

INTERNATIONAL TELECOMMUNICATION UNION

# TELECOMMUNICATION DEVELOPMENT BUREAU

**ITU-D STUDY GROUPS** 

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### FOR INFORMATION

Question 18/2: Strategy for migration of mobile networks to IMT-2000 and beyond

### STUDY GROUP 2

SOURCE: VENEZUELA

TITLE: VENEZUELAN EXPERIENCE ON THE IMPLEMENTATION OF CDMA 1XRTT NETWORK BY ONE EXISTING TDMA OPERATOR IN THE 800 MHZ BAND (824-849 MHZ/869-894 MHZ)

#### Abstract:

This document is based on the information submitted by the operator to the first meeting of Permanent Consultative Committee II, held in Orlando, Florida in February 2003, in the document CCP.II-RADIO/doc 148/03.

This document shows the background information, evaluation criteria, network characteristics, construction, tests of operation of the CDMA 1xRTT network and implementation of the network by the Venezuelan operator.

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### **1. BACKGROUND**

By 2001, one Venezuelan mobile operator, completed studies on the feasibility and revision of the business case for deployment of a new technology in the 800 MHz band, with two options: **GSM and CDMA**, and several requirements, such as: substantial increase in network capacity, greater compatibility with existing infrastructure, better positioning to provide 3G services, and substantial reduction of future CAPEX and OPEX requirements.

In studies of the two options, six main aspects were taken into account by the operator:

- Availability of technologies in the 800 MHz band
- Efficiency of frequency use (traffic handling capacity)
- Compatibility with existing infrastructure
- Positioning to offer 3G services
- International experiences
- Availability of terminals

# 2. STUDY OF OPTIONS

### 2.1 Availability of technologies in the 800 MHz band

By 2001, only one digital technology could provide solutions that met the requirements considered by the operator: CDMA 1xRTT. Some manufacturers had announced their intent to provide a GSM solution for the 800 MHz band, but thus far, this had not materialized.

The operator had then to choose either the CDMA 1xRTT option, with successful experiences in other countries of the Americas, or GSM, without knowing whether that solution would be developed, and without previous experiences to draw upon. In addition to the infrastructure problem, there was major concern in connection with the GSM option regarding the availability of user terminals as, thus far, no manufacturer was offering GSM terminals in the 800 MHz band.

### 2.2 Efficiency of frequency use (traffic handling capacity)

To date, on this item, CDMA has shown itself to be the technology making the most efficient use of the spectrum and, therefore, providing greatest traffic handling capacity. Nonetheless, we must note another important problem that had to be resolved: radio frequency engineering.

Having to implement the new network in the very congested 800 MHz band, it was necessary to revise frequencies plan to provide for the coexistence of a new technology. This involved considerable effort to make room for the new technology in part of that band without affecting the quality of the existing TDMA system.

# 2.3 Compatibility with existing infrastructure

As GSM is a form of TDMA technology, some people had the impression that there was greater compatibility between these two technologies (GSM and TDMA) than between TDMA and CDMA. However, the fact that IS-136 and GSM are two forms of TDMA does not mean that they are at all compatible from either the user terminal or the operator network standpoint, while TDMA and CDMA networks share the same communications protocol in the core network (ANSI-41).

Such a feature of compatibility enabled the operator to share the same TDMA applications and systems on a new CDMA 1x network. In concrete terms, it meant sharing such important platforms as HLRs, voice mail, SMS, WIN, prepaid, etc., enabling customers to migrate from the TDMA to the CDMA platform while retaining their telephone numbers and user profiles.

### 2.4 **Positioning to provide 3G services**

Careful study of a TDMA operator's options in migrating toward 3G shows that the GSM route requires additional spectrum (UMTS spectrum), as well as two additional platforms: the GSM network and the UMTS network. However, the CDMA2000 route does not require additional spectrum, as it can be implemented in the 800 MHz band on only one platform: the CDMA2000 network.

### 2.5 International experiences

By 2001, the European operators that had invested heavily to obtain licenses for use of the spectrum required to implement UMTS were in a critical situation since financial point of view. Many could not make payments while others were asking governments to relieve them of their payment obligations. Problems were aggravated by delays in the development of UMTS technology and none of the implementation commitments had been fulfilled. In fact, new delays were announced regularly.

On the other hand, Korean and Japanese experiences with the CDMA 1x platform had been very successful. The number of users was growing rapidly and new applications and terminals were appearing every day.

# 2.6 Availability of terminals

For purposes of the decision, the terminal issue was one of the more studied aspects. The operator had already learned from experience how advantageous it was to have a wide variety of terminals tailored to the different customer segments, as well as manufacturers willing to provide in the terminals the latest technological innovations in the technology used by the operator. Thus, the decision had to take into account the existence of a wide range of manufacturers, committed to delivering terminals tailored to the applications to be implemented and to market requirements, taking into account the Korean and Japanese experience, as well as the decision taken by one large North American operators, and one large Brazilian operator to implement the technology CDMA 1x, generated confidence that terminals would be available.

### 3. NETWORK CONSTRUCTION AND COMMISSIONING

The project to install and bring into operation of the CDMA 1xRTT platform consisted, as mentioned above, of building a network parallel to the TDMA network (over 400 cells), retuning the entire existing network (AMPS and TDMA) to free the necessary spectrum to raise the CDMA 1xRTT carrier, adaptation of sites for installation of the new radio base stations and the MTX, interconnection, connecting platforms and common nodes to the AMPS, TDMA, and CDMA 1x, and adjustment of operating systems, billing, and administrative procedures.

- 4 -ITU-D/2/163-E



#### Plan for Spectrum Migration to CDMA 1xRTT

One of the project's main challenges was to integrate the TDMA and CDMA 1x networks into the core network, operations support systems (OSS), and business support systems (BSS). The objective was to ensure number portability between networks, transparency of services, and compatibility of the two networks by reutilizing platforms providing basic and value added services, such as SMS (*Moviltexto*), voice mail (*Movilmensaje*), HLRs, the other voice services, SCP, and Wireless Intelligent Network (WIN), both for the prepaid service collection platform and for calling records to bill for the new network's services. Processes and systems to support the new wireless data services also had to be designed.

At the time the project began, no platform existed enabling subscribers' profiles and locations to be stored (HLR) that was capable, for both networks simultaneously, of handling and managing subscribers to ensure the transparency of the process.

At the same time, an exhaustive study had to be made of the services associated with the WIN network and their current support procedures so as to be able to integrate them with the new network.

The possibility of coverage of 1x subscribers under the analogue network had to be evaluated, as several services required fundamental changes in treatment. Even basic services such as voice messaging required adjustments to call routing procedures owing to existing differences among providers.

Prepaid service had been operating over TDMA with manufacturers' proprietary protocols which, with introduction of the new network and a new provider, became an obstacle to integration with 1x. For this service, solutions were more sophisticated. Negotiations were conducted with providers and competitors to ensure deployment of a system based on the standard IS-826 communications

protocol for prepaid mobile telephony systems. This involved designing a new network architecture, in order to meet the objectives by the deadlines without affecting existing systems.

Within nine months – from January to October 2002 - all these efforts had met with success, with participation by all company units, while simultaneously satisfying the installation and operating requirements of the existing AMPS, TDMA, and CDPD networks.

# 4. TESTS OF OPERATION

The commercial certification process consisted of validating the network's commercial operation through the use of general testing protocols for calls, services, and systems supporting commercial operation and customer services. The certification process was conducted on the call and service different systems, that is, postpaid and prepaid on-line systems, agents' extranet, voice activation, on-line The operator, operational intranet (Switch-MTX and short message service, postpaid and prepaid calls and services, tests in outdoor locations; indoor tests in each region's most important structures; handoff: maintenance tests for calls when the receiving radio base station changes, for both digital and analogue radio base stations; IVR: card activation, data transmission.

Tests were divided into postpaid and prepaid categories, and a multidisciplinary certification team was formed. Its structure was: the fault repair group, responsible for monitoring and correcting problems on systems operated on The operator; the testing group, organized into regions by the regional managers; and a group of regional manager's office employees, responsible for call and service tests. The test protocol explained the objective, scope, and execution of each test, as well as the anticipated result. This tool was highly important in team coordination, for which a small group was required, which acted as liaison between the regions of each commercial area.