Journal of Theoretical and Applied Information Technology
30th April 2012. Vol. 38 No.2
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ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

CONFORMANCE TESTING IN 3G (34.123)

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ABSTRACT

The Mobile industry has witnessed a tremendous growth in the past few years with the advent of 2G, 3G and 3.5G technologies. The essence of these technologies' lie in higher data rates, video telephony, high-speed internet and lot many others which provide reliable, uninterrupted and healthy communication among the users. This must ensure that the User equipment (UE) adheres to the standards proposed and meets all the requirements as specified by the standard bodies.

This paper is concerned about verifying the functionality of UMTS protocol stack in User equipment through 3G conformance testing. This is carried out in a simulated network environment where different scenarios scripted in TTCN language are run to ensure that the implementations meet the standards proposed by 3GPP, which is referred to as Conformance testing. This would indeed help the certification bodies like GCF and PTCRB to certify the user equipment.

This paper presents the test bench architecture, the environment and testing process which involves testing of various procedures and features in the UMTS. Testing of various features on the User equipment makes it versatile and most significantly qualifies the user equipment. Thus Conformance testing plays an important role in the mobile industry where the user equipment has to pass the minimum requirement in order to reach the user

Keywords: *Third Generation (3G), Universal Mobile Telecommunications System (UMTS), Conformance testing, Tree Tabular Combined Notation (TTCN),Protocol Stack, Third Generation Partnership Project (3GPP), Global Certification Forum (GCF), Personal Communication Service type Certification Review Board (PTCRB).*

1. INTRODUCTION

UMTS is the standard for all the third generation mobile telephone systems and is the successor of the second generation mobile technology called GSM. UMTS networks make use of Wideband Code division multiple access (W-CDMA) radio access technology to provide network access to its users. UMTS is broadly classified in to UMTS Terrestrial Radio Access Network (UTRAN), also referred to as Access stratum (AS) and Core Network (CN) being the Non access stratum (NAS). The architecture of the UMTS is described in the section 2. Conformance testing described in the later sections of this paper goes mainly with AS procedures and a considerable amount of NAS procedures.

Conformance testing is concerned with protocol implementation and its verification at different layers of 3G protocol stack in a UE. Protocol implementation and its functionality in this paper are checked primarily at Layer 2 and Layer 3 of the UE protocol stack which is explained in the section 3.

Testing is carried out in a simulated network environment where the conditions of a live network are established where in different test scenarios are run to analyze the behavior of the UE as well as to check the functionality of the Protocol stack. The test bench architecture, the environment and the process are explained in the section 4.

Conforming to the standards proposed by the standard bodies like 3GPP is achieved by testing various features and procedures which prove the versatility of the UE and the tester (Network). The features and test scenarios along with their conformance practices are discussed in detail in the section 5.

Conformance testing is vital for the User equipment to gain reliance from the UE manufacturers as this helps in certifying the UE.

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This certification is very much needed for the UE manufacturers as it is the Gateway for the UE to reach the public. This paper brings out a very detailed explanation of the technology, the conformance process, its practice and focuses on various features and scenarios in 3G.

2. UMTS NETWORK ARCHITECTURE

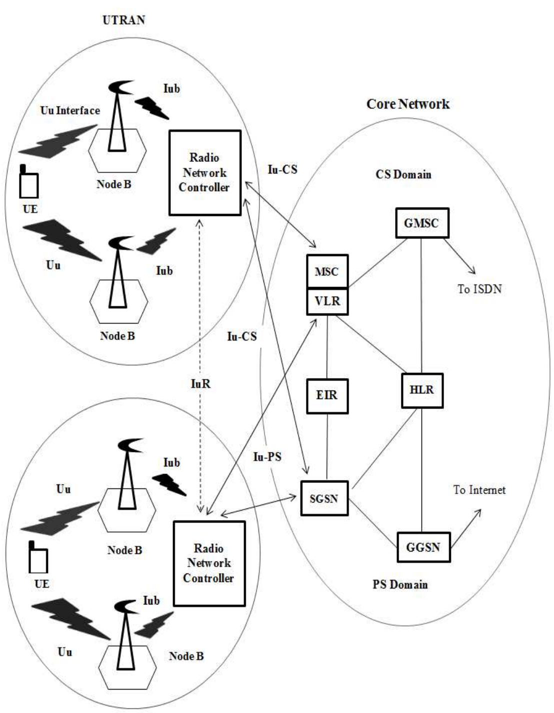

Figure 1: UMTS Network architecture

UMTS consists of UTRAN and CN. UE resides in the UTRAN and is connected to the Node B through WCDMA-Uu interface. Node B being a transceiver base station connects the UE to RNC through Iub Interface. The main task of Node B is to convert the data to and from the Uu and Iub radio interfaces and it manages the power control with in a cell by switching power from one directional antenna to the other as the UE moves around.

Radio Network Controller (RNC) connects the UE to the CN through Node B. It has full control over Node B and commands it accordingly. It is responsible for making handover decisions between the cells. It is also responsible for centralized operation and maintenance of Cells. The Circuit switched data (CS) and the Packet switched data (PS) coming from the Iu-CS and Iu-PS interfaces are multiplexed together for transmission of voice and data via different Iu Interfaces to the UE. Thus UTRAN is responsible for establishing the radio connections, its management and handling handover mechanisms etc. UTRAN is also referred to as Access stratum (AS).

Core Network (CN) on the other hand goes with switching and routing of radio signals. It consists of two domains namely: Circuit Switched (CS) domain and Packet switched (PS) domain. The CS services are handled by the Mobile Switching center (MSC) and Gateway MSC (GMSC). MSC connects to the radio network through Iu-CS Interface. The gateway MSC (GMSC) eventually connects to ISDN or PSTN. The PS services are handled by the Serving Gateway support node (SGSN). The Gateway SGSN (GGSN) connects to Internet. Different registers hold information about the User, the current position, mobility and hardware of the UE.

Conformance testing in this paper is primarily aimed at the UTRAN level and a considerable portion of CN. As mentioned before, conformance testing implicitly means protocol conformance testing and is aimed at checking the functionality of the protocol stack in the UE which is explained in the next section.

3. 3G PROTOCOL STACK IN THE UE:

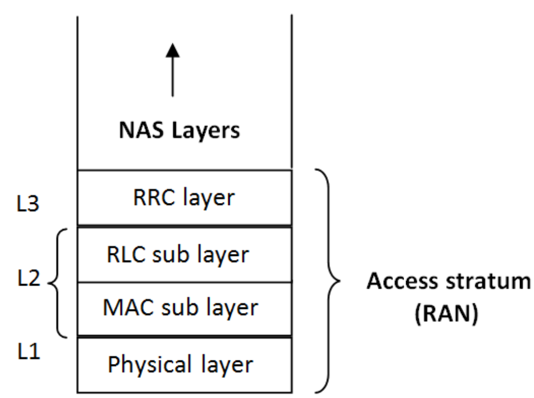

Figure 2: Protocol stack in user equipment

The 3G protocol stack can be largely viewed in to two categories. The first being the Access stratum (AS) or Radio Access Network (RAN) and second being the Non access stratum (NAS).

Layer 1 corresponds to the Physical layer which connects the UE to the Node B. It is the layer concerned with Cell searching, Spreading, Scrambling, Modulation and Power Control mechanisms. The layer 2 is classified in to two sub

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layers namely, Medium Access control (MAC) and the Radio link control (RLC).

The main function of MAC layer is to provide access to the Physical layer through transport channels and it connects to the higher layers through Logical channels thus mapping logical and transport channels. It does multiplexing of data, monitors the traffic and is responsible for Ciphering of voice data. MAC also does priority handling of data with its priority queues.

RLC is responsible for Segmentation and reassembly of data, Error detection and recovery. RLC Operates in three modes namely

1. Acknowledged Mode(AM)
2. Unacknowledged Mode(UM)
3. Transparent Mode(TM)

In the Acknowledged mode, SDUs after being segmented and concatenated in to PDUs, reach the other end of the network where they are decoded. An acknowledgment is expected once the PDU is decoded at the other end.

In Unacknowledged mode, no acknowledgement is expected by the RLC for the PDU it has sent to the end party.

In Transparent mode, Segmentation may or may not happen as it depends on the service.

Layer 2 also contains Packet data converge protocol (PDCP) and Broadcast Multicast protocol (BMC) in the User plane. PDCP is responsible for transmission and reception of Protocol Data units (PDU). BMC is responsible for offering the respective broadcast and multicast services in the user plane. The Access stratum of layer 3 consists of Radio Resource Control (RRC) which is the brain of the RAN. It allocates the Radio resources, does connection management which includes connection setup, release and maintenance besides monitoring these states. It also does Radio bearer management which includes its connection, maintenance and release. The Non Access Stratum of layer 3 goes with three procedures namely, Mobility Management (MM), Call Management (CM) and Session Management (SM).

MM is concerned with the tracking of UE and delivery of mobile services. Location update, Routing area update and roaming are the MM procedures which are discussed later. SM keeps the track of UE across sessions of interaction with the Network and is also concerned with the activation, deactivation and modification of PDP contexts. CM is all about managing the calls like establishment, maintenance and release.

4. SIMULATED NETWORK ENVIRONMENT

Testing is carried out in a simulated network environment rather than a in a live network due to the following reasons.

1. A Live network handles a larger throughput and is not ideal for carrying out testing.
2. A Live network is not flexible compared to a simulated network.
3. In a live network, the degree of interference will be more.
4. A live network is costlier, bulky and does not provide flexibility in carrying out testing activities.

Due to the above mentioned reasons, testing is carried out in a simulated network environment where the real network conditions are established. The system in which the network environment is simulated is called the System Simulator (SS) or Tester, which is provided by SS vendors The SS specifications vary for different vendors like a single box SS can contain 3-4 cells in it or an SS serving as a single cell. One such test bench is shown in the figure 3 where four system simulators each serving as a single cell are used. In a simulated environment, radio connection between the network and the UE is established through RF cables instead of open air interface so as to prevent radio interference

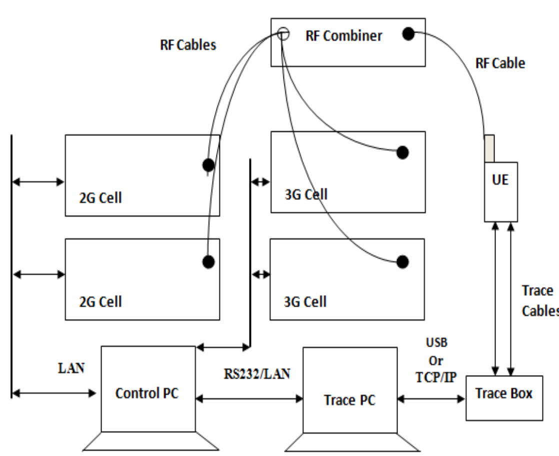

Figure 3: Test bench architecture

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The test bench consists of SS (Tester), UE, Control PC, Trace PC, RF cables, Trace cables, RF Combiners and suitable interfaces. As shown in the fig 3, two 2G cells and two 3G cells are combined by the RF Combiner and the combined RF is fed to the UE. The entire test scenarios defined in the TTCN scripts are run on control PC to invoke the testing process. Control PC is connected to all the testers, through a LAN connection, thus getting access to all the cells. The communication between the SS and UE happens through RF Cables

Trace tool connects the UE to the trace PC through an interface called Trace box. UE specific traces are enabled, captures and are saved as UE logs. It must be ensured prior to testing, that all the parameters are configured properly both in the UE and SS and that information is provided in PICS/PIXIT.

Protocol Implementation Conformance Statement (PICS) contain the information about what the UE supports. Protocol Implementation eXtra information for testing (PIXIT) contains the information needed to carry out testing. Both PICS and PIXITS on the whole are used to sync up UE and SS behavior.

4.1 Testing process:

The process begins with flashing the UE with the code developed for its Modem and processor. After the UE is flashed, the test bench is set up. UE is connected to the SS through RF cables and trace tool connects the UE to the test bench. Desired traces are activated by loading an appropriate Protocol XML file which captures them.

Automation tool is run on the trace PC where in the AT commands flowing from test cases trigger the UE to perform actions and the main purpose of automation environment is to automate all the User actions from the tester through AT commands.

The test case suite which consists of hundreds of test cases belonging to different features and scenarios is present on the control PC. A suitable application on control PC invokes the testing process. The test cases are selected with respect to the UEs capability and the requirement. If the UE supports Release 7 feature, then test cases which come under release 7 are executed besides other basic test cases, the execution of which qualifies the UE.

PICS and PIXIT parameters are set on the control PC to synchronize the UE and SS behaviors. The test bench is now checked for its stability w.r.t power levels by running test cases which provide the power levels of the cells in the SS Once the test bench is stable, the testing of different features and scenarios are carried out. The testing process is shown in the figure 4.

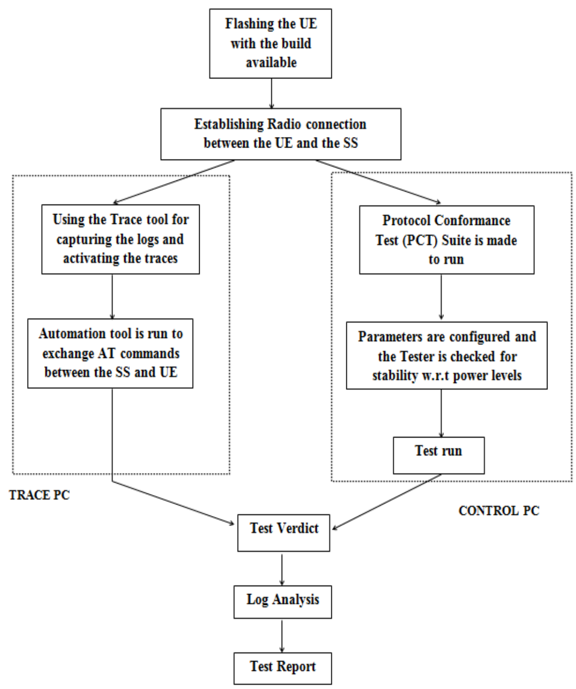

Figure 4: Flow diagram of testing process

5. TEST PROCEDURES, SCENARIOS AND FEATURES:

Conformance testing in 3G is achieved by running different features and scenarios on the UE.

5.1 Registration procedures:

To avail services from the network, UE must register its SIM (Subscriber Identity Module) with the network. Registration procedures are basically classified in to CS and PS for availing voice and data services respectively. CS registration goes with Location update and PS registration goes with GPRS attach as explained below sections.

To verify the registration procedures, any test case can be run as it involves the basic registration module to register to the network.

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5.1.1 CS Registration procedure:

To avail CS services from the network, UE must register its SIM (Subscriber Identity Module) with the network. When the UE wakes up, it is said to be in the IDLE mode hearing to the broadcast information from the cell. Initially UE looks for the signal (strong or weak), camps on to the very 1st signal available to it, called suitable cell- which may not be the best cell. Later it will do cell reselection if stronger cells are available, after it has camped on. Now to connect to the RNC, it sends RRC Connection request. RNC responds to UE saying RRC Connection setup. UE responds with RRC Connection setup complete. UE is now said to be in the connected mode. After establishing the RRC Connection, UE does location update (Location area LA is a group of cells and when UE moves from one cell to the other, it performs Location update) via Initial Direct Transfer (IDT) signaling message to inform the CN about its current location. CN responds through Signaling message down link direct transfer (DDT) asking for SIM authentication. Once the SIM is authenticated, location update request is accepted by the CN. Now the UE is said to have registered to the SS and can avail CS service. This process is explained in the below figure 5.

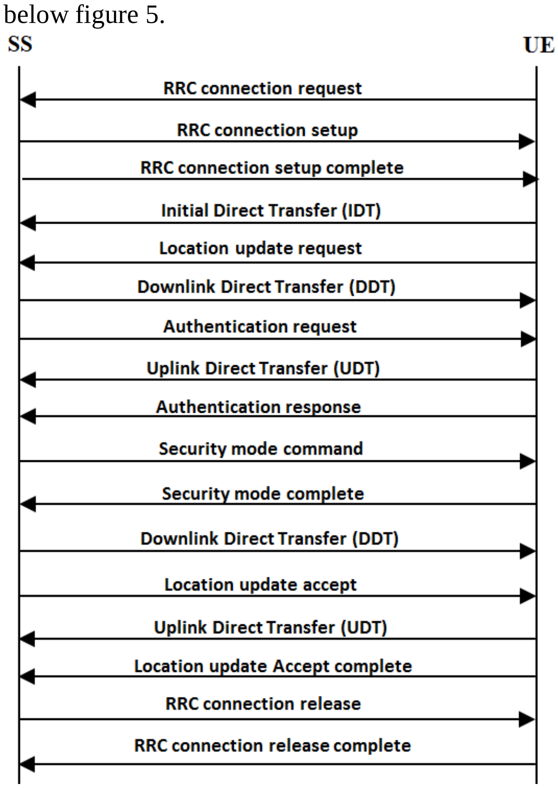

Figure 5: CS registration procedure

5.1.2 PS registration procedure:

To avail GPRS (PS) services, UE must perform GPRS attach with the SS. Since Packets take different routes, they must be ciphered in order to prevent hacking. As shown in fig, after the RRC Connection establishment, UE sends Attach request and SS responds to UE asking for Authentication and Ciphering. A ciphering is key present on the SIM is reported to SS by the UE. After getting authentication and ciphering response, Attach is done by the SS. PS Registration is explained in the below figure 6.

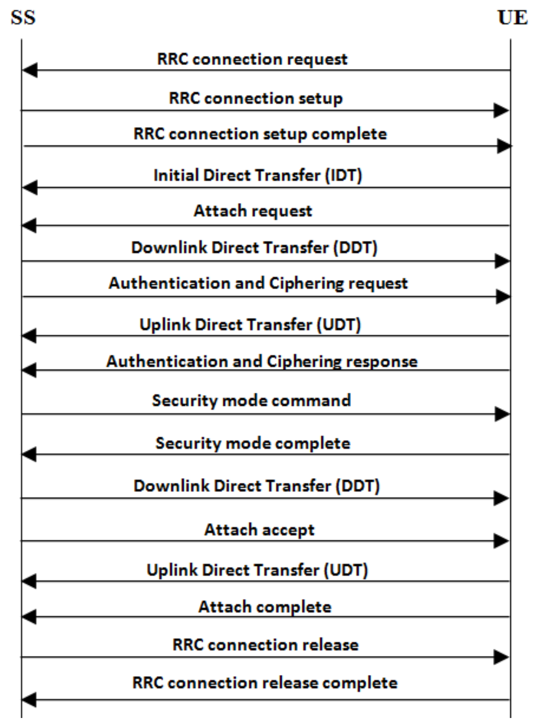

Figure 6: PS Registration procedure

5.1.3 PDP context:

To avail GPRS services, UE has to do attach and initiate PDP context activation. PDP refers to packet data protocol. PDP context is a session management procedure aimed at having a data session with the external packet data networks (PDN) like Internet, X.25 Frame relays etc. SGSN and GGSN play an important role in this aspect. To have a data session with the PDNs, UE must be provided the corresponding address of the data network it has communicate with. After GPRS Attach procedure, UE initiates Activate PDP context by passing the Access point name (APN) as the parameter which is provided by the network and

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the SGSN receives it. SGSN then comes up with the GGSN address (Corresponding to APN value) to which the Create PDP Context request is routed. GGSN finds the IP address of PDN from the DHCP Server (Dynamic host configuration protocol) and sends it to the UE thus activating the PDP context. Now UE can have a data session with the data networks. PDP context deactivation is done once the UE is done with the data session.

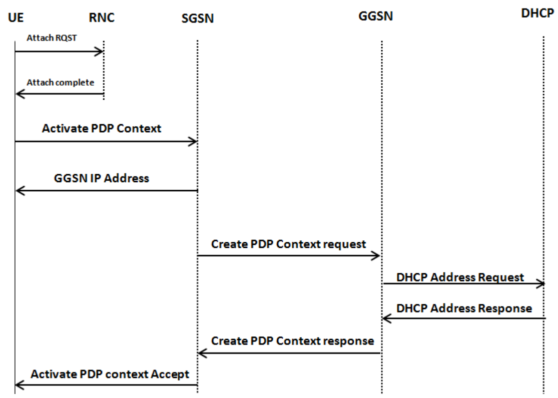

Figure 7: PDP Context activation

5.2 Hand over scenarios:

Handover is a mechanism performed by the UE when it moves from one cell to the other. This mechanism helps UE to continue its activities without any interruption. Basically there are two types of handovers namely Hard Handover (HHO) and Soft Handover (SHO). HHO is one in which the existing radio links are removed before the new links are established. This is called Break before make. SHO is one in which the old links are retained till the new links are added. This is called Make before break.

Hand over happens only when UE is either in connected mode or in Cell_DCH. If the UE is in Cell_FACH and Cell_PCH, Cell update is done and when it is URA_PCH, URA update is done. When UE is in idle mode and moves from one cell to the other, either Location area update or Routing area update is done.

5.2.1 Conformance of Handover scenario:

3GPP Test case 8.3.7.4 *is used to test that the UE handovers to the indicated channel in the GSM target cell when it is in the call establishment phase in the UTRAN serving cell and receives an Inter system handover command from the SS.*

As shown in the Fig 8, after attach is done, UE request for RRC connection to setup a conversational call. After RRC connection setup and security mode complete procedures, UE requests for Connection Management (CM) service seeking Mobile Originating call establishment. UE then makes a MO (Mobile originating) call to SS. SS configures a dedicated channel in the GSM cell. Now SS asks UE to make a handover from UTRAN to GSM cell by issuing Handover from UTRAN command to GSM. The handover command PDU consists of Cell Description, power commands and access type, synchronization indication and ciphering mode settings. UE then configures itself and successfully makes a handover to the prescribed cell and sends Handover success message to SS.

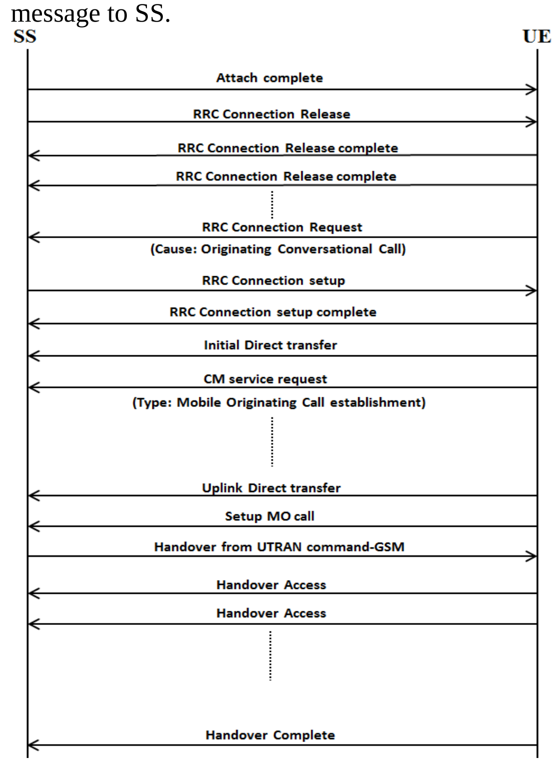

Figure 8: Handover conformance

UMTS progresses through various releases like Release'99, Release 4, Release 5, Release 6, Release 7 and Release 8. Every release comes up with new features, few of which are explained below along with their conformance practices

5.3 Continuous Packet Connectivity (CPC)

CPC refers to Continuous Packet Connectivity. This feature could be explained with the following real time example. There are situations where the user opens different web pages but is actively

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involved with one page. In such situation, data keeps flowing in to the UE though the user is actively surfing through one web page. This result in continuous transmission of control signals which consumes the battery power a lot. CPC ensures that the transmission of control signals occur discontinuously if the user is inactive and happens continuously, if the user is active. This is achieved by making use of inactivity timers, the value of which is set by the higher layers. After a webpage is left idle, inactivity timer starts there by making the transmission of control signals discontinuous. After the timer is run out, the control signal transmission would be at a still smaller rate. If the user switches to the idle page, then the control signals will be transmitted continuously as it finds the data on the data channels.

Technically speaking, in the earlier releases, the control channels happened to be active all the time even when the user was inactive, which resulted in high noise (Interference from the active users) and also resulted in the low battery life of the UE. To resolve all these problems CPC came in to lime light with the following features:

1. Discontinuous transmission in the uplink (UL-DTX)
2. Discontinuous Reception in the downlink (DL-DRX)

5.3.1 UL-DTX:

Discontinuous transmission in the uplink is achieved by transmitting U-DPCCH (Uplink Dedicated Physical control channel) control signals discontinuously in two patterns or cycles. In the first pattern, U-DPCCH control signals will be sent in cycles of smaller length following the activation of inactivity timer. Once the timer expires, U-DPCCH will be transmitted at very smaller rate in the cycle 2 which are of longer durations as shown in figure 9.

Before the discontinuous transmission is started, delay is introduced to ensure that both the UE and SS are in Sync with each other. After the delay, the inactivity timer starts and short cycles of UDPCCH are transmitted. This is Cycle1which goes with transmission of U-DPCCH in a short interval with monitoring the data on E-DCH. Once the inactivity threshold timer expires, it moves to cycle 2 with longer periods of inactivity. Cycle2 to Cycle1 transition happens once the data is seen on the E-DCH. If the data is further not found on E-DCH, the threshold timer starts again monitoring the data. Once the threshold timer expires, it moves to cycle 2. The transition happens once the data is found or else it continues to be in the same cycle. The control signals are transmitted continuously once the continuous data is found on E-DCH. This reduces the uplink interference and also saves the battery life of the UE as the channel is not continuously active. Thus UL-DTX saves the battery power by switching off its transmitter circuit when there is nothing to send in the uplink.
The values of cycle 1 and cycle 2 are set by the higher layers which can be seen in the section 5.3.3.

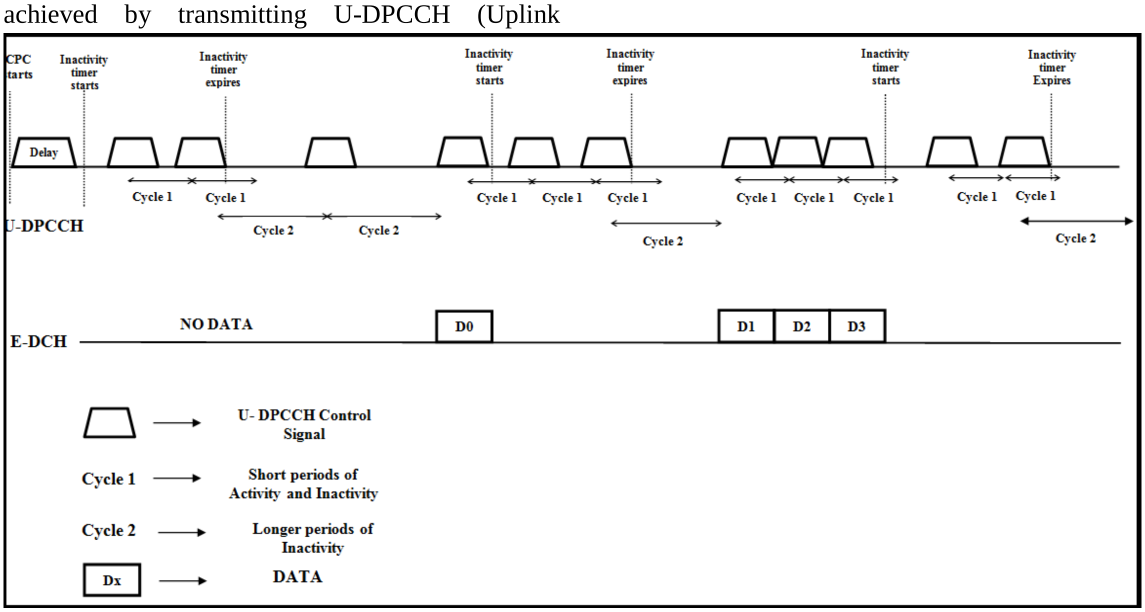

Figure 9: Discontinuous transmission in the uplink

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5.3.2 DL-DRX:

Discontinuous reception in the downlink is achieved by configuring the UE with the DRX cycles so that the UE can hear to the downlink channels like HS-SCCH (High speed Shared control channel) at certain instants of time.

The DRX cycle should be an integer multiple of the DTX cycle as both the uplink and downlink are interdependent. DRX helps in saving the battery power to a great extent when there is nothing to be received in the downlink.

5.3.3 Conformance of CPC:

This feature can be verified by running ***3GPP test case 8.1.2.19*** *which is used to confirm that the UE establishes a signaling Radio bearer mapped to HS-DSCH and E-DCH, with the Discontinuous transmission (DTX) and Reception (DRX) according to the received RRC Connection setup message from the SS.*

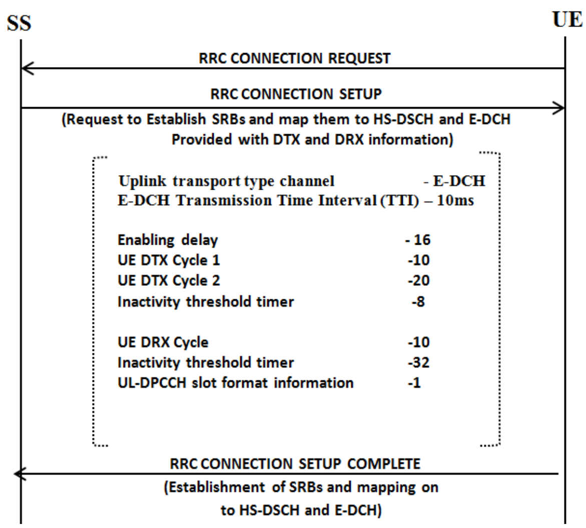

Figure 10: Conformance of CPC

In this, UE initiates an RRC connection request to connect to SS and SS sends an RRC Connection setup message requesting UE to establish Signaling Radio Bearers (SRBs) and also requesting UE to map SRBs to HS-DSCH and E-DCH channels. SS also provides DTX and DRX information in setup message.

UE establishes SRBs (radio bearers that carry DCCH signaling messages) and map them on to HS-DSCH which is DRX enabled and E-DCH which is DTX enabled. After configuring the above parameters, UE sends an RRC Connection setup complete message to SS. Fig 10 shows the parameters that are given by the SS during RRC connection setup message where in E-DCH is identified as uplink transport channel with a TTI of 10ms. Delay of 10 is provided to synchronize UE and SS.

UE_DTX_Cycle1 has a short period of 10 and UE_DTX_Cycle2 has longer periods of inactivity say 20. The inactivity threshold timer expires at 8 moving in to cycle2. Based on all the above parameters, SS checks to see whether UE is in has configured itself to the CPC.

5.4 Flexi L2 Downlink:

In the earlier releases of UMTS, the RLC PDU size was kept small and fixed as the MAC layer was not able to segment the larger SDUs in to smaller payloads. Hence the RLC PDUs were kept small enough to be encapsulated in to smaller payloads. The increasing data rates of the UMTS in the later releases like Rel'7 demanded the usage of large size RLC PDUs as it would increase the peak data rates. MAC layer was also enhanced to MAC-ehs with improved multiplexing capabilities. Larger RLC PDUs were segmented and encapsulated in to smaller payloads; the loss of which would demand the retransmission of the entire RLC PDU resulting in increased RTT as well as introducing delays and noise in the transmission. To overcome this, the use of Dynamic RLC PDUs was adopted by the RNC. This requires that UE is configured to MAC-ehs as well as Flexible RLC Downlink.

5.4.1 Conformance of FLEXI L2 Downlink:

Conformance here ensures that UE is configured with respect to MAC and RLC layers so as to download the flexible RLC PDUs.

3GPP test case 7.1.5a.1 *is aimed at confirming the UEs capability of handling multiple logic channel mapped to the same MAC-ehs.*

SS sends Radio bearer setup message to UE asking for the establishment of Radio bearers besides providing information about the priorities of logical channels at MAC level, the window size of MAC-ehs to be configured by the UE, the power levels and the downlink shared channels. The downlink MAC header which comes to UE is set as MAC-ehs. UE configures itself and establishes the

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radio bearers. SS now puts the UE in to close UE test loop in order to test the characteristics of the UE. UE responds saying Close UE test loop complete. Now SS sends the PDUs to UE, where in UE receives the PDUs, de-multiplexes it and maps on to the correct logical channels as indicated in the Logical channel Identifiers and the data is looped back to SS. This procedure continues till UE is put in to Open test loop by the SS where in UE comes out of the loop in to normal mode.

MAC-ehs PDU sent by the SS has three SDUs each assigned to three radio bearers established by the UE. The SDUs are routed to the correct logical channels based on Logical channel Identity (LCH-ID). After the MAC-ehs SDUs are de-multiplexed successfully, they are looped back to SS, where the SS checks whether the LCH-IDs are correct. This scenario is used to verify whether the SDUs are routed to the correct logical channels in the UE. This concept is explained in the below figure 11.

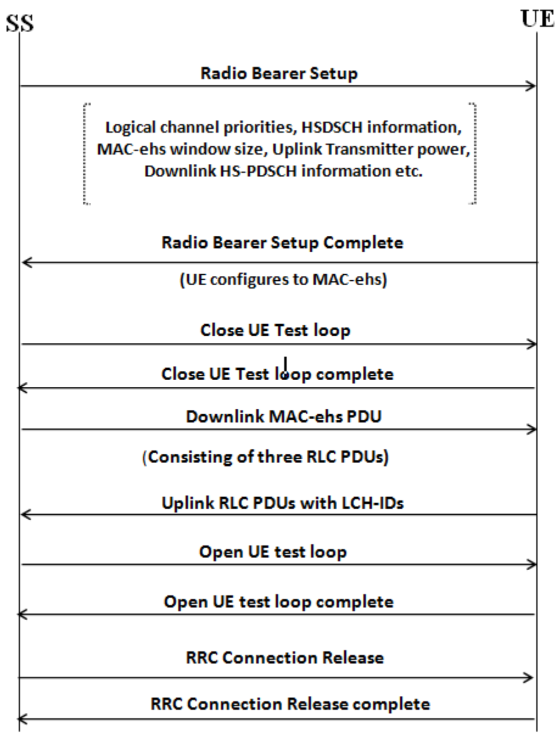

Figure11: Conformance of MAC-ehs

3GPP Test case 7.2.2.14 *is used to test that a large SDU is correctly received for varying RLC PDU sizes up to the maximum RLC PDU size and also to* deliver the correctly reassembled SDUs to the higher layers

In this scenario, UE is supposed to do two tasks as mentioned below.

1. UE has to receive a large SDU in an RLC PDU which is dynamic in size.
2. UE has to reassemble the SDUs correctly and deliver it to the higher layers.

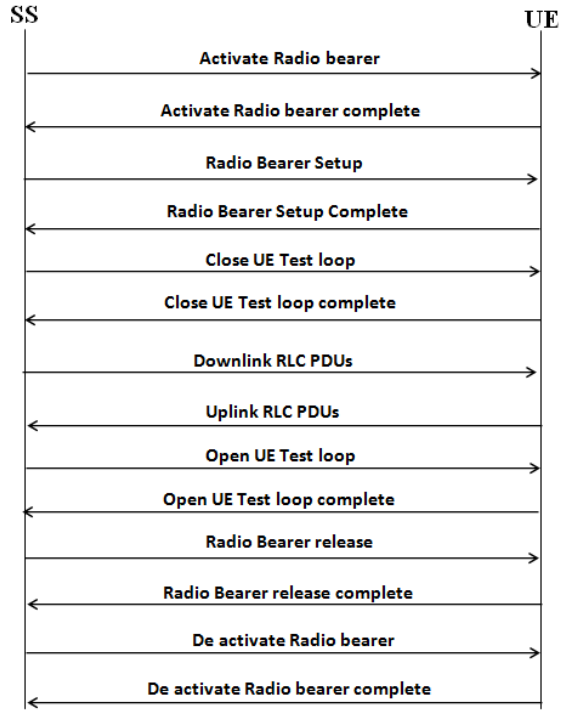

Fig 12: Conformance of Flexible RLC PDUs.

To get the UE in to test mode, Activate Radio bearer is transmitted by the SS. UE responds saying Activate radio bearer setup complete after which UE does the following

1. UE can set up the radio bearers based on its radio access capabilities if it is been asked to do.
2. All the radio bearers belonging to user plane will be terminated by the UE in its test loop function.
3. UE would disable all those mechanisms in the NAS layers which would try to release the radio channels.

In order to realize the two tasks, UE is put in to test mode by the SS. SS keeps sending SDUs in a RLC PDU of varying sizes to the UE and UE decodes it and sends back to the SS thus realizing the first task.

Once UE decodes and forwards the entire variable RLC PDUs, UE is asked to process the data by the SS instead of forwarding them to SS. Once UE decodes and processes the data, UE comes out of

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the test loop and sends open UE test loop complete to SS. This accomplishes the second task. After SS is satisfied with the UEs performance, Radio bearers are released and are deactivated to get UE out of the test mode. It is explained in the figure 12.

5.5 64QAM downlink:

It is a higher order modulation scheme aimed at higher data rates in the order of 21Mbps. It is being used as the downlink modulation mechanism with QPSK in the uplink. Not all the UEs support 64QAM. It is configured in the UEs which are aimed at higher data rates. 64QAM comes in to picture at the physical layer and hence conformance testing imposed at this layer ensures that the UE has the capability to receive bits at such a higher rate.

5.5.1 Conformance of 64QAM:

The following are the parameters to be set for supporting 64QAM feature in the UE.

Discontinuous transmission DTX is set TRUE
Discontinuous reception DRX is set TRUE
HS-DSCH Category is set to 14 to achieve a data rate of 21Mbps in the downlink
HSUPA category is set to 6 to achieve a data rate of 5.8 Mbps in the Uplink

64QAM feature can be verified by means of ***3GPP test case 8.2.2.63*** *which activates and deactivates the 64QAM feature up on receiving the Radio bearer reconfiguration message.*

After the registration procedure, SS sends Radio Bearer configuration to UE. It includes a TRUE value of DL_64QAM which is essential for activating the 64QAM feature in the UE. After receiving the information from the SS, UE configures itself for the 64QAM feature and notifies it to SS through Radio bearer reconfiguration complete. SS queries the UE for 64QAM configuration through UE capability information and UE answers it with UE capability confirm message. SS acknowledges the UE with UE capability information confirm. To deactivate the 64QAM DL feature, SS sends Radio bearer reconfiguration with no value set for DL_64QAM and UE reconfigures its parameters based on this. UE sends Radio bearer reconfiguration complete to the SS. UE capability enquiry is sent by SS and UE responds saying UE capability information. After SS is aware of the deactivation of 64QAM in UE, it releases the channels. It is shown in figure 13.

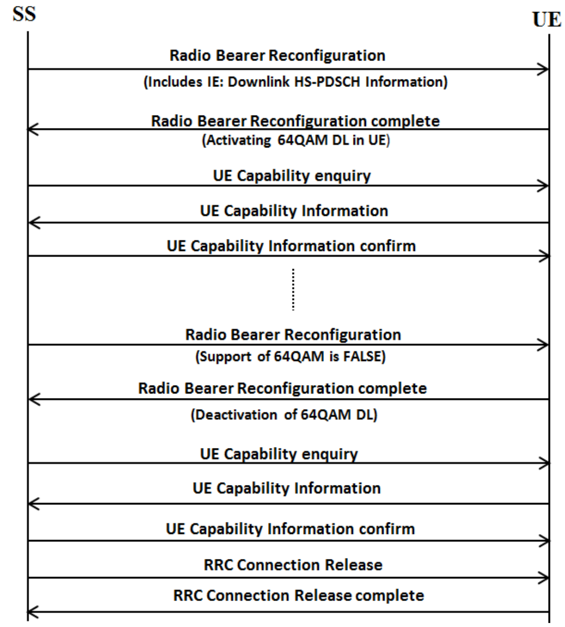

Fig 13: Conformance of 64QAM feature

6. RESULTS:

After the tests are run, the result is checked for the following three verdicts Pass, Fail and Inconclusive.

PASS signifies that the test case ran smoothly with every procedure defined in it meeting the objective and that the test case conforms to the standards proposed.

FAIL signifies that the test case could not achieve its objective and hence does not conform to the standards.

INCONCLUSIVE notifies that the test case objective was not achieved because of various factors and once these are fixed; there is a possibility for the test case getting passed. After the verdict, analysis is made by looking in to the logs to find out where the test case has gone wrong and the final report is drafted.

7. CONCLUSION:

Thus conformance testing helps in verifying the functionality of UE with respect to various features and helps in qualifying the UE. Regression testing can be carried out to gain more reliance about a particular feature as this would make a UE more stable and reliable. Conformance thus plays a significant role in the mobile industry where it helps in bringing out the UE to the real world.

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ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

ACKNOWLEDGMENT:

Author wishes to acknowledge Dr.P.Swaminathan, The Dean, School of Computing and is thankful to TIFAC-CORE at SASTRA University for the time and support.

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