation (kHz) required between the band edges of two adjacent band systems for them to co-exist.

Minimum Frequency Separation is less than the Minimum Carrier Separation.

The difference is of the order of one half of the sum of the two systems channel spacing.

e.g. for GSM and TETRA a minimum frequency separation of 'x' kHz equates to a minimum carrier separation of 'x' + 112.5 kHz. See **Figure 1** below.

CO-EXIST: -

The systems will operate satisfactorily in adjacent bands.

i.e. the magnitude of the interference anticipated is considered acceptable.

Figure 1