BRITAIN TAKES LEAD IN CELLULAR RADIOPHONES

Making a call on the move, whether you are in Manchester, Milan or Munich came a step nearer reality today (18 February 1988) with the first demonstration of a prototype mobile telephone system that can operate anywhere in Europe.

The technical standards for the new system have been developed by the Special Mobile Group of the Conference of European Posts and Telecommunications (CEPT) and will open the door for the development of a pan-European cellular radio network. The present generation of mobile telephones is only able to operate within national boundaries.

An experimental programme, partly financed by DTI and undertaken by GEC-Marconi, British Telecom Research Laboratories and Racal Research, has developed this prototype equipment giving Britain a significant lead in the fast growing cellular telephone market.

After Industry Minister John Butcher demonstrated the system, he said: "This new system is proof that industrial collaborative research and development works. As a result of leading companies working together Britain can now justifiably claim to be ahead of the pack and making the fastest progress in this new technology. By being' the first in Europe to demonstrate a working system that meets the new European standards we are poised for growth in a major market of the future."
NOTES FOR EDITORS

The three companies involved in this work are:

**Racal Research Ltd.** part of the Racal Group which includes Racal-Vodafone - the operator of one of two UK cellular telephone services (Racial and UK electronics company Plessey recently set up a new company ORBITEL to manufacture equipment for the cellular radio market):

**British Telecom Research Laboratories**, associated with the other UK cellular operator Cellnet, which is run jointly by British Telecom and Securicor:

**GEC-Marconi Research**, owned by the GEC group of companies which includes Marconi Communication Systems, active in present-day cellular telephones via their Marconiphone subsidiary.

The new system has been promoted and developed by CEPT (Conference of European Posts and Telecommunications), which is essentially composed of European PTT (Post/telephone/telegraph) organisations. The EEC has strongly encouraged the development of the new system, as it sees common technical standards as desirable for the unification of European markets. The technical work is being, co-ordinated by the CEPT/GSM (Special Mobile Group) committee, which has drafted the specification documents which industry will have to turn into Europe's cellular radio systems by 1991.

In the UK, this activity has been tracked by the DTI's Cellular Radio Advisory Group (CRAG), which has co-ordinated this project and other UK research on the system, and promoted UK involvement in the technical standardisation process.

The system operates in the 900 MHz band, like other cellular systems, but is technically novel in a number of respects. It uses a complex method of digital transmission to convey the speech and other signals on the radio path. This brings advantages in performance and efficiency, but leads to formidable complication in the equipment (both the mobile or portable set and in the fixed equipment).

The experimental system constructed in this project consists of three identical pieces of equipment, forming the two ends of the radio-telephone system, plus a 'spare' unit. One set was mounted at a fixed location (a British Telecom building in London called Riverside House was
A second set was mounted in a vehicle so that the communications link could be tested under realistic mobile conditions: this was driven around a chosen route, and system performance is monitored. In some experiments, the third set was used as a source of interference. The measurements are partly objective (digital error-rate), and partly subjective voice communication tests using conversation between people at the two ends.

The experimental equipment occupies a fairly large rack of complex electronics: however, the researchers are confident that the cell-phones - which should be available from about 1991 - will be smaller than current models, thanks to advanced miniaturisation of chips, and smaller batteries (possible because of the greater efficiency of the new sets).

Today's demonstration shows the fixed and mobile equipment. For this purpose, the 'mobile' end is stationary, but the speech quality is representative of the performance to be expected in the production system. The demonstration shows that the radio part of the system (the part apparent to the user) works satisfactorily, and gives adequate speech quality and intelligibility.

**TECHNICAL DESCRIPTION**

The 'test-bed' consists of the three identical sets of equipment, each being a complete radio sub-system following closely the technical standards currently being formulated by GSM. The main technical characteristics of the GSM standards are as follows:

- **Frequency band:** 900 MHz
- **Channel spacing:** 200 kHz
- **Transmitted rate:** 270.833 kbits/sec
- **TDMA frame:** 4.615 ms, 8/16 channels per carrier
- **Channel coding:** convolutional code
- **Speech coding:** 13 kbits/s regular-pulse excitation with long-term predictor (RPE/LTP).
The implementation of the test-bed hardware (and software) uses generally-available components, and is designed to allow experimental variation of the technical characteristics, so that alternative proposals can be compared. An example is the channel coding method: the relevant GSM committee (Working-Party 2) recently changed the details of the coding method to be used, and the (software) implementation of this in the test-bed was modified within a few days so that the new specification could be verified. This verification function is seen as one of the primary raisons d'etre of the test-bed.

The implementation of the various functions in the test-bed is as follows:

RF units (developed by Marconi): conventional circuitry using a common fast-hopping synthesizer for transmitter and receiver.

IF and multiple-access modules (developed by Racal with Marconi providing some of the software): receiver uses a signal-processing implementation based around a TMS32010 processor, which performs channel estimator and 16-state Viterbi detector algorithms used to compensate for distortion due to multipath distortion of the radio signal. This method can cope with multipath delays of about 14 microseconds, which should be adequate for the worst conditions found in built-up areas such as London.

Speech coder (the BT contribution): again based on signal-processing chips, in this case the WE-DSP32.

The modular construction (together with the instrumentation and data-logging equipment) accounts for the large size of the experimental gear. However, in an eventual implementation, units which occupy whole racks will be miniaturised into custom-designed single chips. Thus, the receiver signal-processing would occupy one chip, with the speech codec on another. However to implement the required functions economically will call for one micron chip technology, which is now only just becoming available.

A fuller technical description can be found in Proceedings of the IERE Land Mobile Radio Conference held in December 1987 at Warwick University.

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