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Dect with Cordless Module for Base Station and its Automation

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***Abstract*- Cordless module for Base Station (CMBS) is a part of Digital Enhanced Cordless Telecommunications (DECT). DECT is a digital radio access application, used in business, domestic and public environments which provides voice, data and networking applications. The DECT can perform following functions such as Generate Incoming and Outgoing calls, Testing speech path in incoming and outgoing calls, Intercom calls with different band types, Parallel call tests, Call conference tests (both intercom and external), Register and deregistering of Handset(HS), Call waiting, call hold, and resume tests. This paper presents the DECT standard and explains its main operating principles and automation. The result shows that the performance of DECT Automation in Data Transmission and the Call Setup are better than the manual testing.**

***Keywords*-** Advent, Automation, Base, CMBS, Cygwin, DECT**,** Fixed Point (FP), Handset, JSystem**,** JTag, Portable Point (PP), System Under Test(SUT)**,** Moxa**,** TDMA, Tera Term**,**

I. INTRODUCTION

Cordless phones using the Digital Enhanced Cordless Telecommunications standard are among the most widely deployed security technologies with 90 million new handsets shipping every year [1]. The technology is also popular in other applications with even higher security needs including machine automation, building access control, alarm systems, and wireless credit card terminals [2]. The DECT standard provides a general radio access technology for wireless telecommunications, operating in the preferred 1880 to 1900 MHz band [3]. DECT supports multimedia and voice technologies. It is a common standard for cordless personal telephony originally established by ETSI, a European standardization body. DECT is a system for cordless business communications. DECT provides 120 duplex channels to provide wireless speech bearers. The present Enhancements to this standard now allow data services up to a data rate of 1Mbps.

Currently the testing is done using the manual process. In this work the automation of the DECT is discussed. The methodology used by automation is presented in brief.

The remaining part this paper is organized as follows. In Section II the framework services of the test automation are briefly explained, Section III provides the frame format and allocation of slots, Section IV discusses the initial setup required to carry out the testing, Section V provides the Software architecture being used for automation, and Section VI provides the Simulation Results.

II. FRAMEWORK SERVICES

In this section the framework of JSystem automation is briefly discussed. In Fig. 1 the JSystem framework services are divided into six building blocks that provide the simple and exact functionality required to perform all testing operations required by QA engineers.

SUT Independence is the ability to run the same test on different setups without changing the test. System Object lifecycle service includes the ability to control the creation, initiation and destruction of system objects. Reports mechanism enables the user to quickly analyze the cause of any test execution failure. Analyzers provide an easy way to verify System Objects operations. The System Object operations are used to manage and or receive information from the SUT. Monitors are processes that are also referred to as threads; these threads are defined per test. The fixture is a special type of procedure that brings the SUT to a specific configuration state. The fixture enables the tests to share system configurations. As Multi User Support, the JSystem Automation Framework supports the ability to define tests according to parameter.

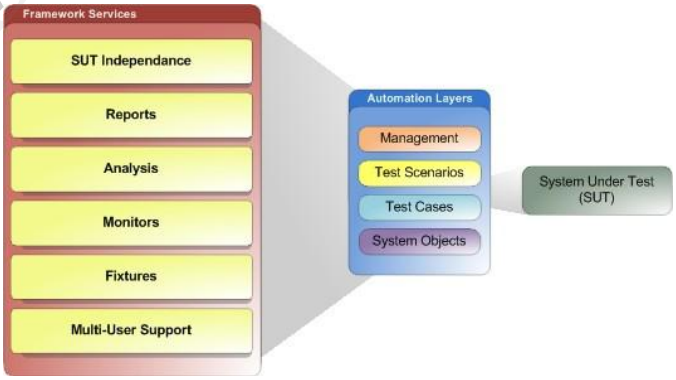

Fig. 1. Framework Services[4]

The testing tools include requirement analysis, defect tracking, and configuration management tools. Integration of test automation and support tools, such as defect tracking, is crucial for the automatic reporting of defects for failed test cases. The automation framework administrator manages test

case libraries, test platforms, and test tools, and provides tutorials.

III. FRAME FORMAT FOR DECT

The Frame Format for DECT is explained in this section. Basic DECT frequency allocation uses 10 carrier frequencies (MC) in the 1880 to 1900 MHz range [5]. The time spectrum is subdivided into time-frames, which are repeated every 10 ms.

One time-frame is composed of 24 individually accessible timeslots that can be used for transmission or reception using Time Division Multiple Access (TDMA). The 10 ms time-frames are divided in two halves. The first 12 timeslots are used for FP transmission (downlink) and the other 12 are used for PP transmission (uplink) as in Fig 2. Due to the use of TDMA structure DECT offers the possibility of 12 simultaneous basic DECT (full duplex) voice connections per transceiver. In comparison to technologies with only one link per transceiver DECT is the more cost-effective technology.

The PP constantly checks the channels with the best RSSI value whether it has access rights for the sending base station. A low RSSI value symbolizes free and non-interfered channels, whereas a high RSSI value symbolizes busy or interfered channels [3].

A call can be originated by either PP or FP. During a PP originated call setup the PP selects the best available channel for set-up and accesses the FP on this channel. During a FP originated call setup a page message containing the unique portable identity is sent by the FP. When the page message has been received, the PP sets up a radio link on the best available channel. The call initiating party sends message containing information like the portable identity or the fixed identity to the contrary one [5].

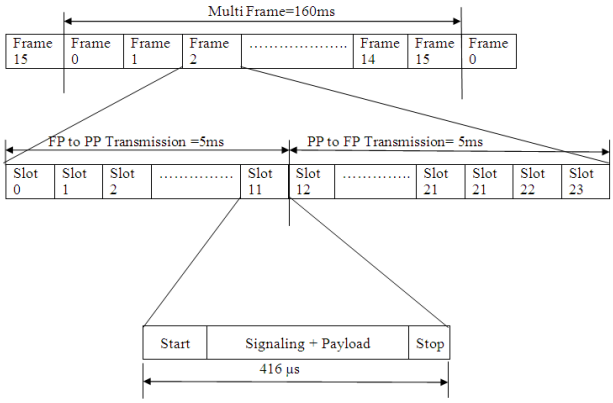

Fig. 2. The Frame format for the DECT

IV. CMBS SETUP FOR TESTING

In this Section, the devices and the softwares used for the testing and their operations are explained.

DCX79 Setup with CMBS

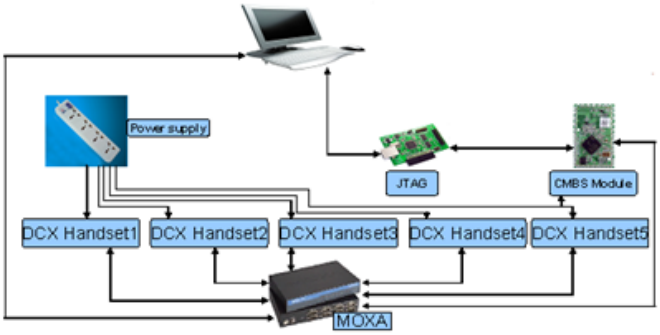

Fig. 3. Set up for testing

The Setup requires a PC which is linked to all Handsets and CMBS through Moxa. The CMBS is connected to PC through JTAG as in Fig. 3.

The Fig. 4 shows the communication between PP and FP. Prior to the first use of a PP in conjunction with a FP the key-allocation procedure has to be done. This procedure can be initiated either by the manufacturer or the user before the first use. The same PIN has to be entered in both devices, whereas sometimes the FP is provided with a fixed default PIN that the user has to enter on the PP [6].

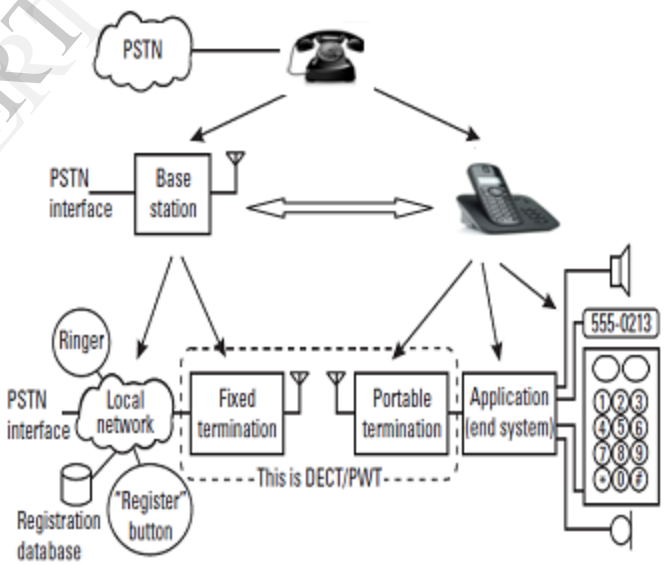

Fig. 4. Digital Enhanced Cordless Telecommunications (DECT)

A mutual authentication is performed between the Fix Radio Termination (FT) and the Portable Radio Termination (PT) whereby the PT authenticates itself against the FT and the FT authenticates itself against the PT. Some of the Hardware and Software requirements for automation are as explained below.

A. *Advent Instruments*

These are specializes in developing innovative and high performance test equipment for telephone. Leveraging sophisticated technologies, Advent Instruments aim to create products that provide the features, speed, and accuracy required by designers and production facilities.

B. *MOXA: USB to Serial Converters*

For many applications, a PC must connect directly to a number of devices over a serial interface. Moxa's UPort line offers PCs a high-performance, industrial-grade connection of serial devices over a single USB port. A wide range of models is available at 480 Mbps, advanced UARTs for high-end serial performance, COM port mapping, and more. UPort USB-to-serial products are ideal for modern PCs and laptops that need a direct serial connection to industrial devices.

C. *JTAG*

USB-JTAG Interface Adapter is a small hardware adapter that connects the USB port of PC to the JTAG debugging port of your target hardware. We can test different builds on the target hardware, program the on-chip FLASH memory of many devices, program external FLASH memory of many target system. A USB interface that provides power and fast PC communication, Real-time in-circuit emulation using an on-chip debug interface, depending on your device and target hardware configuration, you may be required to connect the target cable to the appropriate target connectors, flash programming via the on-chip debug interface.

D. *Tera Term*

Tera Term (rarely TeraTerm) is an open-source, free, software implemented, terminal emulator (communications) program. This program can be used to display data received on computer serial port.

E. *Cygwin*

It is a Unix-like environment and command-line interface for Microsoft Windows. Cygwin provides native integration of Windows-based applications, data, and other system resources with applications, software tools, and data of the Unix-like environment. The Build commands are used to build the image for Handset and Base.

V. THE TEST AUTOMATION METHODOLOGY

In this Section the process of Automation and its working is explained.

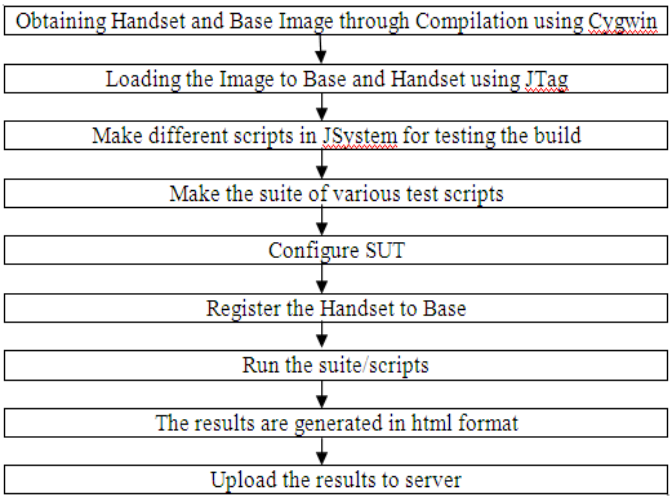

Fig. 5. The Automation Methodology.

The JSystem Scripts are made using the building blocks that are being developed using Java. The combination of building blocks makes a test script. The Automation Methodology is as in Fig. 5. The JSystem architecture comprises of the System under Test, the System Under Test (SUT) is the device or software that is being tested, as well as the equipment and applications that participate in the test setup. The main aspects of automation are as below.

A. *System Under Test (SUT)*

The system under test (SUT) is the user testing environment. When planning an automation project one of the first steps required is to define the SUT. The SUT is the device or software that is being tested, as well as the equipment and applications that participate in the setup.

B. *Functional Requirements*

The build commands used are different for Handset and Base depending on the builds released, the image is built as in Fig. 6. Once the image is produced, it has to loaded to Handset and Base using Vega memory tool as in Fig 7. After loading the image, the CMBS module is connected to PC through commands. Once the CMBS get connected to PC, then it can be controlled by CMBS host command prompt as in Fig 8, then image can be tested by different JSystem scripts as shown in Fig 9.

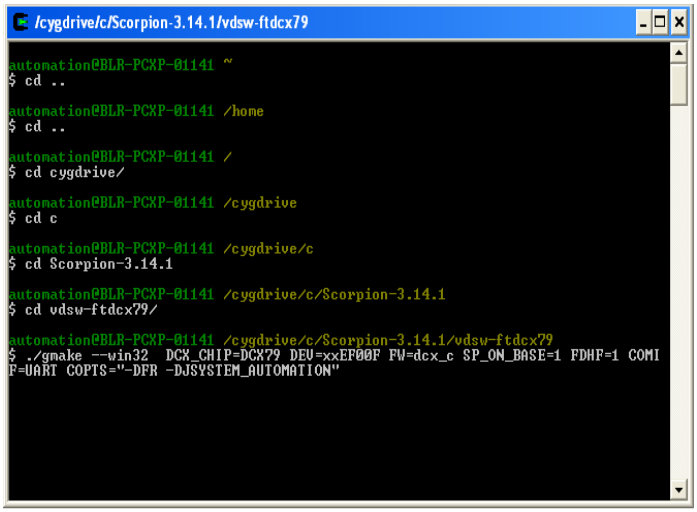

Fig. 6. Cygwin for building images

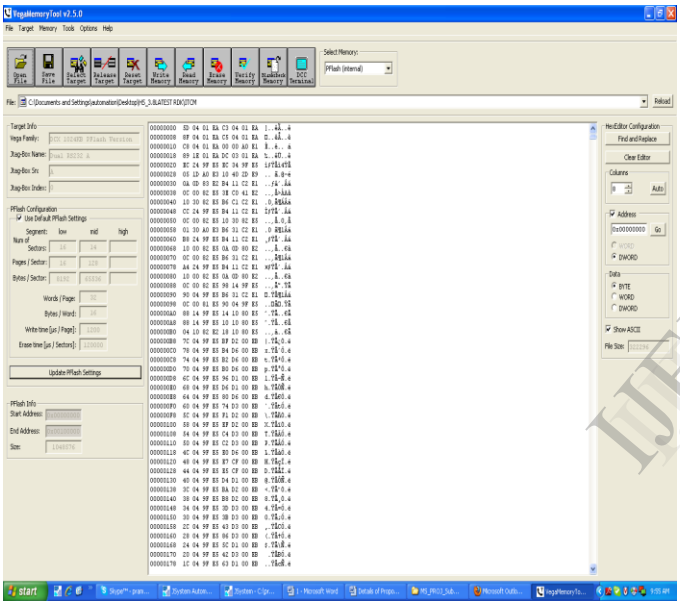

Fig. 7. Vega memory tool for flashing

C. *Security/Privacy*

Subscription PIN code, used to subscribe a new handset to a base station. It is only valid for one subscription. Master PIN code, used to access the Master Mode. The Master Mode is a special mode, where a handset is used to control the settings of the base station and for system administration tasks (subscribe/desubscribe handsets etc.).

Handset PIN code, used to lock and unlock the handset for outgoing calls. These PIN codes are all factory set to 1590. They can (and should) be changed by the user as soon as possible to avoid fraudulent attacks on the system. Other PIN codes might be required depending on the type of base subscribed to, e.g. the User PIN code for a User Authentication Request.

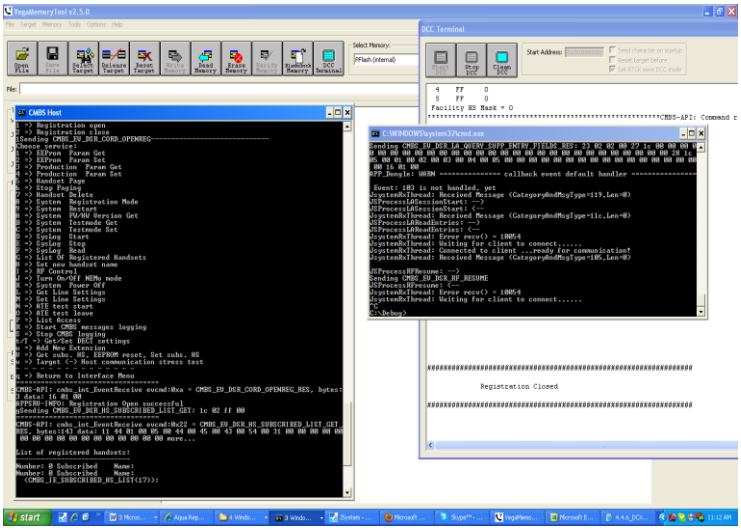

Fig . 8. CMBS connection and its control

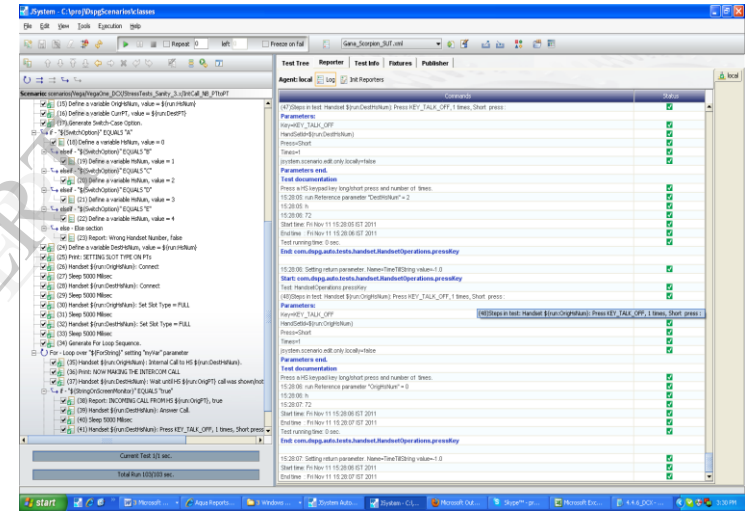

Fig. 9. Jsystem Script

D. *Portability*

Automation can be run on any windows system by setting up all the software's required hence it is easily portable.

E. *Quality Assurance Requirements*

Modules or libraries are tested with a variety of input arguments to validate that the results that are returned are correct.

F. *Accuracy Requirements*

A testing framework generates user interface events such as keystrokes and mouse clicks, and observes the changes that

result in the user interface, to validate that the observable behavior of the program is correct.

VI. SIMULATION RESULTS

The JSystem delivers a Framework for system testing automation that provides a model and architecture structure that supports complex testing environments. This enables the user to build tests with full setup configuration independence, define test parameterization, build complex scenarios and utilize enhanced reporting functionality.

Once the Handset got registered to Base, Data transmission can be done both from Handset side and Base side. For the manual transmission of data the Tera Term Software is used as in Fig. 10 and Fig. 11.

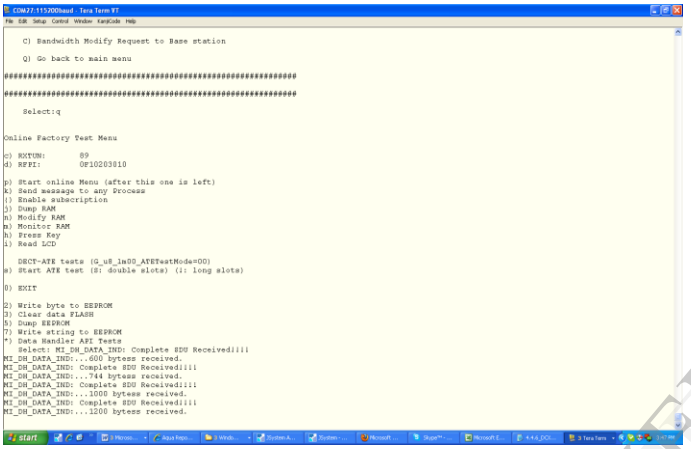

Fig. 10. Data Transmission from Handset

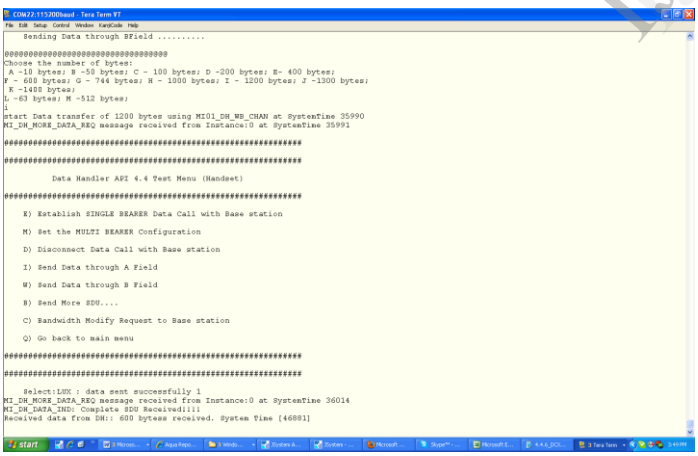

Fig. 11. Data Transmission from Base

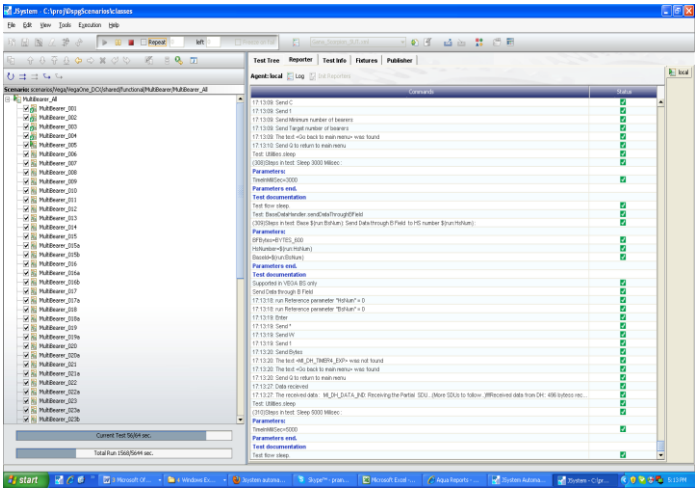

Fig. 12. JSystem Suite execution

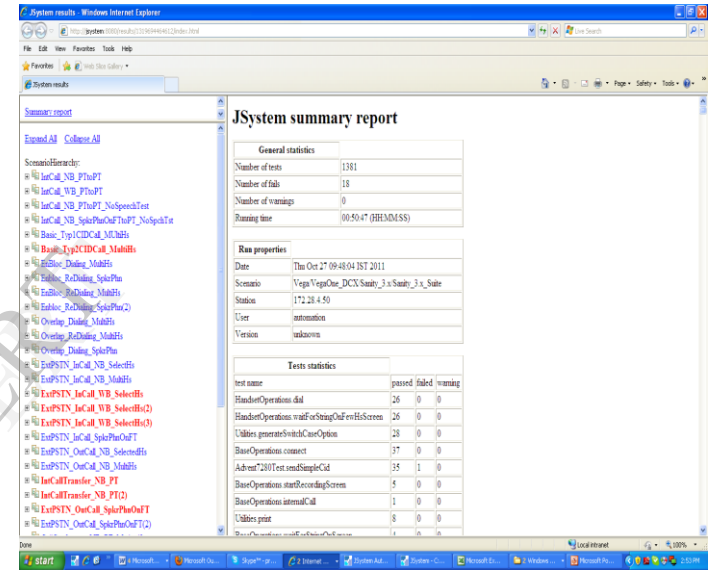

Fig. 13. JSystem Summery Report

For the execution of all scripts, the Suite is made , which is the combination of all individual scripts and is run by JSystem as in Fig 12. After the execution of the Suite, the JSystem summery report is seen in the HTML format. The execution of the Suite can be stopped in between if there are any errors, and can be run from the point where it has been stopped before , the summery report is as in Fig 13. After obtaining the results the summery report is uploaded to the server, and the test status is obtained as in Fig 14.

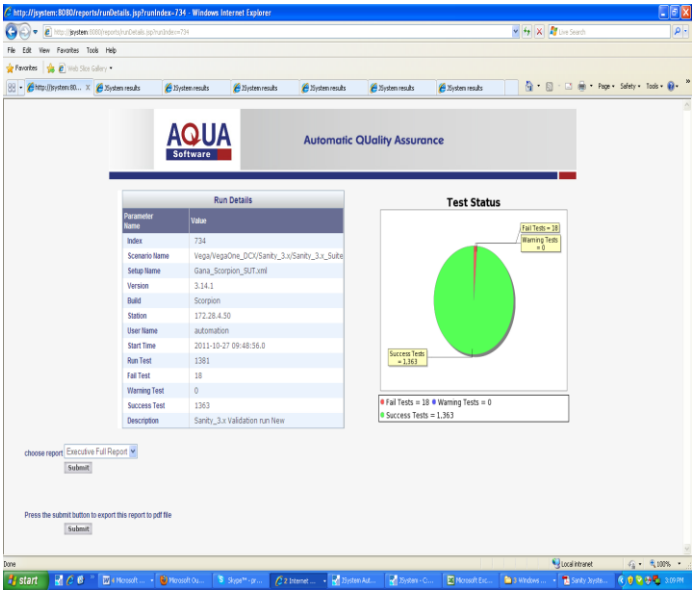

Fig. 14. Test Status

VII. CONCLUSIONS

The results confirm that the Automation of DECT using CMBS makes the testing process simple and more effective compared to the Manual testing procedures. As a future work when a bug is found in the field, that means a test case has been missed out to check that, analyzing why it was not found internally and add a regression test case at the appropriate level as part of the normal process.

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