Chater 1. Introduction

1.1 Basics

Finally, and a few years later than expected, digital mobile telephony has fully taken over analogue mobile technologies. Its advantages are widely known: lower data error, higher quality voice, easily adjustable synchronisation, the absence of noise amplification in the regeneration stage, etc.

Roughly speaking, and as far as the present project is concerned, two types of digital mobile radio systems are to be distinguished:

- Public Digital Mobile Radio Systems
- Private (or Professional) Mobile Radio Systems

The main difference between them is the type of customer for which they are designed: while in public systems, like GSM, the users' main purpose is to communicate with acquaintances - as well as providing some multimedia and entertaining capabilities-, in private systems users require more specific resources and, often, much more demanding specifications which usually involve very short delays, faster call setups and highly reliable communication.

TETRA, which stands for TErrestrial Trunked RAdio, is a type of Private Mobile Radio (PMR) system. A PMR system is a system set up by a company or a group of users in order to provide mobile radio services. The 'walkie-talkie' is the traditional example of such technology, where users interact with one another without making use of a public infrastructure such as the Public Switched Telephone Network (PSTN). Thus, the first need of such systems is a new infrastructure to support the services provided. It can be stated,

to put it in a simple way, that this is the main drawback of PMR systems, the need to deploy a new infrastructure which of course requires an important investment of money.

TETRA is also a trunked radio system. A trunked system is, in short, a computer-controlled system, typically fairly complex. In practice, this means that there has to be a software in order to manage and maintain the system working. This, from an economical point of view, is not really a problem since computers are affordable nowadays. The problem, so to speak, comes from the fact that this 'complexity' makes the system require some type of support. In fact, this support is continuously needed, for TETRA's operation involves continuous management.

Both TETRA and GSM, along with some other technologies, are to be used and integrated in a common architecture called e-Triage. e-Triage is a massive project funded by the German Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung). Its main objective is the efficient electronic on-site registration of victims in Mass Casualty Incidents (MCIs) such as earthquakes or a hurricanes. After a disaster event the terrestrial commercial networks are likely to be overloaded, damaged or not operative, if they ever existed. The idea is to enable a fast distribution of the information to operation control centers and hospitals for a better handling of victims. To achieve this, e-Triage designs the end-device used to register the victims, the distributed database where the information of the victims is saved, and the communications infrastructure necessary to transmit the data.

As part of this project, an article has been submitted and accepted by the American Institute of Aeronautics and Astronautics (AIAA) [1]. The paper describes the communications infrastructure used in the e-Triage Project. The TETRA sections there gathers a discussion on standarisation and the type of satellite link that should be used in the context of e-Triage. More on this in Chapter 2.

1.2 Objectives and structure of this document

The main and most important objective of the present project is the integration of TETRA and GSM in e-Triage, with a particular concern on testing the operation and

viability of both technologies together over satellite. In order to achieve this several scenarios have been investigated in the test bed, first involving only TETRA and then TETRA plus GSM. The approach has been done this way due to the fact that TETRA is a much less known technology in comparison with GSM. In fact, the first and main problem faced throughout the entire project was the nearly absence of information on TETRA over satellite. Although some other technologies as GSM have already been studied and implemented over satellite, TETRA is still an unexplored field, and there was only once paper on the matter at the time of the current document was written [2]. For this reason, some of the approaches taken have consisted of exploiting the similarities with other technologies that have already been taken over satellite.

Very briefly, these are the steps that have been followed:

- Brief explanation of e-Triage in order to fit the present project in it (Chapter 2)
- Study and understand of the principles that govern TETRA set of standards, based on interfaces. Since GSM is a more well-known technology its explanation is not as large, and often technologies are explained by comparison between each other (Chapter 3).
- Study of the viability of TETRA and GSM over satellite (Chapter 4).

These first four chapters can be seen as the theoretical part of the project. The remainder is the practical part, so to speak.

- Definition of the architecture proposed and explanation of the equipment used, and how the theoretical approach given in the previous chapter is affected by the real implementation (Chapter 5).
- Real implementation of the scenarios that are going to be studied (Chapter 6).
- Results, conclusions and possible improvements in further research (Chapter 7).

1.3 System requirements

The requirements of the system are summarised here:

- Provide safe and reliable communication among users.
- The complexity of having different mobile technologies coexisting and running at once has to be transparent to final users, specially since they won't probably be experts on technological issues and are likely to work under extremely stressful conditions.
- The system must be 100% IP-based