



1.1.1.1.1 AMANTYA TECHNOLOGIES

Doc. No : AMANTYA-v1.0

Release Date: 01-10-20

NBLoT Agnostic ACP User Manual

Page 1 of 23

NBLoT AGNOSTIC ACP

User manual

	1.1.1.1.1 AMANTYA TECHNOLOGIES	Doc. No : AMANTYA-v1.0 Release Date: 01-10-20
	NBloT Agnostic ACP User Manual	Page 2 of 23

Contents

1	About This Document	5
1.1.	Introduction	5
1.2.	Purpose and scope	5
1.3.	Audience	5
1.4.	Abbreviation	5
1.5.	References	6
2	Architecture	7
3	Tuning eNodeB hardware	8
3.1	Static IP assign	8
3.2	NBloT eNodeB Power Up	9
3.2.1	Power up	9
3.2.2	Ethernet connection	9
3.2.3	UI based login	9
3.2.4	SSH Login	9
3.3	Device Provision	10
3.3.1	Enable eNodeB binaries start at reboot/power-up	10
3.3.2	Support for ftcmd command	10
3.3.3	Support for delayed reboot	10
4	Warnings for handling eNodeB	12
5	Test Case execution	13
5.1	Test execution	13
5.1.1	Test execution with ACP <TBD>	13
5.1.2	Test execution without ACP	13
5.2	System Adapter	16
6	eNodeB and VZW_SA_Agent	18
7	Compilation of source code	20
7.1	TE compilation steps	20
7.2	VZW System Adapter Agent compilation steps	22
7.3	System Adapter compilation steps	23



1.1.1.1.1 AMANTYA TECHNOLOGIES

Doc. No : AMANTYA-v1.0

Release Date: 01-10-20

NBloT Agnostic ACP User Manual

Page 3 of 23

	1.1.1.1.1 AMANTYA TECHNOLOGIES	Doc. No : AMANTYA-v1.0 Release Date: 01-10-20
	NBLoT Agnostic ACP User Manual	Page 4 of 23

Document Version History

Version Number	Version Date	Revised By	Description
V1.0	01-10-2020	Vikas Dubey	User Manual for Test Executor and NBLoT eNodeB setup.
V1.1	16-10-2020	Vikas Dubey	Compilation steps for TE, SA, VZW_SA_Agent added



1 About This Document

1.1. Introduction

Amantya supports Verizon in developing an NBloT device tester product based on the 3GPP 36.523-3 and 3GPP 36.523-1 UE conformance testing specifications. This product is used for end of the line UE testing by Verizon. The product consists of necessary customizations in the Verizon ACP product along with integration of NBloT L1, L2 stack, 3GPP 36.523-3 TTCN-3 scripts, to verify conformance of commercial handsets.

1.2. Purpose and scope

This document will help in setup of ACP NBloT test platform for certification of UE by Verizon. It covers setup of Test execution environment on Windows Desktop/laptop (Test Executor, System Adapter) and NBIOT System Simulator (VZW System Adapter Agent, NBloT L1,L2 Stack).Verizon IMSLess-DR test cases will be executed and response captured by Test Executor on Windows System.

1.3. Audience

Amantya assumes the readers of this document are:

- Product development team
- Test or Validation team
- Verizon ACP Team

1.4. Abbreviation

Table 1: Definitions

Abbreviation	Expansion
3GPP	3 rd Generation Partnership Program
ANSI	American National Standards Institute
AT / MMI	Attention / Man-Machine-Interface
DRB	Dedicated Radio Bearer
DUT	Device Under Test
IMS	IP Multimedia Subsystem
SA	System Adaptor
SYS	System



1.1.1.1.1 AMANTYA TECHNOLOGIES

Doc. No : AMANTYA-v1.0

Release Date: 01-10-20

NBloT Agnostic ACP User Manual

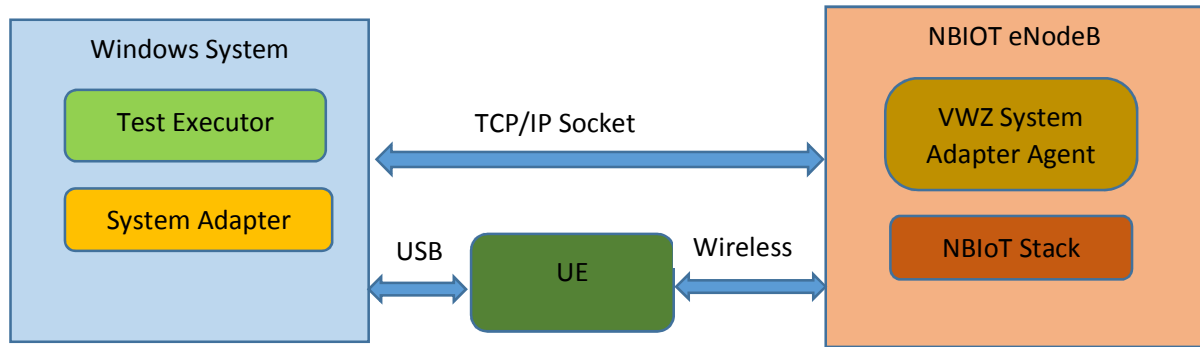
Page 6 of 23

Abbreviation	Expansion
SRB	Signaling Radio Bearer
eNB /eNB	eNodeB
TCI	TTCN-3 Control Interface
TRI	TTCN-3 Runtime Interface
TE	Test Executor/Engine
TMWC	Test Manger Web Client
TMWS	Test Manager Web Server
TM	Test Management
TL	Test Logging
TRI	TTCN-3 Run time Interface
TTCN	Testing and Test Control Notation
UE	User Equipment
VZW	Verizon Wireless

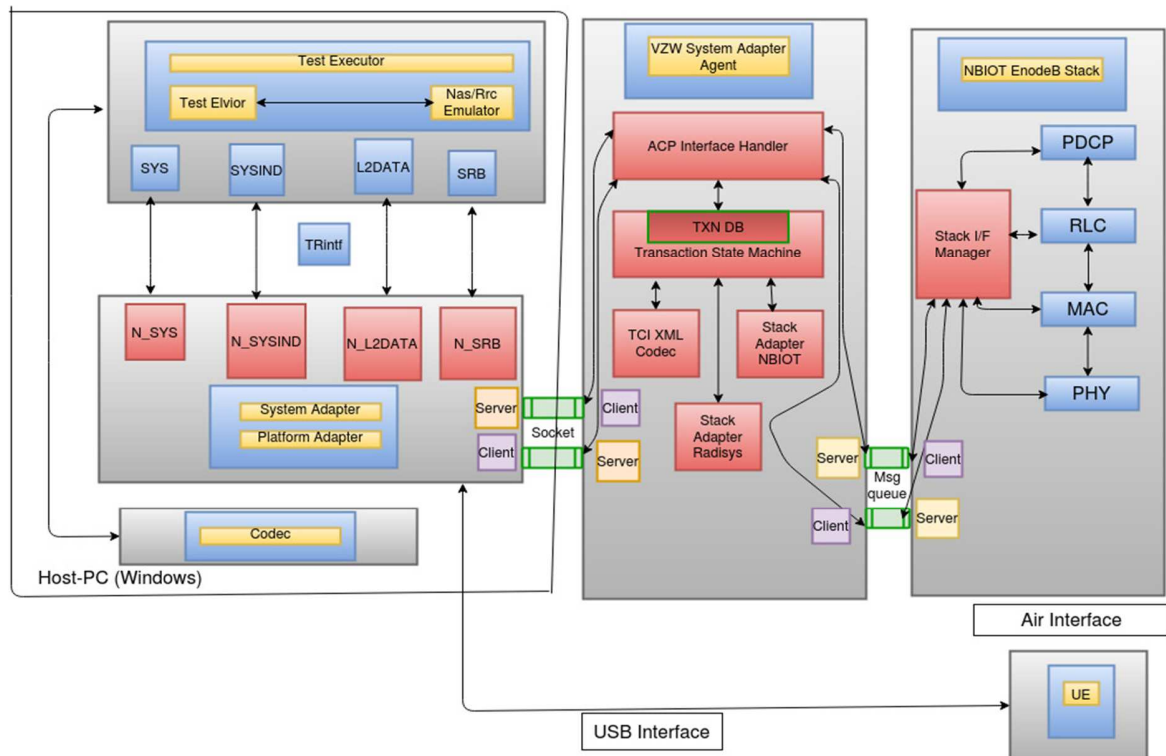
1.5. References

2 Architecture

Block View:



Detail View:



4. Reboot system.

3.2 NBLoT eNodeB Power Up

3.2.1 Power up

To power up the Board, connect power Adapter as shown below. There is a push button with power symbol. Push it to Power ON the eNodeB NBIOT board. On Power Up, Blue LED will continuously glow. To Shutdown, long press the power button. Orange LED will blink to denote RF messages transfer.



3.2.2 Ethernet connection

There is Port for Ethernet connection on back of eNodeB NBIOT Board. Static IP can be assigned as given in section 3. By default Static IP will be 192.168.2.51.



3.2.3 UI based login

UI based login is possible by connecting, monitor, key board and mouse.

1. Power Adapter connection is shown in Orange box.
2. Ethernet connection is shown in Green Box.
3. Monitor (over HDMI), Key board (over USB), Mouse (over USB) connection shown in Red box.
4. Login user: **user**, password: **root123**



3.2.4 SSH Login

After Ethernet connection, static IP assign, connect to router with gateway 192.168.2.1, ssh can be done from remote computer on eNodeB Board as: **ssh root@192.168.2.51**

Password: root123

	1.1.1.1.1 AMANTYA TECHNOLOGIES	Doc. No : AMANTYA-v1.0 Release Date: 01-10-20
	NBIoT Agnostic ACP User Manual	Page 10 of 23

3.3 Device Provision

3.3.1 Enable eNodeB binaries start at reboot/power-up

1. Login in the enodeb hardware using ssh, user-id: root and password:root123
#ssh root@192.168.2.51
2. Edit **/etc/rc.local** and add **sh /opt/NBIOT/start_binary.sh**

```
# /bin/sh -e
#
# rc.local
#
# This script is executed at the end of each multiuser runlevel.
# Make sure that the script will "exit 0" on success or any other
# value on error.
#
# In order to enable or disable this script just change the execution
# bits.
#
# By default this script does nothing.
sh /opt/NBIOT/start_binary.sh
exit 0

"/etc/rc.local" 14L, 335C
```

3.3.2 Support for ftcmd command

1. Login in the enodeb hardware using ssh command, user id; root and password:root123
#ssh root@192.168.2.51
2. Copy the platform_details.sh to enodeb hardware using scp command.
#scp platform_details.sh root@192.168.2.51:/opt/NBIOT/



platform_details.sh

3. run in enodeb terminal **#ln -s /opt/NBIOT/platform_details.sh /usr/bin/ftcmd**

3.3.3 Support for delayed reboot

1. Login in the enodeb hardware using ssh command, user id; root and password:root123
#ssh root@192.168.2.51
2. Copy the stack_reboot.sh to enodeb hardware using scp command.
#scp stack_reboot.sh root@192.168.2.51:/opt/NBIOT/



stack_reboot.sh

	1.1.1.1.1 AMANTYA TECHNOLOGIES	Doc. No : AMANTYA-v1.0 Release Date: 01-10-20
	NBIoT Agnostic ACP User Manual	Page 11 of 23

3. run in enodeb terminal **# ln -s /opt/NBIOT/stack_reboot.sh /usr/bin/reboot**

	1.1.1.1.1 AMANTYA TECHNOLOGIES	Doc. No : AMANTYA-v1.0 Release Date: 01-10-20
	NBLoT Agnostic ACP User Manual	Page 12 of 23

4 Warnings for handling eNodeB

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user authority to operate the equipment.

1. To comply with FCC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

2. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter this equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ◆ Reorient or relocate the receiving antenna.
- ◆ Increase the separation between the equipment and receiver.
- ◆ Connect the equipment into an outlet on a circuit different from that to which the receiver is needed.
- ◆ Consult the dealer or an experienced radio/TV technician for help.

5 Test Case execution

5.1 Test execution

Note: Below is sequence of execution of test setup.

1. Run System simulation binaries (VZW_SA_Agent and NBloT eNodeB L1L2 stack).
2. Test Cast tool setup with TTCN project
3. Run test case from Test Cast
4. Run System Adapter

5.1.1 Test execution with ACP <TBD>

5.1.2 Test execution without ACP

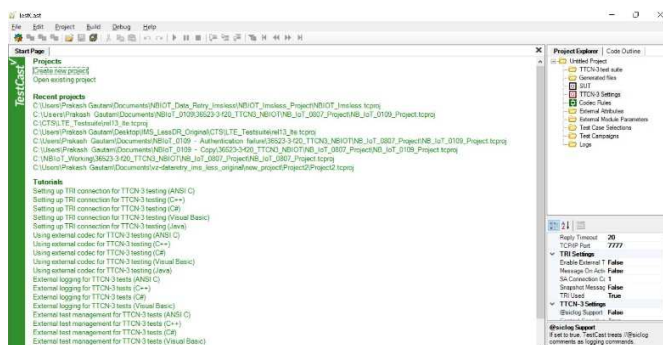
TTCN3 is a third-party software provided by Elvior. Test cast software is basically a TTCN3 script execution tool. It provides following functionality:

- It includes all the UE conformance test cases as specified by 3GPP
- It provides NAS and RRC codecs to support the Test cases
- It controls the UE using AT Command and ADB command
- It configures and bring the eNodeB up
- It provides the functionality of RRC Layer and NAS Layer emulation using the codecs as mentioned above
- It supports impairment for RRC and NAS messages to handle negative scenarios as mentioned in Test case
- Test Cast software sends and receives all messages in TCI-XML format

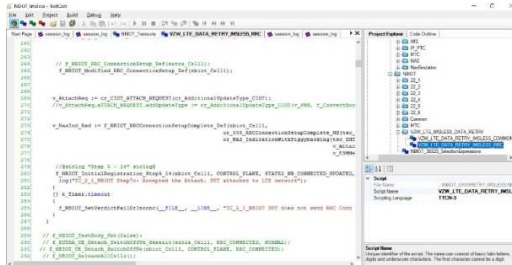
When a Test case execution is requested, Test Cast starts cell bring up procedure as per the precondition mentioned in Test case. Once the cell is up it starts test case execution and on completion it provides the verdict.

Test case execution steps:

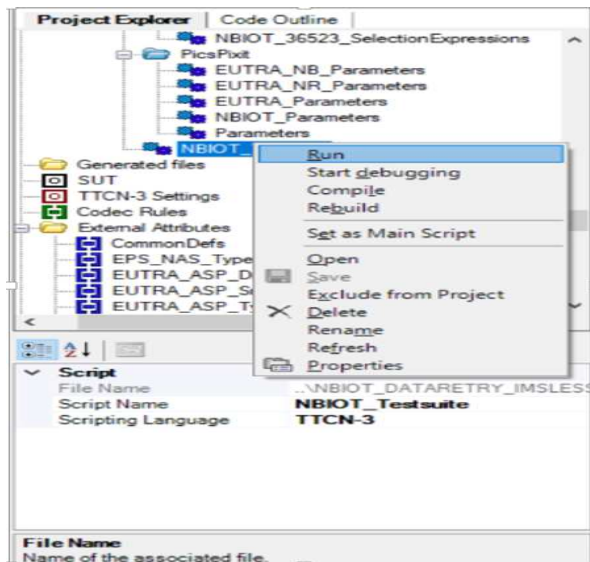
1. Open Test Cast tool



2. Select project from list of projects above.



3. Run Test case



- Test execution produces a test log that is visible in the ttcn3_log pane. The session log contains all information of test and gives complete flow of execution and provides info whether the test has been successful or failed.

5.2 System Adapter

System Adaptor (SA) module is mainly responsible for routing the UE control messages, eNodeB signalling messages and configuration messages.

1. System Adapter binary will be placed under

C:/ACP/SA_EXE/hw_v4

Local Disk (C:) > ACP_NB

Name	Date modified	Type	Size
SA_EXE	29-09-2020 17:29	File folder	
tmBin	30-09-2020 13:17	File folder	

Name	Date modified	Type	Size
sa_adb_command.cfg	19-12-2019 12:18	CFG File	2 KB
sa_at_at_command.cfg	19-12-2019 12:18	CFG File	1 KB
sa_mmi_at_command.cfg	19-12-2019 12:18	CFG File	2 KB
saConfig.cfg	01-10-2020 10:12	CFG File	2 KB
saConfig.cfg~	07-09-2020 10:00	CFG~ File	2 KB
start_iperf_host.bat	19-12-2019 12:18	Windows Batch File	2 KB
start_iperf_ue.bat	19-12-2019 12:18	Windows Batch File	1 KB
startAdapter.bat	18-09-2020 10:23	Windows Batch File	1 KB
startFtpServer.bat	19-12-2019 12:18	Windows Batch File	1 KB
StartStop_NAT_expect.exp	19-12-2019 12:18	Exports Library File	1 KB
StartStop_NAT_Server.bat	19-12-2019 12:18	Windows Batch File	1 KB
stop_iperf_ue.bat	19-12-2019 12:18	Windows Batch File	1 KB
stopFtpServer.bat	19-12-2019 12:18	Windows Batch File	1 KB
SystemAdapter.exe	17-09-2020 17:58	Application	1,478 KB
SystemAdapter.pdb	20-07-2020 23:02	Program Debug Data...	10,524 KB

Update SaConfig.cfg in C:/ACP/SA_EXE, for below parameters

- a. SELF_IP: IP of the Windows system(192.168.2.210)
- b. COMPORT: Comport on which UE/Testing device will connect.
- c. ENB_SSAP: IP of the NBloT eNodeB System (192.168.2.51)

```

1 //!< SA CONFIGURATION DATA FILE
2 //!<
3 //!< SA reads this file at startup to configure itself.
4
5 //!< *****
6 //!< IP and port
7 //!< TE_IP --> IP address of the test cast, where test executor is running
8 //!<
9 //!< COMPORT --> COMPORT of the UE connected to the system (Ex: 49)
10 //!< ENB_SSAP_IP --> Tenb SSAP IP address
11 //!< ENB_SSAP_PORT --> Tenb SSAP port information
12 //!< NUMBER_OF_AT_CMD_ATTEMPTS --> no of time the SA has to try sending AT command to UE
13 TE_IP=127.0.0.1
14 TE_PORT=41365
15 SELF_IP=192.168.2.205
16 SA_APP=VERIZON_SYSTEM_ADAPTER
17 MODE=ONLINE
18 BAUDRATE=115200
19 COMPORT=4
20 ENB_SSAP_IP=192.168.2.51
21 ENB_SSAP_PORT=41365
22 ENB_SSAP_IP=NONE
23 ENB_SSAP_PORT=41365
24 ENB_SSAP_IP=NONE
25 ENB_SSAP_PORT=41365
26 ENB_SSAP_IP=NONE
27 ENB_SSAP_PORT=41365
28
29 NUMBER_OF_AT_CMD_ATTEMPTS=5
30 UE_IPV4_ADDR_FDN_1=192.169.2.226
31 UE_IPV6_ADDR_FDN_1=5546:222:2259::226
32 UE_IPV4_ADDR_FDN_2=192.168.2.227
33 UE_IPV6_ADDR_FDN_2=5546:222:2259::227
34
35 HM_IP=127.0.0.1
36 HM_PORT=55543
37 ADB_COMMAND=TRUE
38 NUM_OF_RTPG=4
39 RTPG_IPV4_1=192.168.2.213
40 RTPG_IPV6_1=5546:222:2259::213
  
```

2. Launch System Adapter



1.1.1.1.1 AMANTYA TECHNOLOGIES

NBLoT Agnostic ACP User Manual

Doc. No : AMANTYA-v1.0

Release Date: 01-10-20

Page 17 of 23

System Adapter binary run through startAdapter.bat script file at C:/ACP/SA_EXE/hw_v4.
Double click to run the batch file.

Local Disk (C:) > ACP_NB > SA_EXE > hw_v4				
Name	Date modified	Type	Size	
add_rtpg_arp.exp	20-07-2020 23:02	Exports Library File	2 KB	
board_info.txt	30-09-2020 13:53	Text Document	1 KB	
iperf.exe	19-12-2019 12:18	Application	108 KB	
iperf_connect.bat	19-12-2019 12:18	Windows Batch File	1 KB	
iperf_disconnect.bat	19-12-2019 12:18	Windows Batch File	1 KB	
iperf_killapp.bat	19-12-2019 12:18	Windows Batch File	1 KB	
iperf_runcommand.bat	19-12-2019 12:18	Windows Batch File	1 KB	
iperfCommand.txt	19-12-2019 12:18	Text Document	1 KB	
libjv	20-07-2020 23:02	JAR File	4 KB	
mscxp120.dll	19-12-2019 12:18	Application extension	654 KB	
mscxp120.dll	19-12-2019 12:18	Application extension	950 KB	
sa_adb_command.cfg	19-12-2019 12:18	CFG File	2 KB	
sa_at_command.cfg	19-12-2019 12:18	CFG File	1 KB	
sa_mmio_command.cfg	19-12-2019 12:18	CFG File	2 KB	
saConfig.cfg	30-09-2020 13:12	CFG File	2 KB	
saConfig.cfg~	07-09-2020 10:00	CFG~ File	2 KB	
start_iperf_host.bat	19-12-2019 12:18	Windows Batch File	2 KB	
start_iperf_ue.bat	19-12-2019 12:18	Windows Batch File	1 KB	
startAdapter.bat	18-09-2020 10:23	Windows Batch File	1 KB	
startIpsServer.bat	19-12-2019 12:18	Windows Batch File	1 KB	
StartStop_NAT_expect.exp	19-12-2019 12:18	Exports Library File	1 KB	

6 eNodeB and VZW_SA_Agent

1. VZW system adapter agent Windows system IP configuration. Update SA_IP in VzwSaAgent/config/config.cfg to IP of Windows system (192.168.2.210) where System Adapter is running.

```

root@nbiotacp01: /opt/abhishek/config
#
# Name : config.cfg
# Description : This is configuration data file for VZW_SA_AGENT.
#               It contain parameters required for a dedicated connection with
#               other modules namely, SA, SS and HM.
#
#####
# CONFIGURATION DATA FOR SA
#####
# SA_IP: IP Address of SA
SA_IP=192.168.2.80
# SA_PORT: Server socket at SA listening at this port number
SA_PORT=41365
# SELF_PORT_LISTEN_SA: Server socket at VZW_SA_AGENT(Towards SA) listening at this port number
SELF_PORT_LISTEN_SA=41365
#####
# CONFIGURATION DATA FOR SS
#####
# SS_ENB_IP: IP Address of SS
SS_ENB_IP=127.0.0.1
# SS_ENB_PORT: Server socket at SS listening at this port number
SS_ENB_PORT=5132
# SELF_PORT_LISTEN_SS: Server socket at VZW_SA_AGENT(Towards SS) listening at this port number
SELF_PORT_LISTEN_SS=5132
#####
# CONFIGURATION DATA FOR HM
#####
# HM_IP: IP Address of HM
HM_IP=127.0.0.1
# HM_PORT: Port Number of HM
HM_PORT=5135
#####

```

2. Amantya will share Agnostic_Nbiot_v1.0.tar.gz package for NBLoT eNodeB and VZW_SA_Agent. Place this package under C:/ACP/tmBin/hw_v4/default_eNB_bin.

Local Disk (C:) > ACP_NB > tmBin >			
Name	Date modified	Type	Size
hw_v1	01-10-2020 18:34	File folder	
hw_v2	01-10-2020 18:33	File folder	
hw_v3	01-10-2020 18:34	File folder	
hw_v4	30-09-2020 13:13	File folder	
b13_ssh_expect	24-02-2020 21:54	File	3 KB
b13Slave51.bat	01-10-2020 12:44	Windows Batch File	2 KB
BoardInfo.bat	19-12-2019 12:18	Windows Batch File	1 KB
BoardInfo_Nb.bat	29-09-2020 15:49	Windows Batch File	1 KB
plink	24-02-2020 21:54	File	0 KB
PINK.EXE	24-02-2020 21:54	Application	665 KB
PUTTY.EXE	24-02-2020 21:54	Application	1,154 KB
removeKnownHosts.bat	24-02-2020 21:54	Windows Batch File	1 KB
removeKnownHosts.sh	24-02-2020 21:54	Shell Script	1 KB
robo_reboot.sh	24-02-2020 21:54	Shell Script	1 KB
runATCommand.bat	24-02-2020 21:54	Windows Batch File	1 KB
scp_eNB_binary.bat	24-02-2020 21:54	Windows Batch File	2 KB
scp_eNB_binary_expect	24-02-2020 21:54	File	2 KB
slaveStart.bat	24-09-2020 19:02	Windows Batch File	1 KB
ssh_expect	24-02-2020 21:54	File	3 KB
start_all_eNB.bat	24-02-2020 21:54	Windows Batch File	1 KB
start_binary.sh	23-09-2020 16:12	Shell Script	1 KB

Local Disk (C:) > ACP_NB > tmBin > hw_v4 > default_eNB_bin	
Name	Date modified
Agnostic_Nbiot_v1.0.0.tar.gz	01-10-2020 14:57
result.txt	01-10-2020 18:02
result_enodeb.txt	01-10-2020 18:03



1.1.1.1.1 AMANTYA TECHNOLOGIES

NB IoT Agnostic ACP User Manual

Doc. No : AMANTYA-v1.0

Release Date: 01-10-20

Page 19 of 23

3. Run the BoardInfo_Nb.bat through Cygwin Terminal or Windows Power Shell to get Board information in form below. Pass IP address of eNodeB Hardware as parameter to batch file.
(Ex Run command as **./BoardInfo.bat 192.168.2.51**)

```
$ ./BoardInfo.bat 192.168.2.51
C:\ACP\tmBin>cd "C:\ACP\tmBin"
C:\ACP\tmBin>expect ssh_expect root root123 192.168.2.51 "fcmd get asinfo; uname -a"
REQ LCCP-2601: Feature applied
REQ LCCP-2776: Feature applied
Done /usr/bin/su -o UserKnownHostsFile=/dev/null -o StrictHostKeyChecking=no -o KexAlgorithms=diffie-hellman-group-sha1 root@192.168.2.51
Warning: Permanently added '192.168.2.51' (ECDSA) to the list of known hosts.
root@192.168.2.51:~# password: root123
Welcome to Ubuntu 16.04 LTS (GNU/Linux 4.8.0-58-lowlatency x86_64)
 * Documentation:  https://help.ubuntu.com/
758 packages can be updated.
616 updates are security updates.
Last login: Sat Jan 16 19:37:56 2021 from 192.168.2.210
root@user-NUC715DNHE:~# fcmd get asinfo; uname -a
Linux user-NUC715DNHE 4.8.0-58-lowlatency #63-16.04.1-ubuntu SMP PREEMPT Mon Jun 26 19:14:11 UTC 2017 x86_64 x86_64 x86_64 GNU/Linux
```

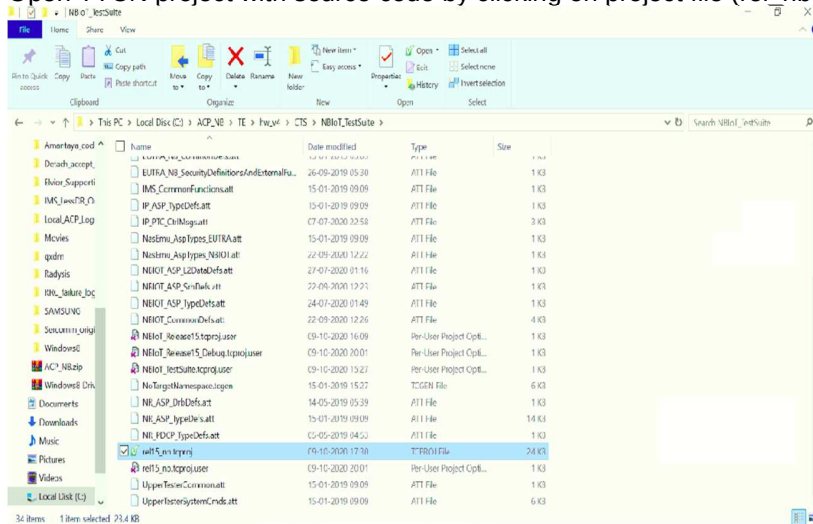
Before running the batch file, modify it has correct Username and password of eNodeB Hardware.

4. Copy the C:/ACP/tmBin/hw_4v/default_eNB_bin contents to enodeb.
#scp C:/ACP/tmBin/hw_4v/default_eNB_bin/* root@192.168.2.51
5. Login to enodeb through ssh, userid:root and password:192.168.2.51
#ssh root@192.168.2.51
Run the install_binary.sh through enodeb terminal
6. Reboot enodeb hardware run enodeb binaries.

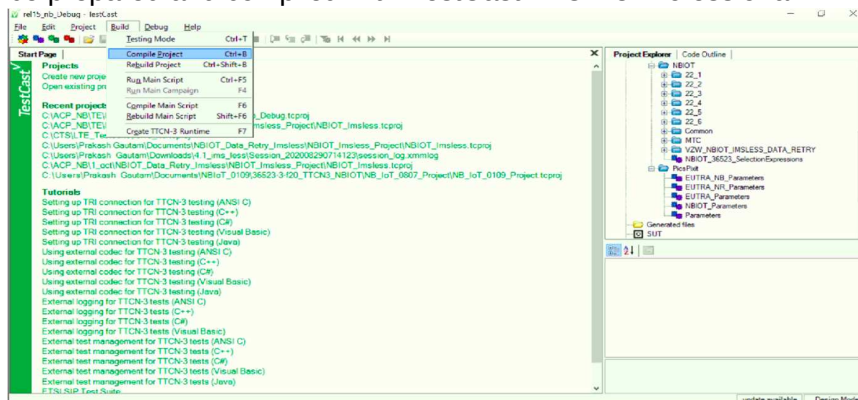
7 Compilation of source code

7.1 TE compilation steps

1. Open TTCN project with source code by clicking on project file (rel_nb.tcproj) as shown below.



2. Test scripts (including codec rules and external attributes and TTCN3 settings) must be prepared and compiled with TestCast TTCN-3 Professional.



3. Press Create TTCN-3 Runtime (Build->Create TTCN-3 Runtime or F7). This will compile whole test suite and a folder named "Ttcn3runtime" created with all binaries, script and project file.



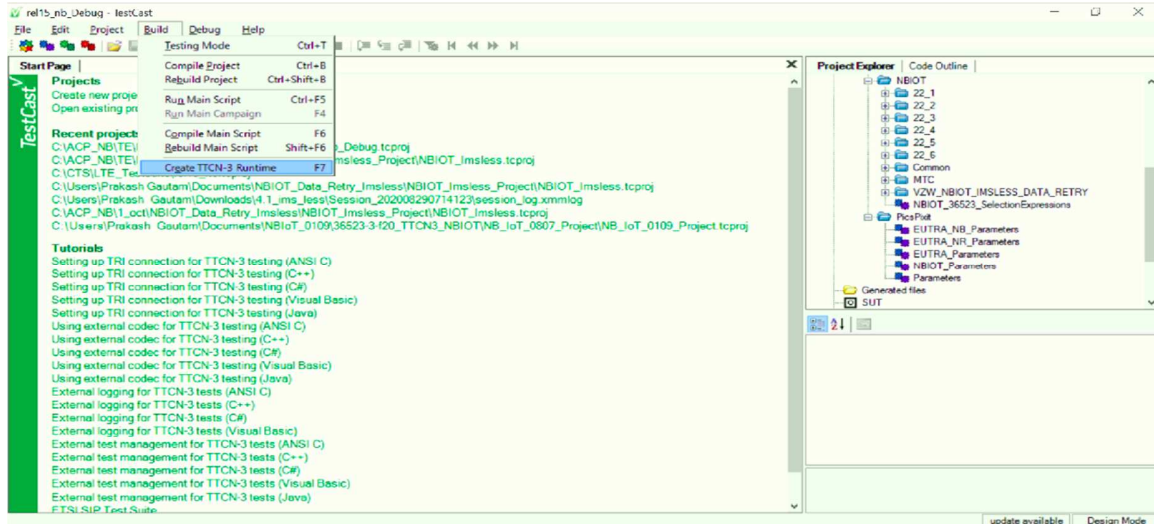
1.1.1.1.1 AMANTYA TECHNOLOGIES

NBIoT Agnostic ACP User Manual

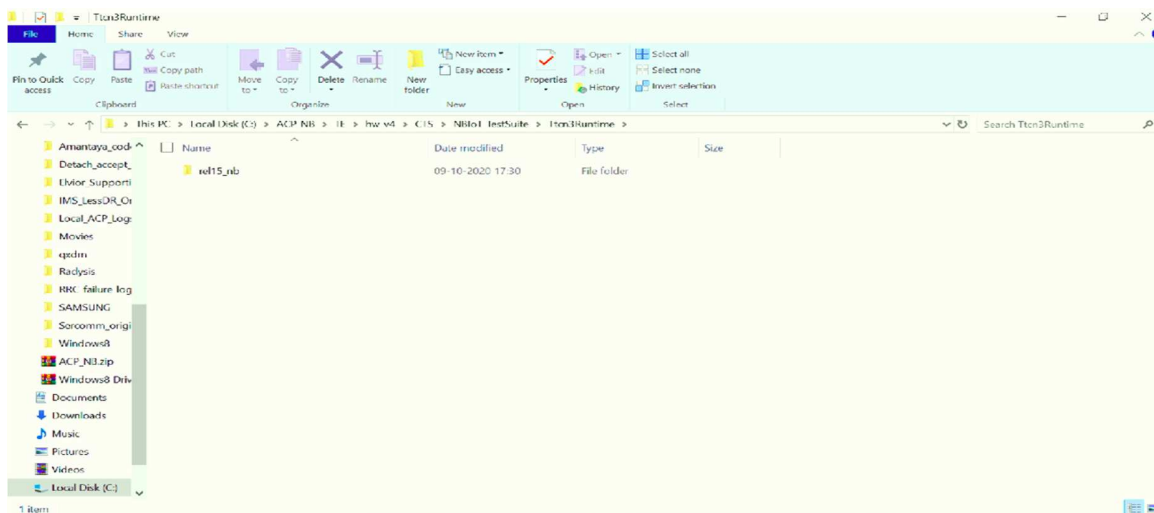
Doc. No : AMANTYA-v1.0

Release Date: 01-10-20

Page 21 of 23



4. A folder named "Ttcn3runtime" created in the same path where your source TTCN3 project file is present and it contain a folder named "rel15_nb" or source TTCN3 project file name.



	1.1.1.1.1 AMANTYA TECHNOLOGIES	Doc. No : AMANTYA-v1.0 Release Date: 01-10-20
	NBIoT Agnostic ACP User Manual	Page 22 of 23

7.2 VZW System Adapter Agent compilation steps

1. Compilation has been done on Ubuntu 16.04 Linux platform.
2. Go to the path of VZW_SA_AGENT code and run the command “./build.sh clean”

```
~/Nbiot/VZW_SA_AGENT$ ./build.sh clean
```

3. Now run “build.sh” command to compile the code.

```
~/Nbiot/VZW_SA_AGENT$ ./build.sh
```

4. Now these logs should be visible at the end of the compilation process.

```
Moving vzwSaAgent_Nb to bin
mv vzwSaAgent_Nb /home/mehboob/Nbiot/VZW_SA_AGENT/bin/
```

Logs of successful compilation

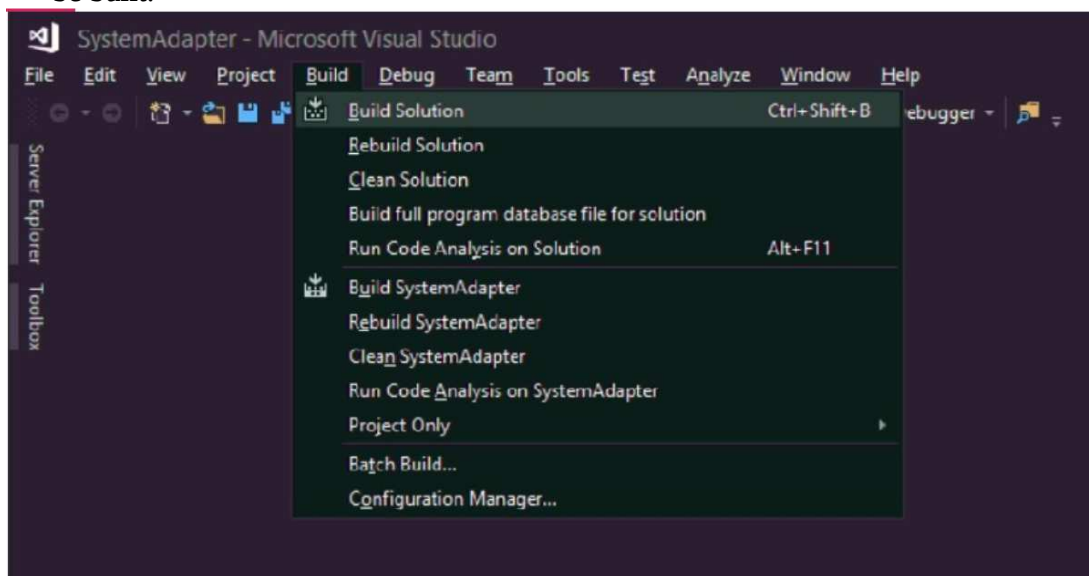


VZW_SA_Agent_compilationLogs.txt

	1.1.1.1.1 AMANTYA TECHNOLOGIES	Doc. No : AMANTYA-v1.0
	NBloT Agnostic ACP User Manual	Release Date: 01-10-20
		Page 23 of 23

7.3 System Adapter compilation steps

1. Compilation has been done on Microsoft Visual Studio 2017
2. In **Solution Explorer**, choose or open the solution (**SystemAdapter**).
3. On the menu bar, choose **Build** and then choose **Clean Solution** to delete any intermediate and output files. New instances of the intermediate and output files can then be built.



4. On the menu bar, choose **Build** and then choose **Build Solution** to compile all project files and components. Alternatively, you can use the keyboard shortcut **Ctrl + Shift + B** to build the solution.

