**IEEE P802.11**
**Wireless LANs**

# HIPERLAN Type 1

## by DASSAULT ELECTRONIQUE

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## Abstract

Further to the joint meeting between IEEE P802.11 and ETSI project BRAN hold on September 10, 1997 in London, DASSAULT ELECTRONIQUE is pleased to confirm its commitment to the industrialisation and mass production of HIPERLAN type 1 products compliant with the ETSI ETS 300.652 standard. Mass production will begin October 1998, those products address mainly the office automation market (including portable PC, PDA,...) with PC-Card interface intended for NDIS / IP / Windows 95/NT environment.

Attached is a more comprehensive description of the HIPERLAN type1 standard.

Considering the cooperation between ETSI and IEEE P802.11, this paper is to show the serious plan to make a product according to Hiperlan type 1.

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# HIPERLAN

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# EXECUTIVE SUMMARY

## HIPERLAN (HIGH PERFORMANCE RADIO LAN)

HIPERLAN is an ETSI standard referenced ETS 300652.

HIPERLAN operates in the 5,2 GHz non licensed band now being opened in all Europe, more than 20 MBps bandwidth on each of 5 collateral channels and provides true multimedia networking capability with sophisticated priority management schemes as well as true inter-operability standard for non proprietary products.

It can be considered as the SECOND GENERATION WLAN after 2.45 GHz

The targeted products based on the HIPERLAN standard, is probably the one capable of providing, in a realistic timescale and at a realistic marketprice :

- an open Radio LAN solution,
- an easy migration from existing LAN's (Ethernet compatible),
- a high user data rate compatible with multimedia requirements,
- a geographical coverage compatible with LAN user needs (50 to 100 m).

To support this strategy, D.E. has been the leader of an CE/ESPRIT III project (LAURA) whose objectives included the creation and implementation of the first HIPERLAN prototype. A specific task of this project was the liaison with the standardisation bodies, namely ETSI sub-technical committee RES10. Through one of its subsidiaries (DASSAULT A.T.) the company took the chairmanship of this STC RES10 as early as October 1992.

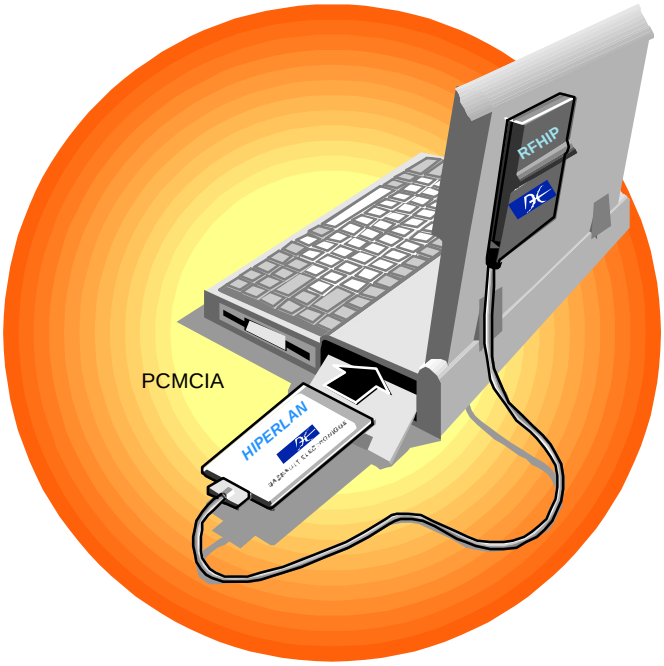
In addition, as a system application developer and supplier, D.E. is now involved in large projects embedding WLANs like those required by the medical community.

## HIPERLAN INDUSTRIAL STRATEGY FOR DASSAULT ELECTRONIQUE

D.E. is convinced that the Wireless LAN market is bound to explode as soon as HIPERLAN products are on the shelves. Therefore, D.E. is currently industrialising HIPERLAN products :

- components and chipsets (RF MCM, Modem part, MAC protocol),
- network adapters (ISA, PCI, and mainly PCMCIA),
- network layers and specific software applications based on HIPERLAN.

D.E. will propose pre-product for pilot tests in April 98 and is preparing mass production for October 98.



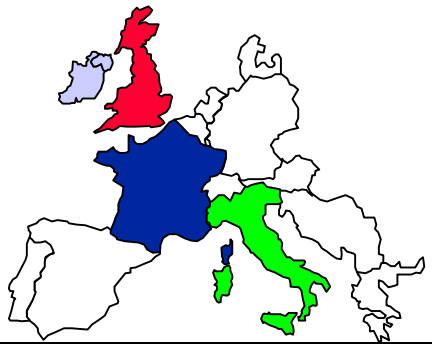
# DASSAULT ELECTRONIQUE'S HIPERLAN ACTIVITY

## THE ORIGINS

D.E. has pioneered the HIPERLAN concept (HIgh PErformance Radio LAN), mainly through an Esprit project named LAURA (Esprit Projects are European Research Projects partially fund by the European Commission on a competition basis) and a huge standardisation activity within the ETSI (European Telecommunications Standardisation Institute), and now through various experiments, among which medical ones.

Local
Area network
User
Radio
Access

- EUROPEAN PROJECT (ESPRIT) STARTED IN 1993
- LEADER DASSAULT ELECTRONIQUE GROUP
- SUCCESSFULLY ACHIEVED IN OCTOBER 1995
- FAISABILITY, DEFINITION, PROTOTYPING and EXPERIMENTATION OF RLAN CONCEPT
- ETHERNET COMPATIBLE (PROTOCOL LEVEL)
- MULTIMEDIA ORIENTED (DATA RATE, SYNCHRO)
- THIS PROJECT HAS GIVEN BIRTH TO HIPERLAN



## TECHNICAL ASPECTS OF THE HIPERLAN STANDARD

The standard, now fully approved, is named "ETS 300.652".

# A RADICALLY NEW CONCEPT : HIGH SPEED RLAN


ETS 300 652

Herebelow some technical characteristics of the standard, which has been designed with the primary goal of inter-operability This means that two HIPERLAN labelled products coming from different suppliers shall be inter-operable, like Ethernet Network Units. This rule has originated a second standardisation group, dealing with conformance towards the standard and establishing a comprehensive test plan.

**USER CHARACTERISTICS**

- **TYPICAL DISTANCE BETWEEN 2 STATIONS : 50 M**
- **MOBILITY : MOBILE SPEED : 5 TO 10 KM/H (AT MAX. THROUGHPUT)**
- **MAX. NUMBER OF NODES : LIKE ETHERNET**
- **USER DATA RATE (MAC LEVEL) : 10 TO 20 MBPS (HIPERLAN STANDARD = MAX. AIR DATA RATE : 23 MBPS)**
- **TOTALLY DECENTRALISED NETWORK MANAGEMENT :**
  - **NETWORK INTERNAL ROUTING : "INTRA-FORWARDING" PROTOCOL**
  - **AD-HOC TOPOLOGY : NO BASE STATION ; IMMEDIATE SETTING TO WORK**
  - **NOTA : BASE STATION CONFIGURATION ALSO AVAILABLE**
- **OPTIONS : DATA ENCRYPTION, ATM GATEWAY, …**

The above summary of main user characteristics shows that the targeted user data rate is much higher than that of the current WLAN (mainly proprietary products running in the 2.45 GHz band and not capable of more than 1 to 2 Mbps in favourable situations). This leads to new applications like the multimedia ones in professional as well as home environments.

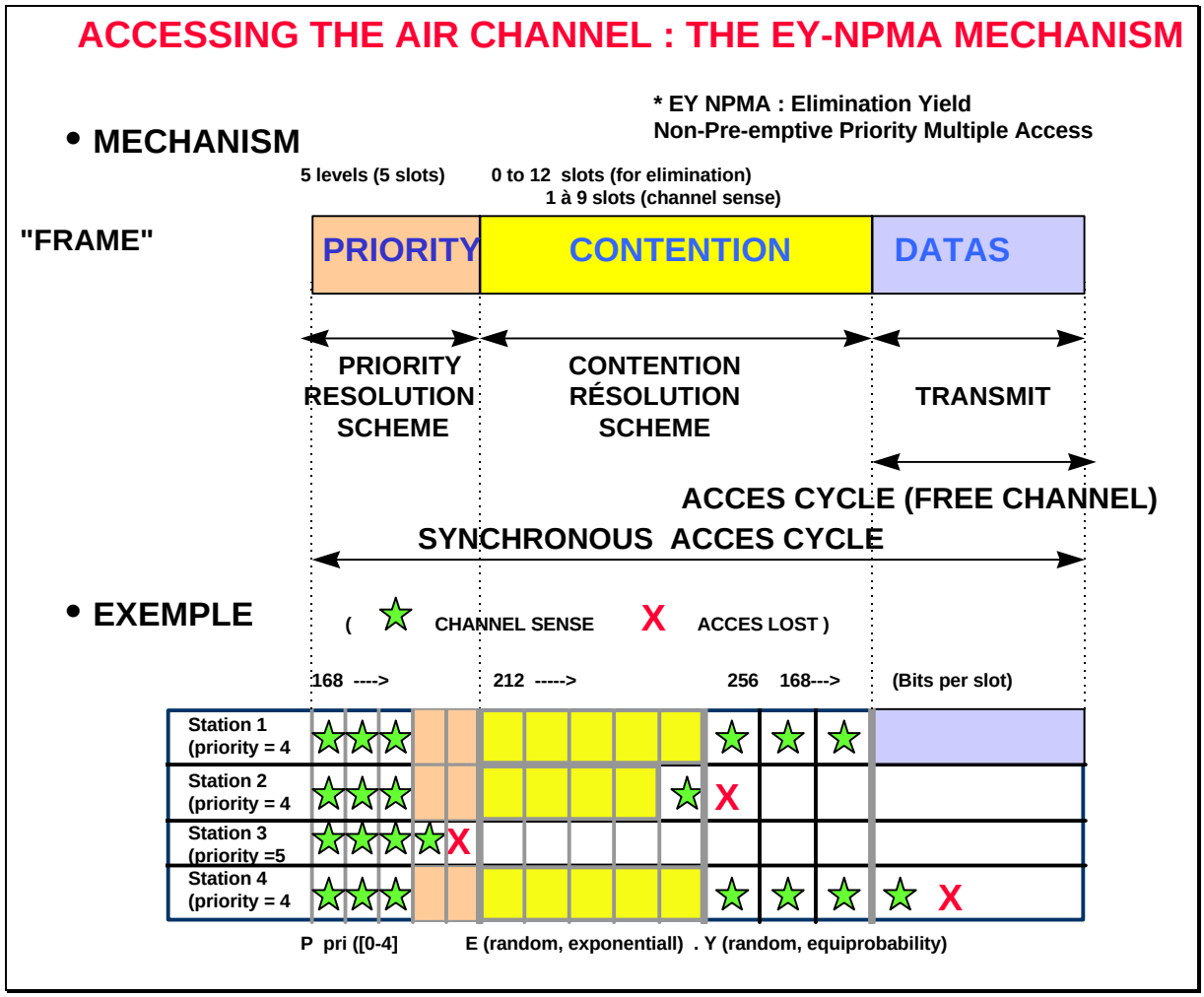
## TECHNICAL CHARACTERISTICS

- **RADIO FREQUENCY : 5.15 TO 5,30 GHZ ALLOWING 5 CARRIERS (THUS 5 INDEPENDANT COLATERAL CHANNELS)**
- **MAX EMITTING POWER : 30DBM (CEPT RECOMMANDATION)**
- **DIFFERENT CLASSES OF POWER LEVELS (SOME mW TO 1 WATT)**
- **NON DIRECTIVE MONOPOLE ANTENNA FOR BOTH TRANSMITTING AND RECEIVING**
- **GMSK* (BT = 0,3) MODULATION (ETSI RECOMMANDATION)**
- **EQUALISATION BASED DEMODULATION (Most suitable technics, but implementation dependant)**
- **CODE REDUNDANCY BASED ON BCH* (31-26) CONVOLUTION CODE**
- **NETWORK ACCESS PROTOCOL : CSMA/CA ET CD**
  - **CHANNEL ACCESS & COLLISION RESOLUTION BASED ON :**
    - **COMB MECHANISM**
    - **ACKNOWLEDGE SIGNAL FROM RECEIVING NODES AFTER COMPLETED TRANSMISSION**

** GMSK : Gaussian Minimum Shift Keying*

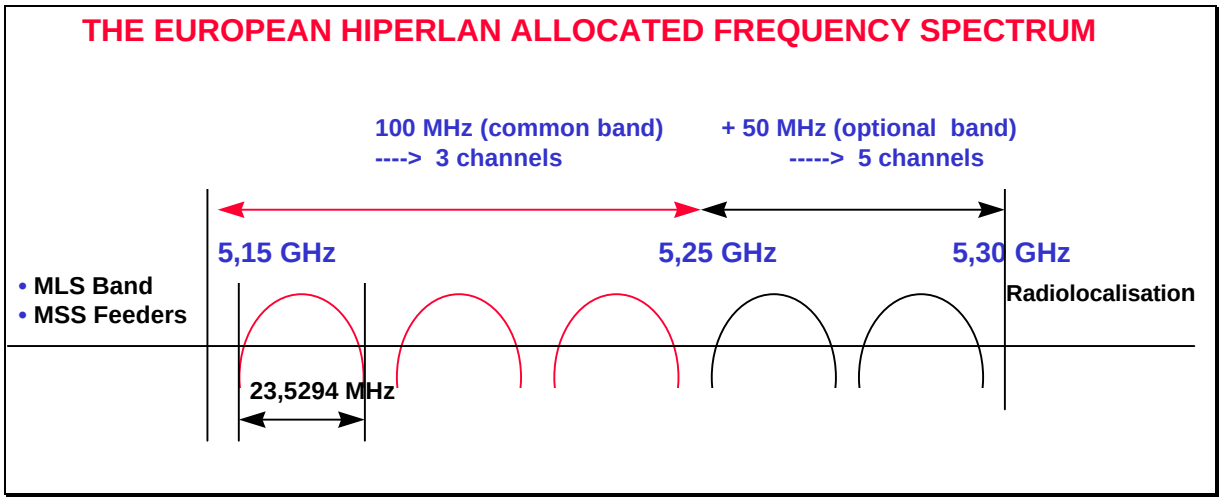
** BCH : Bose Chaudhuri Hocquenguem*

The following diagrams gives some flavour about the rather sophisticated method chosen for accessing the channel. An HIPERLAN network does not need any Base Station for allocating each node a « slot time » (a time duration in order to the community of receivers). On the contrary, a shared algorithm, called CSMA - CA (for Carrier Sense Medium Access, Collision Avoidance) is processed inside each station. Note that the ability of sparing a Base Station is well appreciated by those who have in mind deploying very affordable WLANs, like for small installations or even home applications.
The selected method is based on a priority resolution algorithm, allowing for data flow regulation, especially when both synchronous and asynchronous data are to be mixed. Obviously, the multimedia applications were the main drivers for introducing such mechanisms.




Coming back to basic physical aspects of the standard, a common non licensed spectrum has been allocated for all the European countries members of the ETSI committee. In fact a basic spectrum of one hundred MHz has been freed, allowing for three adjacent independent channels, and a additional 50 MHz band is optionally offered to countries willing to dispose of up to five collateral channels.

The US regulation body (the FCC), pushed by industrial lobbies like WINFORUM and SUPERNet, has also opened a spectrum comprising the 5.15-5.35 GHz band, and has declared compliant the HIPERLAN products.

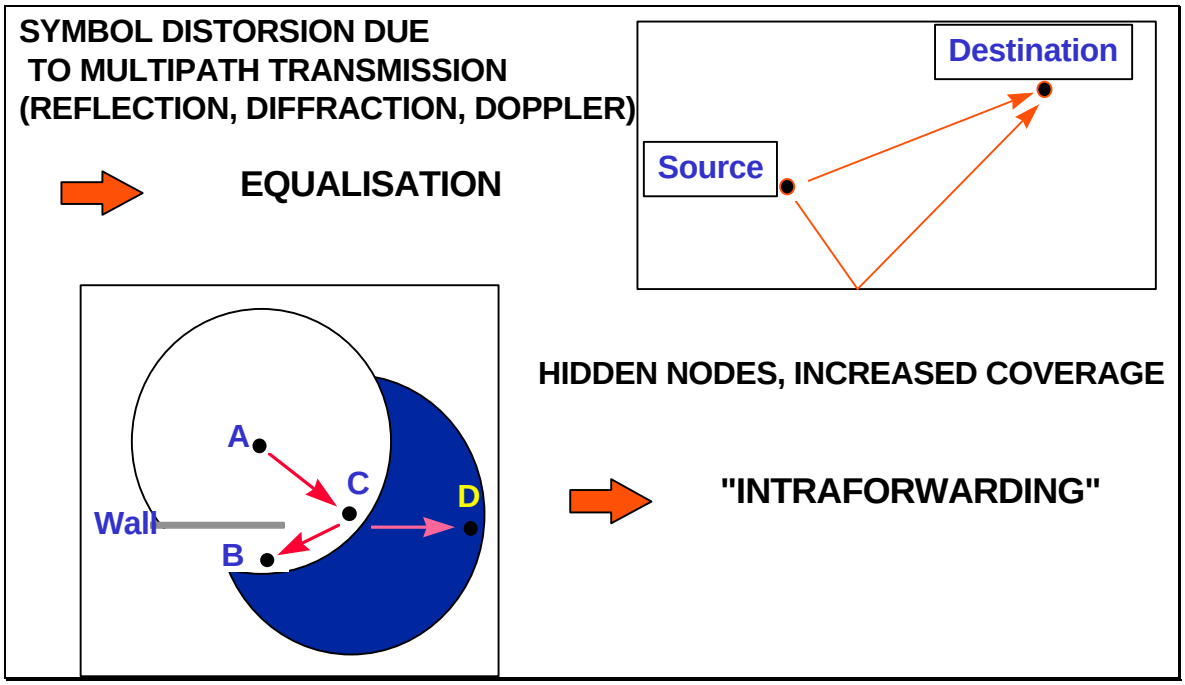



To continue this very short tour of the HIPERLAN characteristics, here are some words about the **signal processing aspects.**

First, due to the combination of the selected air frequencies and targeted data rate (a coding efficiency leading to about 1 bit per hertz), the physical phenomena degrading the transmitted symbols are numerous and unavoidable. This is particularly true indoor, where inter-modulation, Doppler effects, and reverberation or diffraction phenomena badly affect the transmitted symbols. Thus, sophisticated symbol recovery mechanisms are mandatory.

The Digital Signal Processing mechanism for the symbol recovery is not part of the standard, this flexibility letting each developer responsible for his implementation. However, the equalisation method is considered as the preferred one, although relatively silicon consuming. The standard has provided a special predetermined pattern, the **training sequence**, which is sent at the beginning of each frame.
Thus, very simply speaking, the equalisation consists in adapting the convolution coefficients of the receiver demodulator on the fly when receiving this special pattern, in order to recover the exact form of the pre-determined symbols before decoding the information message itself. This process indeed is one of the most tricky of the technology, and the implementation is possible only for specialists combining skills in RF, modem and ASIC technologies.

The HIPERLAN standard comes with an answer to the hidden nodes (see figure herebelow), named « intra-forwarding ». This method is an internal re-routing, performed inside the network itself in a transparent way for the applications running above the HIPERLAN layers (which comprise the physical and MAC layers of the OSI model). It is implemented in both H/W and (mainly) S/W.




Many other characteristics of the HIPERLAN technology could be developed here, like algorithms based on the frame definition -more precisely **low bit rate** part of the frames- in order to **manage power consumption**. The power management feature is in fact one of the more critical for a WLAN like HIPERLAN : high data rate capability, high transmit power capability, and nevertheless a product primarily suited for portable equipment. A number of provisions have been set up in the HIPERLAN standard in order to cope with this aspect.

# SYNTHESIS

Building on five years involvement in HIPERLAN, and a huge marketing activity, D.E. will make HIPERLAN a success story. For this purpose an aggressive industrialisation process which is being launched by the company.

The industrialisation will be carried by specialists whose skills embrace all the aspects related to such a product :

- RF part with MCMs and potentially MMICs ;
- modem aspect with special attention to the Signal Processing of the receiving part ;
- very powerful network protocol aspects, largely embedded in H/W ;
- development of a large CMOS ASIC covering both interface, network protocol and modem protocol aspects ;
- Network and upper S/W layers, including a number of system features not defined by the HIPERLAN standard ;
- integration into PCMCIA and MCM low cost components.

These represent some potential challenges, but they correspond to the core business of Dassault Electronique.