

MICROWAVE AND MILLIMETRE-WAVE TECHNOLOGY REQUIREMENTS FOR THE EUROPEAN FOURTH FRAMEWORK PROGRAMME

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ABSTRACT

The 'Advanced Communications Technologies and Services' (ACTS) research programme forms part of the European Fourth Framework and addresses the communications environment of the first decade of next century. This paper sets out the European Commission philosophy of integration of UMTS, satellite-mobile, wireless-LAN and mm-wave broadband mobile systems into a single structure and the research methodology involving 'National Hosts'.

INTRODUCTION

European research in telecommunications has been increasingly dominated over the last decade by co-ordinated efforts among Member States within the European Commission 'Framework' Programmes. Most notably in the 3rd Framework Programme, which was operational from 1989-1994/5, the RACE programme (Research and development in Advanced Communications for Europe), and in the ESPRIT programme have focused substantial resources in the areas of telecommunications systems and components respectively. In September 1994, the 4th Framework activity in telecommunications was announced as the 'ACTS' (Advanced Communications Technologies and Services) to support research in the 1995 - 1999 time frame.

The objectives of the ACTS programme need to be seen in the context of other aspects of co-ordinated European Union evolutionary trends in telecommunications. In particular, the dual pressures of user demand for multimedia delivery and for migration from wire to radio connected terminals have resulted in a division of research effort (1) into six principal themes:

1. Interactive Digital Multi-media Services
2. Photonic Technologies

3. High-speed Networking
4. Mobility and Personal Communications Networks
5. Intelligence in Networks and Service Engineering
6. Quality, Security and Safety of Communications Services and Systems

The Mobility and Personal Communications area has been defined to reflect a communications environment which will emerge in the first decade of the next century, i.e. beyond what is foreseen as the consequences resulting from standardisation of UMTS which the European Telecommunications Standards Institute (ETSI) is scheduled to complete by 1998. The ACTS environment is seen as one in which the technologies associated with cordless/cellular systems, wireless-LANs, satellites and the mm-wave Mobile Broadband Service (MBS) are integrated to provide a platform for the seamless delivery of fixed network services of all kinds to radio-connected terminals. It is in this area that the principal challenges for the microwave and mm-wave industries are to be found.

In order to understand the Commission philosophy with regard to mobile and personal communications, it is important to appreciate that the major driving forces behind the ACTS programme are associated with evolution of the fixed network - the European ATM Pilot and the Trans-European Networks TEN-ISDN and TEN-IBC - and the assumption that user expectations will demand that as many as possible of the services which broadband optical networks will support can be delivered to personal non-wired terminals. Future personal communications needs therefore cannot be met simply by continuous development of the second generation environment

represented by GSM, DECT and DCS 1800.

EVOLUTIONARY PATHS IN PCN

3rd Framework Research - RACE and ESPRIT

A major role of European Commission supported research has been to provide the technological basis for the standards-making function of ETSI, the European Telecommunications Standards Institute. The RACE programme supported basic research directed towards UMTS and MBS, the 'Mobile Broadband Service', tackling these issues from the systems standpoint. ESPRIT, concentrated on component technology and on wireless LANs.

Within RACE, the principal projects which have run and are currently running are:-

PLATON - concerned with the development of software tools that will allow efficient planning of the UMTS network;

CODIT - exploring the potential of code-division multiple access for UMTS, and considering such issues as radio interface parameters, fast and soft handover etc;

MONET - concerned with network standards for UMTS and the interface between UMTS radio-oriented elements and the IBCN which itself includes 'Intelligent Network' functionality;

MBS - targeting the frequency allocation for broadband wireless pico-cell networks in the 62-63GHz and 65-66GHz bands, and paying particular attention to low cost transceiver technology based on GaAs P-HEMT MMICs;

MAVT - working on video coding algorithms to allow transmission of moving and still video in a mobile environment;

ATDMA - the time-division multiple access equivalent of CODIT with emphasis on the concept of an adaptive terminal which can access different air-interfaces according to the local radio environment and required services;

SAINT - addressing the problem of integrating satellite and terrestrial elements of the UMTS and

TSUNAMI - focusing on component issues, particularly in relation to adaptive antenna systems.

In addition to these projects, related work in non-mobile topics include MOBILISE, concerned with evolution of the Universal Personal Telecommunications (UPT) in the fixed network, MODAL addressing the radio over fibre issue for MBS support and MOEBIUS investigating satellite broadband services to ships.

Standardisation Issues

The parallel activities relevant to the microwave engineering community in ETSI during the first half of the present decade have been responsible for the GSM and DECT standards and for the DCS 1800 version of GSM which provides the air-interface standard for European PCN. National policies within Member States have also contributed, as has the European Commission's stance on progress towards 'Open Network Provision' (2). In UK, for instance, the emphasis on open competition among service providers and network operators has stimulated interest among PCN operators in minimising PTO interconnections by utilising microwave links. Allocations in the 38GHz and 55GHz bands are available for this and studies have indicated (3) that, in the 55GHz band, with frequency separations between 'go' and 'return' paths of 1.4GHz, channel spacing of 7MHz may be achieved for 8Mbit/s transmissions. A substantial European effort among the major component manufacturers is now being devoted to developing low-cost MMICs for these frequency bands, specifically aimed at the PCN infrastructure market. In the context of W-LANs, ETSI is now finalising the HIPERLAN standard which is the outcome of ESPRIT project LAURA which has targeted the 5 and 17GHz bands.

THE ACTS TASKS

The perception is, then, that ACTS will bring together previously separate research objectives in digital broadcasting and terrestrial and satellite personal communications of all kinds to realise a continuum of applications capability. To microwave engineers, the focus of interest is mainly Area 4 'Mobility and Personal Communications Networks'. This comprises 16 'Tasks'. Those with significance for the microwave industry fall into two categories: (a)

system oriented technology for 'demonstrators' and (b) technology to support new service concepts. In the former category are projects aimed at promoting the convergence of UMTS, MBS and W-LAN technologies, in the latter are projects which continue work on intelligent multimode terminal (IMT) capability and radio over fibre systems. Throughout, there is emphasis on the need to achieve maximum transparency from fixed to radio system elements in support of ATM formatted traffic.

THE 'NATIONAL HOST' ENVIRONMENT

An important aspect of the Commission philosophy in the ACTS programme derives from the view that the impetus for technological advance should come from user demand and the provision of new and innovative services and applications. Therefore access to user communities is a vital part of the research effort. This is being addressed through the concept of 'National Hosts', i.e. the established networks in participating member states of the EU over which innovative services and applications can be trialed. Whilst many Member States have offered their ATM pilot networks, Finland and UK have offerings which are mobile related. The Finnish Host in particular is a consortium of operators, spectrum regulatory interests and research establishments aimed specifically at trialing UMTS services; the UK Host offers opportunities for PCN and cable operators to investigate MBS and W-LAN services.

PARTICIPATION BY ORGANISATIONS OUTSIDE THE EU

For the first time, the ACTS programme recognises the global nature of the telecommunications industry. Hitherto, participation in Commission programmes has been limited to organisations with major R&D and manufacturing commitments in Union States, but this restriction has now been lifted, opening the opportunity to any organisation to participate. Non-EU participants will not receive funding from the Commission, but North American, Canadian and Japanese interests have already identified an intention to take part.

CONCLUSIONS

The ACTS programme represents a radical departure from earlier 3rd Framework research supported by the European Commission. In addition to receiving

substantially greater financial resources for the personal communications sector than in previous programmes, the emphasis in ACTS has moved away from technology per se to new applications and services based on exploitation of 3rd Framework research. This new focus, together with the approach to service and application trials via National Hosts, offers unprecedented opportunities for the microwave engineering industry to address an enormous potential market for products operating in frequency bands from the low-GHz to mm-wave parts of the spectrum. Unrestricted international participation should encourage rapid progress into the third generation personal communications environment.

REFERENCES

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