CMW500 Hands On
LTE Carrier Aggregation

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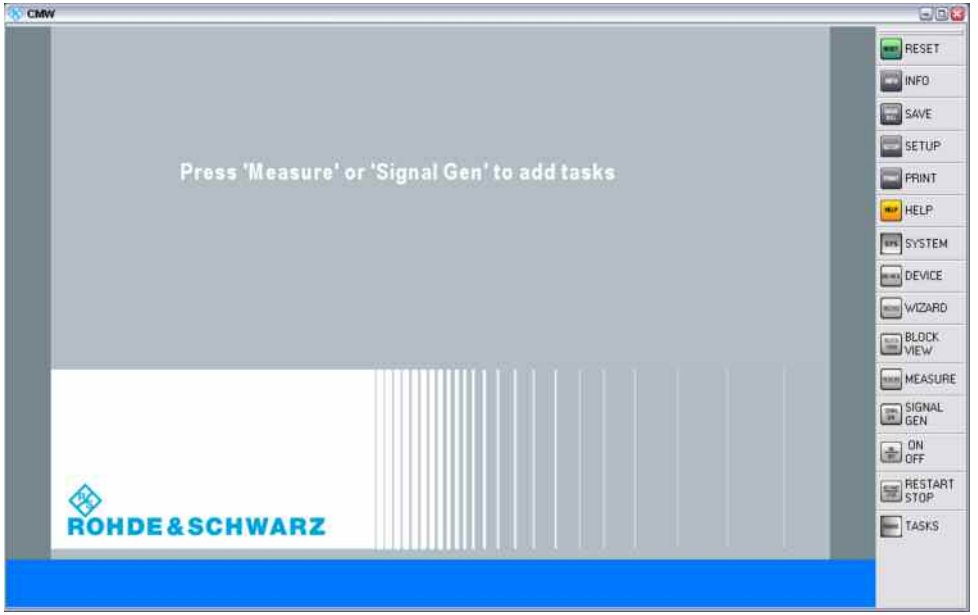
The LTE-CA Hands ON session requires following items:

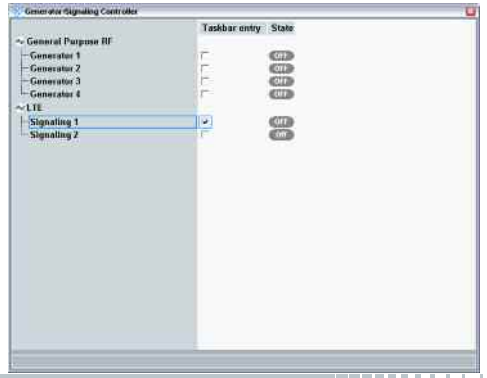
- A CMW500 loaded with the following Hardware
  - CMW-B590D x2 – Advanced Front End
  - CMW-B570B x4 – Transceiver Module
  - CMW-B300B x2 – Signaling Unit Wideband
  - CMW-B450B x1 – Data Application Unit
- CMW Signaling Software Applications
  - CMW-K0
- CMW Firmware
  - BASE 3.2.20
  - DAU 3.2.11
  - LTE 3.2.50
- A Samsung Galaxy S4-A supporting LTE Carrier Aggregation (LTE Band3+LTE Band5)
- A Valid Test SIM Card
  - CMW-Z04

RESET CMW and MAP LTE Signaling Application

- Reset the CMW
  - Use the “Close” tab to close all the open windows
  - Press the “RESET” key
  - Select “Preset” tab

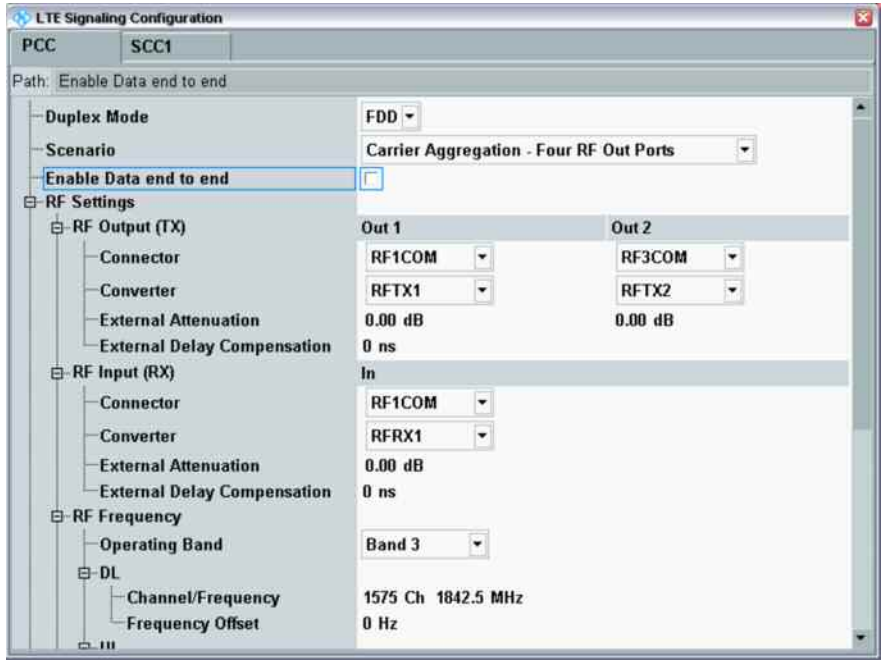
- Map the LTE Signaling Application
  - Press the “SIGNAL GEN” tab
  - Scroll in the Generator/Signaling Controller windows and locate the LTE Signaling entry
  - Checkmark the LTE Signaling TaskbarEntry
  - Hit the “LTE Signaling” hot tab at the bottom of the CMW display





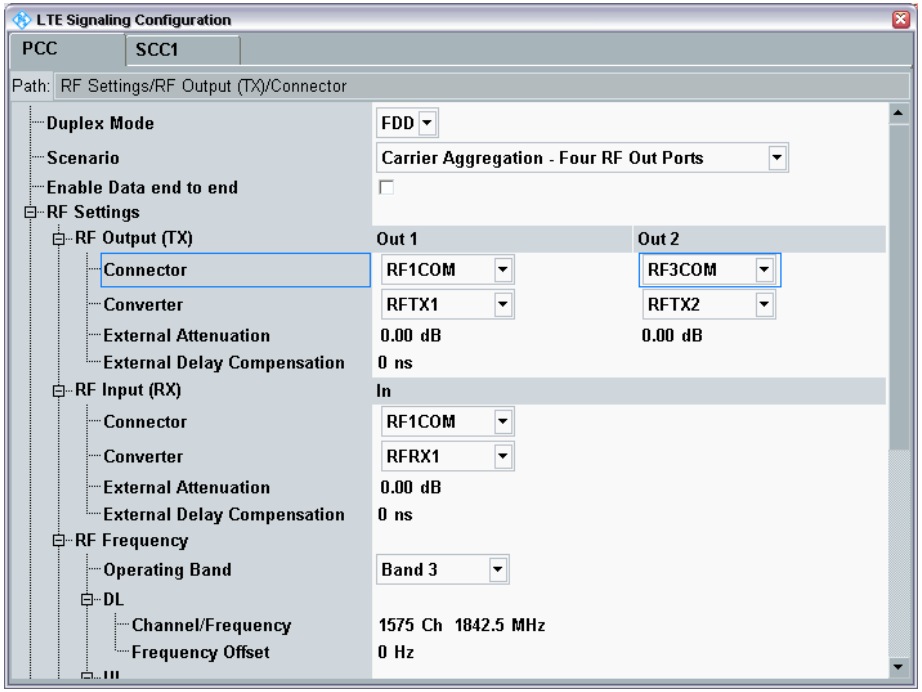
TEST in TEST MODE Connection

- Set the CMW for Carrier Aggregation Mode
  - Press the “Config” tab
  - Press the “PCC” tab
  - Expand the “Scenario” entry and select the “Carrier Aggregation – Four RF Out Ports”
- Set CMW for Test Mode
  - Uncheckmark the “Enable Data end to end”



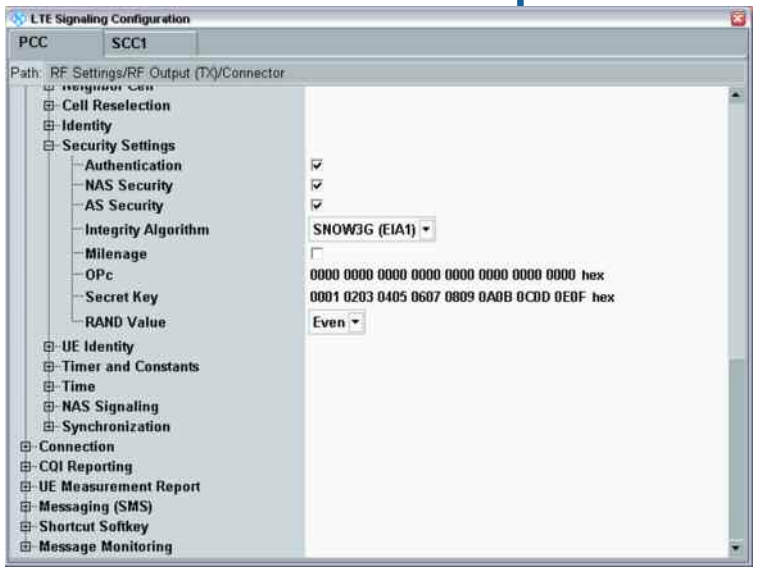
Set the Primary Component Carrier Cell – Step1

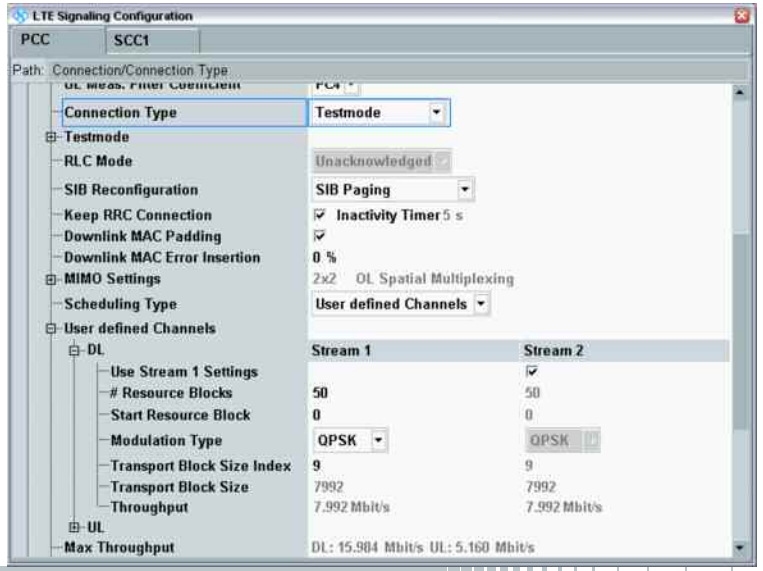
- Press the “PCC” tab
- Expand the “RF Settings” entry
  - Expand the “RF Output (TX)” entry
    - Set Out1 Connector to “RF1COM” port
    - Set Out1 Converter to “RFTX1”
    - Set Out2 Connector to “RF3COM” port
    - Set Out2 Converter to “RFTX2”
- Expand the “RF Input (RX)” entry
    - Set In Connector to “RF1COM” port
    - Set In Converter to “RFRX1”
- Expand the “RF Frequency” entry
    - Set the “Operating Band” to “Band 3”



Set the Primary Component Carrier Cell – Step2

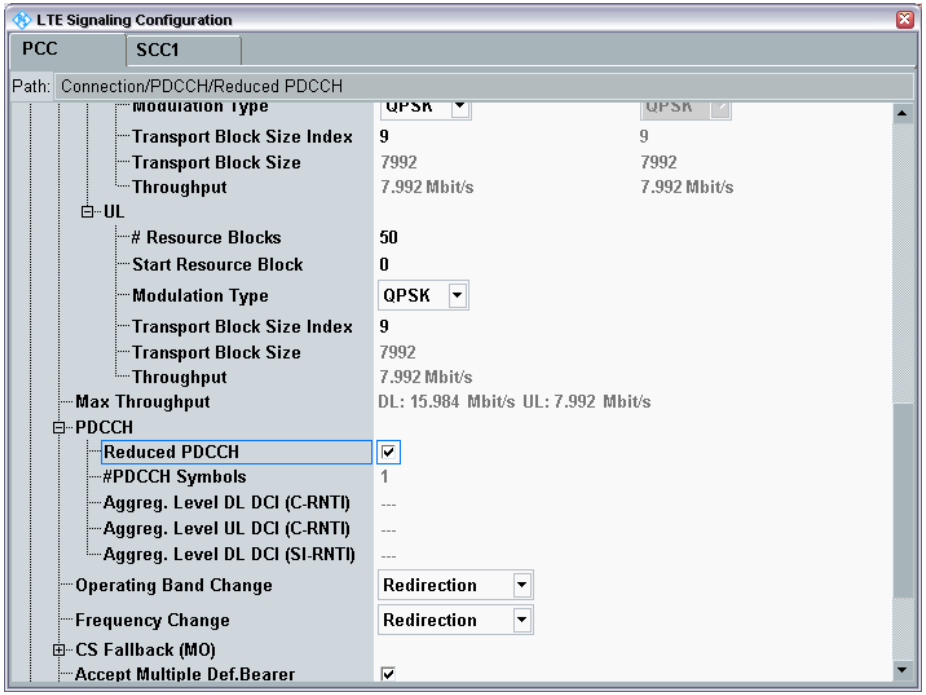
- Expand the “Network” Entry
  - Expand the “Security Settings” entry
  - Set the “Integrity Algorithm” to “SNOW3G(EIA1)”
- Expand the “Connection” Entry
  - Set the “Connection Type” to “Testmode”
  - Checkmark “Downlink MAC Padding”
  - Change “Scheduling Type” to “User Defined Channels”
- Expand the “User Defined Channels”
  - Expand the “DL” entry
  - Set the “Transport Block Size Index” to “9”





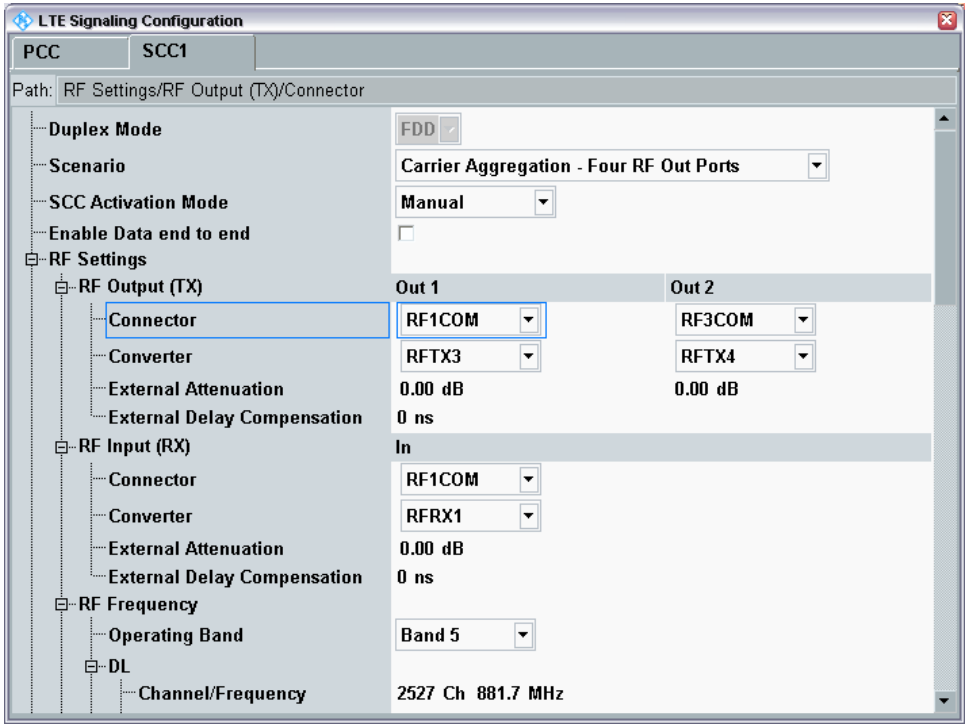
Set the Primary Component Carrier Cell – Step3

- Expand the “User Defined Channels”
  - Expand the “UL” entry
  - Set the “Transport Block Size Index” to “9”
- Expand the “PDCCH” entry
  - Checkmark “Reduced PDCCH”
- Set the “Operating Band Change” to “Redirection”
- Set the “Frequency Change” to “Redirection”
- Checkmark “Accept Multiple Def.Bearer”



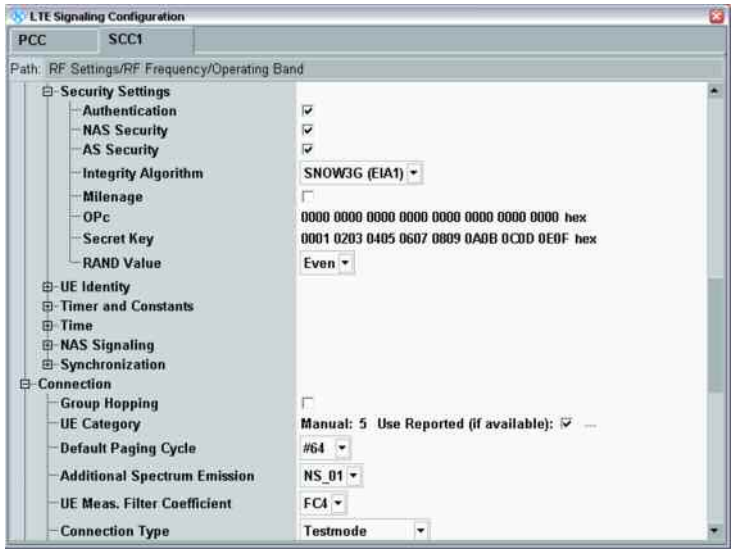
Set the Secondary Component Carrier Cell – Step1

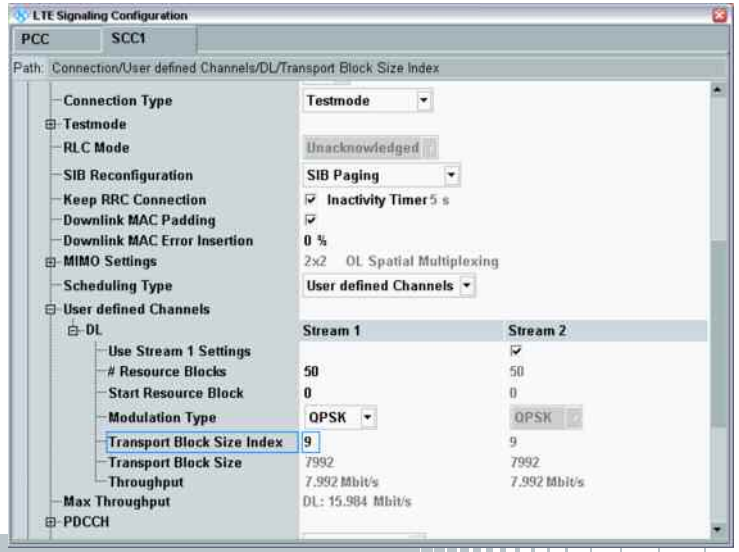
- Press the “SCC1” tab
- Set the “SCC Activation Mode” to “Manual”
- Uncheckmark “Enable Data end to end”
- Expand “RF Settings” entry
  - Expand the “RF Output (TX)” entry
    - Set Out1 Connector to “RF1COM” port
    - Set Out1 Converter to “RFTX3”
    - Set Out2 Connector to “RF3COM” port
    - Set Out2 Converter to “RFTX4”
  - Expand the “RF Input (RX)” entry
    - Set In Connector to “RF1COM” port
    - Set In Converter to “RFRX1”
  - Expand the “RF Frequency” entry
    - Set the “Operating Band” to “Band 5”



Set the Secondary Component Carrier Cell – Step2

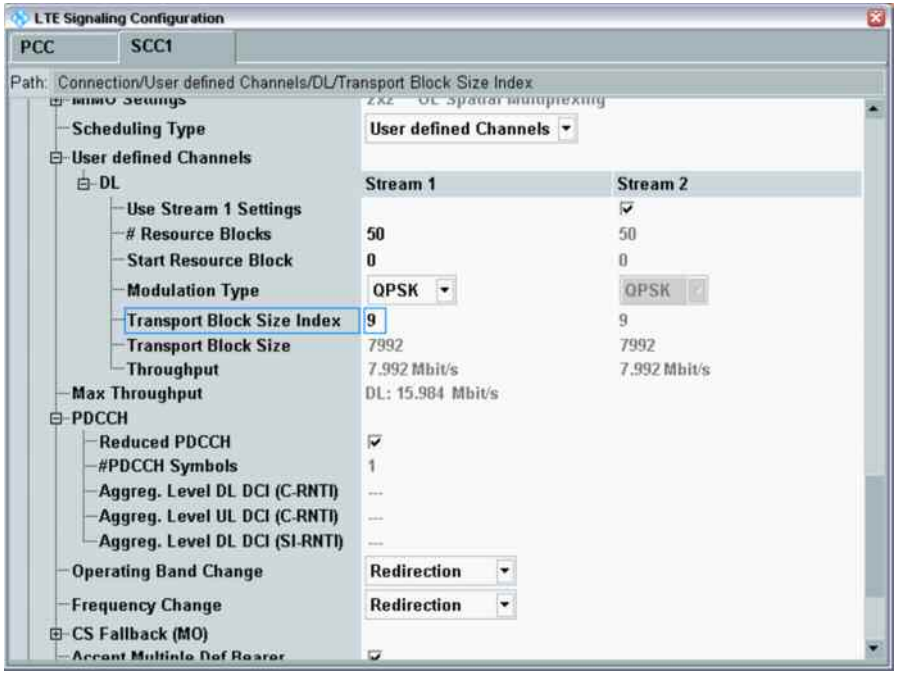
- Expand the “Network” Entry
  - Expand the “Security Settings” entry
  - Set the “Integrity Algorithm” to “SNOW3G(EIA1)”
- Expand the “Connection” Entry
  - Set the “Connection Type” to “Testmode”
  - Checkmark “Downlink MAC Padding”
  - Change “Scheduling Type” to “User Defined Channels”
- Expand the “User Defined Channels”
  - Expand the “DL” entry
  - Set the “Transport Block Size Index” to “9”





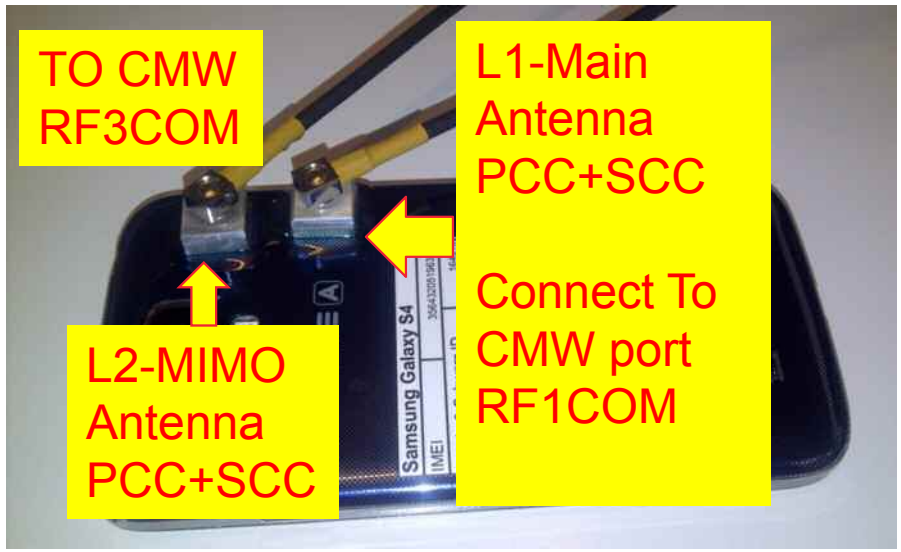
Set the Secondary Component Carrier Cell – Step3

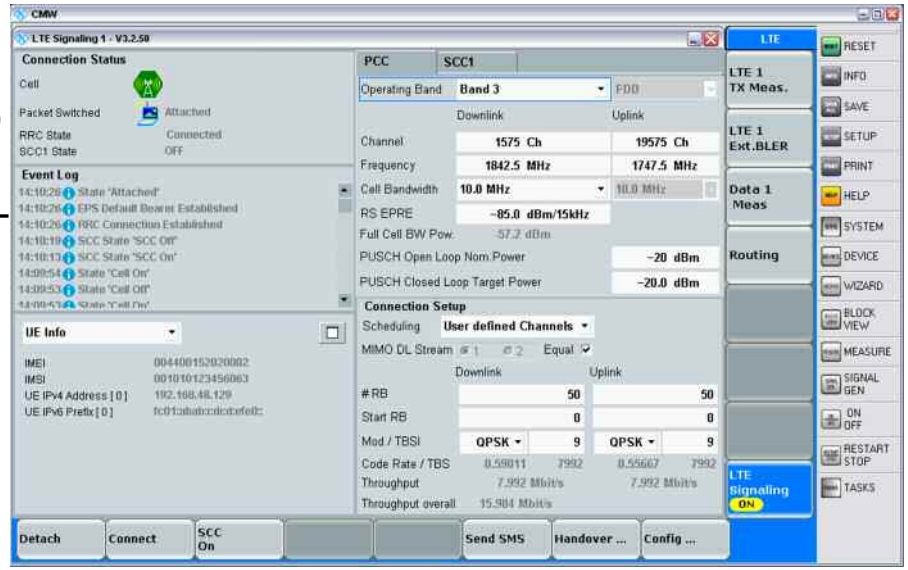
- Expand the “PDCCH” entry
  - Checkmark “Reduced PDCCH”
- Set the “Operating Band Change” to “Redirection”
- Set the “Frequency Change” to “Redirection”
- Checkmark “Accept Multiple Def.Bearer”



Attach DUT

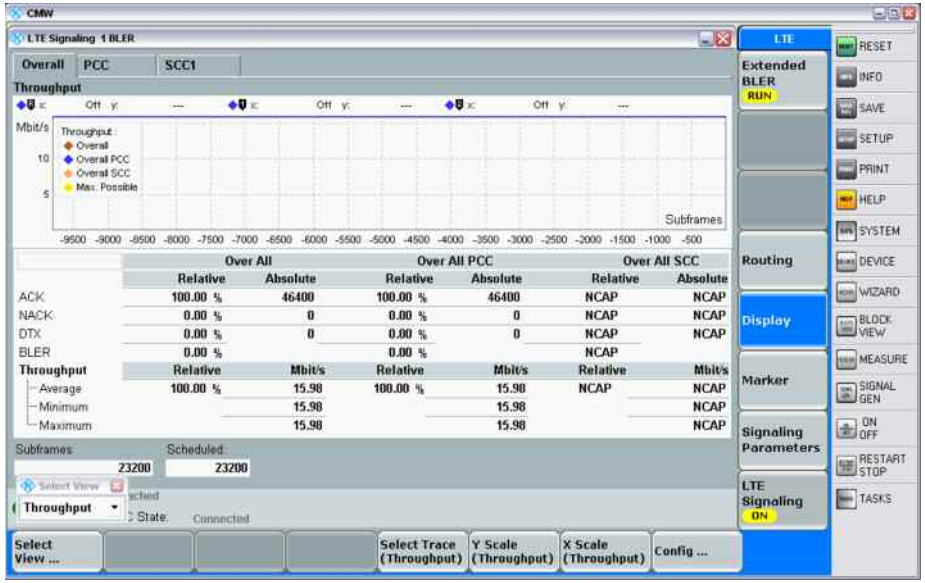
- Close the Config screen
- Press the “PCC” tab
- Press the hot tab “LTE Signaling”
- Press the “ON/OFF” tab to start the LTE cell
  - Wait until the message “State ‘Cell On’” appears in the “Event Log” frame
  - At this time the CMW is waiting for a DUT to Attach
- DUT RF Connection
  - Connect the primary RF port of the DUT to the CMW RF connector “RF1COM”
  - Connect the secondary RF port of the DUT to the CMW RF connector “RF3COM”
- Power ON the DUT
  - The DUT has successfully attached when the “Packet Switched” state in the “Connection Status” frame is “Attached”





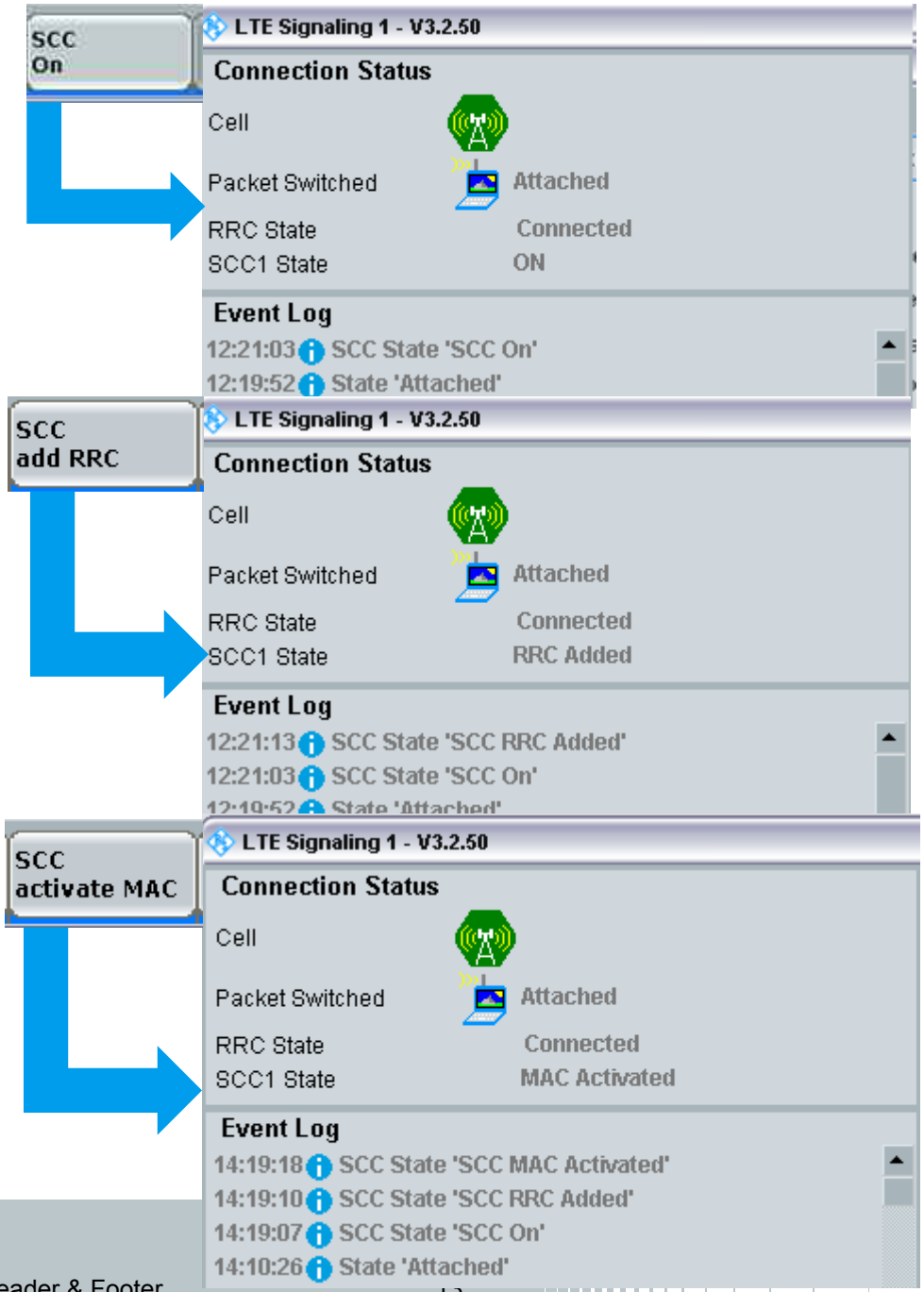
Check Throughput using PCC Cell

- Press the “LTE1 Ext. BLER” tab
- Select the Throughput Overall screen
  - Press the “Display” tab
  - Press the “Select View” tab and select the “Throughput”
  - Press the “Overall” tab
- PCC Throughput test
  - Press the “Extended BLER” hot tab
  - Press the “ON/OFF” tab
  - As only the PCC cell is activated you only see valid Throughput measurement in the “Overall” and “PCC” fields
- Press the “LTE signaling” hot tab twice to exit



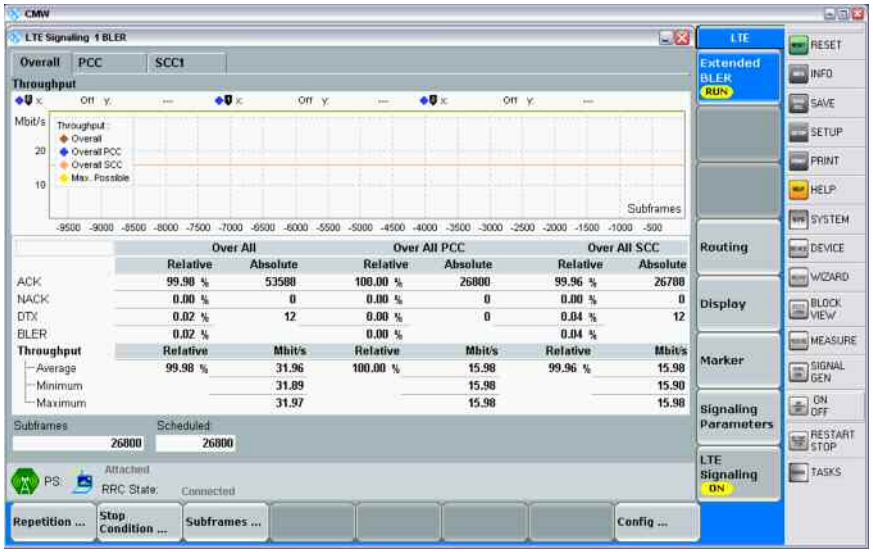
Establish SCC carrier

- Establish the SCC carrier in 3 steps
  - Press the “SCC On” tab
  - Press the “SCC add RRC” tab
  - Press the “SCC activate MAC” tab
- When the “SCC1 State” is “MAC Activated” under the “Connection Status” Frame, the DUT has established the call with the SCC carrier



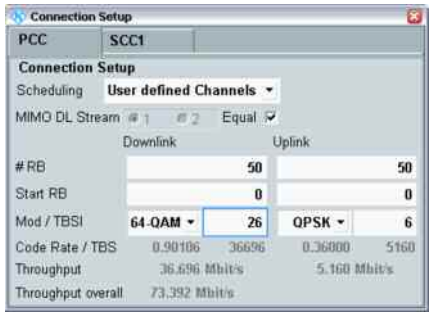
Check Throughput Test with PCC and SCC carriers

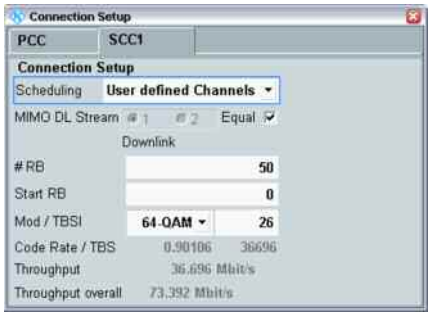
- From the Signaling screen, Press the “LTE 1 Ext.BLER” tab
- Select the Throughput Overall screen
  - Press the “Display” tab
  - Press the “Select View” tab and select the “Throughput”
  - Press the “Overall” tab
- PCC and SCC Throughput test
  - Press the “Extended BLER” hot tab
  - If the BLER Measurement is not running, press the “ON/OFF” tab
  - Observe that the Overall PCC and Overall SCC Measurements are now working
  - The Absolute Overall Throughput measurement displays the total throughput over the 2 carriers

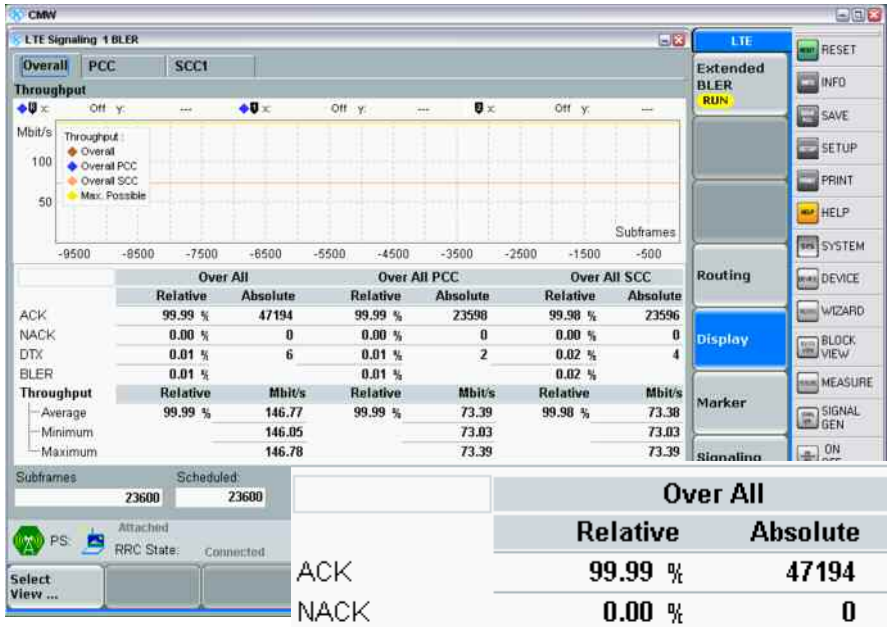


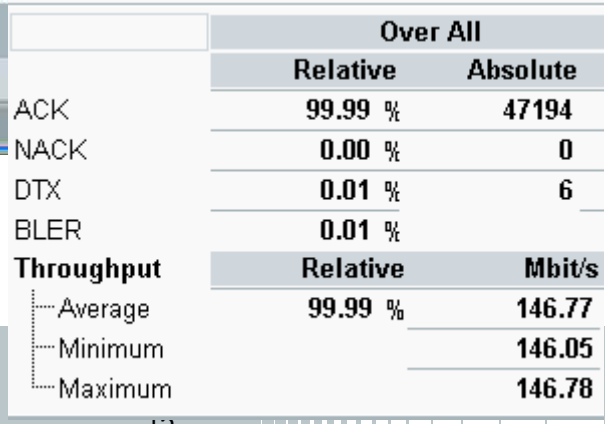
MAX Throughput Test using PCC and SCC carriers

- Change Scheduling
  - From the Extended BLER screen, Press the “Signaling Parameters” tab
  - Press the “Connection Setup” tab
- Change PCC scheduling
  - Press the “PCC” tab
  - For “Downlink”, change “Mod” to “64-QAM”
  - For “Downlink”, change the “TBSI” to “26”
- Change SCC scheduling
  - Press the “SCC1” tab
  - Change the “Mod” to “64-QAM”
  - Change the “TBSI” to “26”
- MAX Throughput over 10 MHz bandwidth
  - Close the Connection Setup windows
  - Observe the Absolute Overall Throughput.
  - Maximum Throughput is 2 * 73.392 Mbit/s = 146.784 Mbit/s



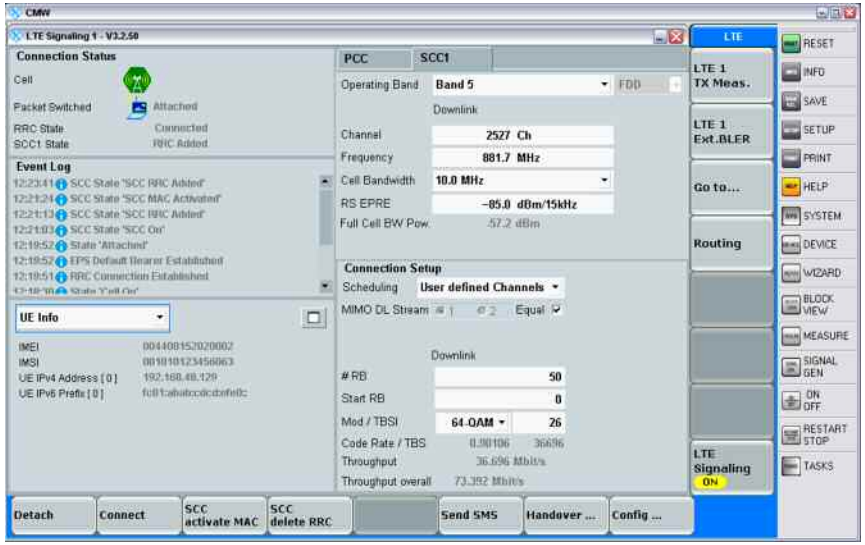


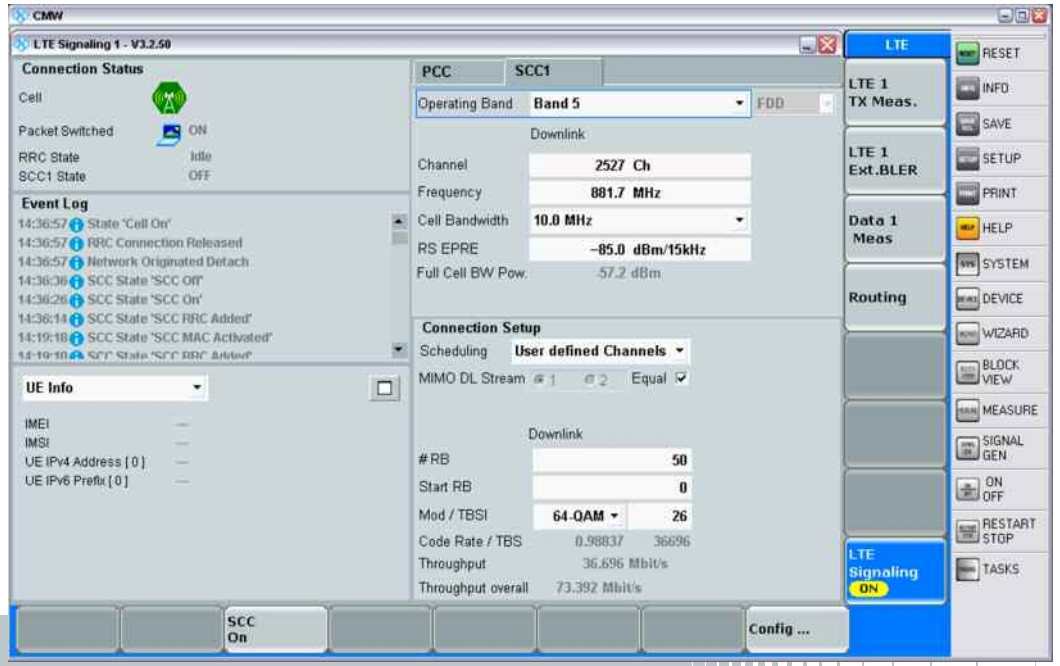




Disconnect the CA Call

- From the LTE Signaling screen, press the “LTE Signaling” tab
- Disconnect the SCC cell
  - Press the “SCC deactivate MAC” tab
  - Press the “SCC delete RRC” tab
  - Press the “SCC Off” tab
- Disconnect the PCC cell
  - Press the Detach tab
  - At this point, the S4-A goes “out of Sync”
- Turn OFF the LTE cell
  - Press the “LTE signaling” tab
  - Press the “ON/OFF” tab



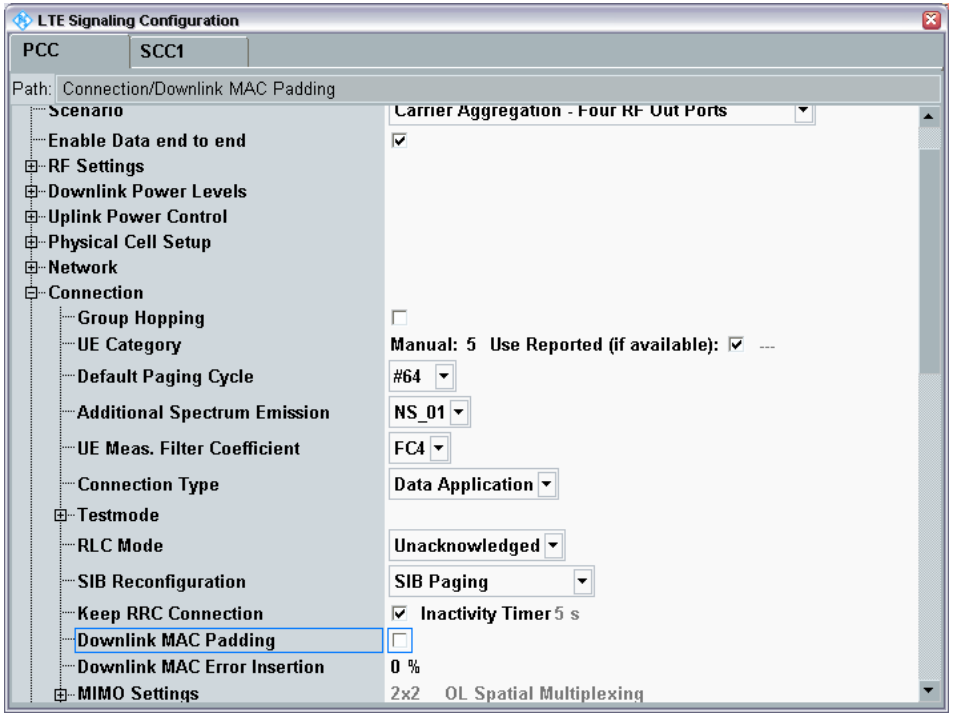


LTE CA Test In DATA end 2 end Mode

Setup the CMW for LTE-CA end 2 end Connection

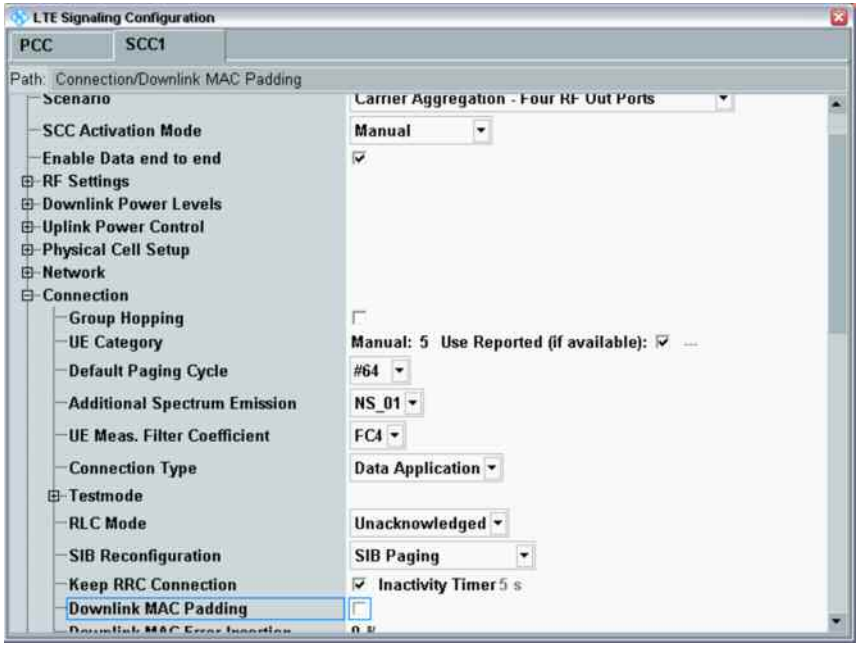
- Ensure the LTE cell is OFF
- Press the “Config” tab
- Scroll up to the top of the screen and checkmark “Enable data end to end”

- Set the PCC cell
  - Press the “PCC” tab
  - Expand the “Connection” entry
    - Set the “Connection Type” to “Data Application”
    - Uncheckmark “Downlink MAC Padding”
    - Set the “User Defined Channels – DL” scheduling to:
      - “Modulation Type”: “QPSK”
      - “Transport Block Size Index”: “9”



Setup the CMW for LTE-CA end 2 end Connection

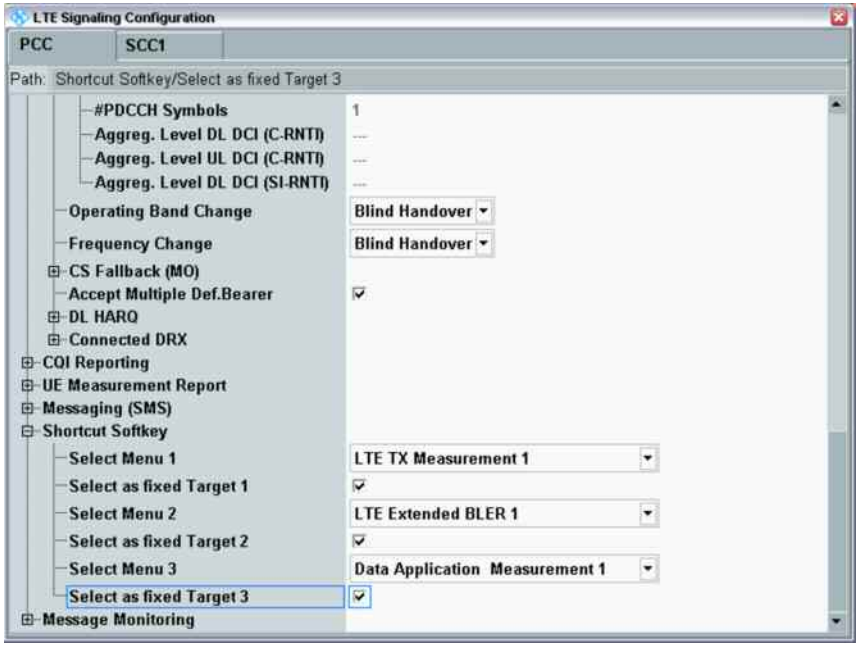
- Set the SCC cell
  - Press the “SCC1” tab
  - Expand the “Connection” entry
    - Set the “Connection Type” to “Data Application”
    - Uncheckmark “Downlink MAC Padding”
    - Set the “User Defined Channels – DL” scheduling to:
      - “Modulation Type”: “QPSK”
      - “Transport Block Size Index”: “9”



Map the Data Application Measurement

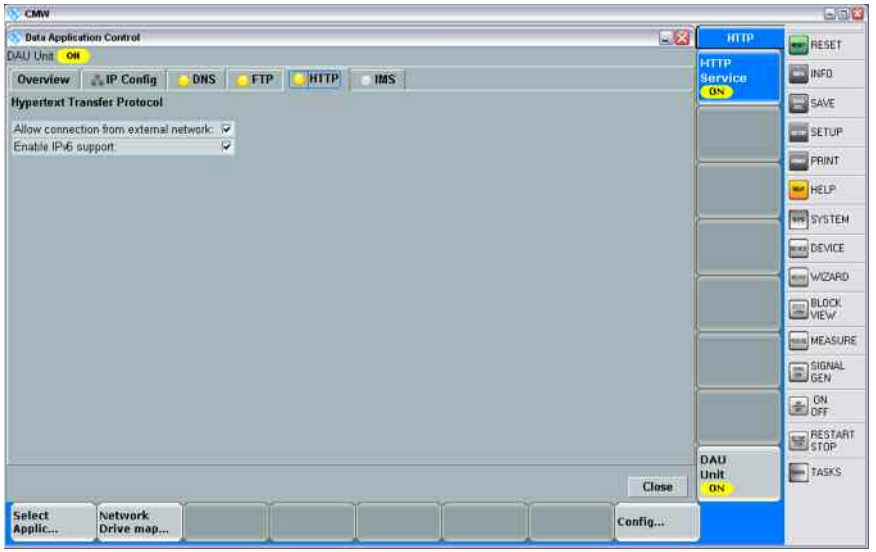
- Press the “PCC” tab
- Expand the “Shortcut Softkey”
- Change the “Select Menu 3” to “Data Application Measurement”
- Checkmark the “Select as fixed Target 3”

- Close the Config screen



Start DAU services

- From the LTE signaling screen, press the “Data 1 Meas” shortcut key
- Press the “Configure Services” tab
- Start DNS server
  - Press the “DNS Server” tab
  - Press the “ON/OFF” tab
  - Wait that the service is ON
- Start FTP server
  - Press the “FTP Server” tab
  - Press the “ON/OFF” tab
  - Wait that the service is ON
- Start HTTP server
  - Press the “HTTP Server” tab
  - Press the “ON/OFF” tab
  - Wait that the service is ON
- Press the “Close” tab
- Press the “Go to RAN” tab to switch back to the LTE Signaling screen

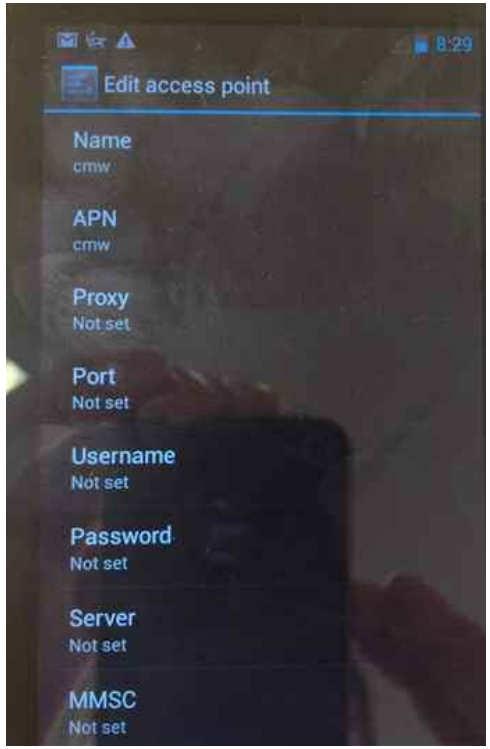


Setup the DUT for a Data Call

- Load Application on the DUT
  - Connect the DUT via WIFI to the Google Play Store
  - Download and install the following applications:
    - Ping&DNS
    - Iperf
    - AndFTP

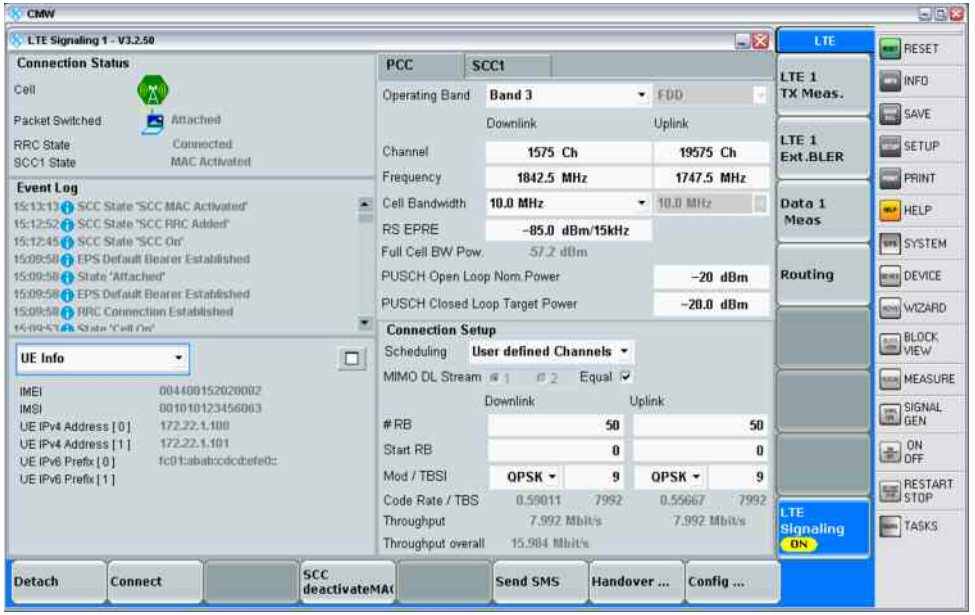
Setup the DUT for a Data Call

- Create An access point
  - In the Android “Settings” Menu, choose “More networks”, then “Mobile networks”, then “Access Point Names”
  - Press the bottom left (Menu) key on the S4-A and choose “+ New APN”
  - Create a dummy Access Point with the Name CMW and the APN name CMW.
  - Activate the Access Point (if it isn’t already activated)
- Power OFF the DUT



Establish The Data Call

- Start LTE call from a LTE-CA Data end 2 end call
  - From the LTE Signaling screen, press the “LTE Signaling” tab
  - Press the “ON/OFF” tab to start the cell
  - Wait for the message “State ‘Cell On’”
- Power ON the DUT.
- After the DUT Attach to the PCC cell, ensure a valid IP address appears in the UE Info box under “UE IPv4 address” and/or “UE IPv6 Prefix“
  - Default UE IPv4 address starts at 172.22.1.100
- Establish the connection with the SCC cell
  - Press “SCC On” tab
  - Press “SCC add RRC” tab
  - Press “SCC activate MAC” tab

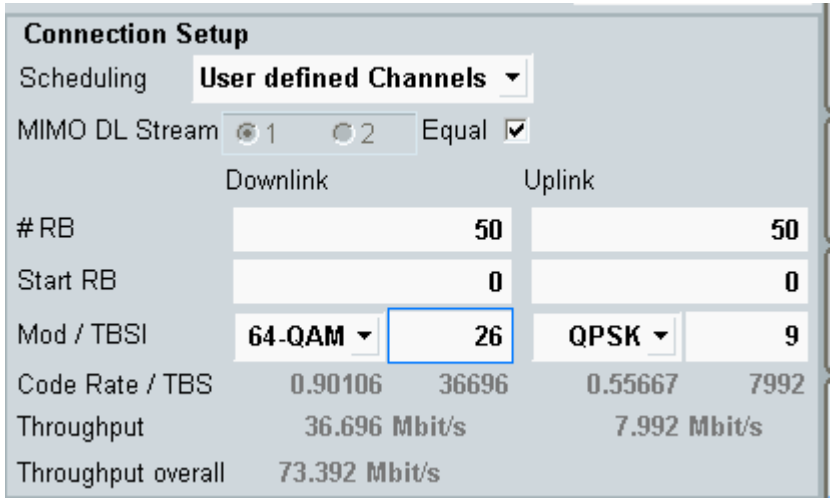


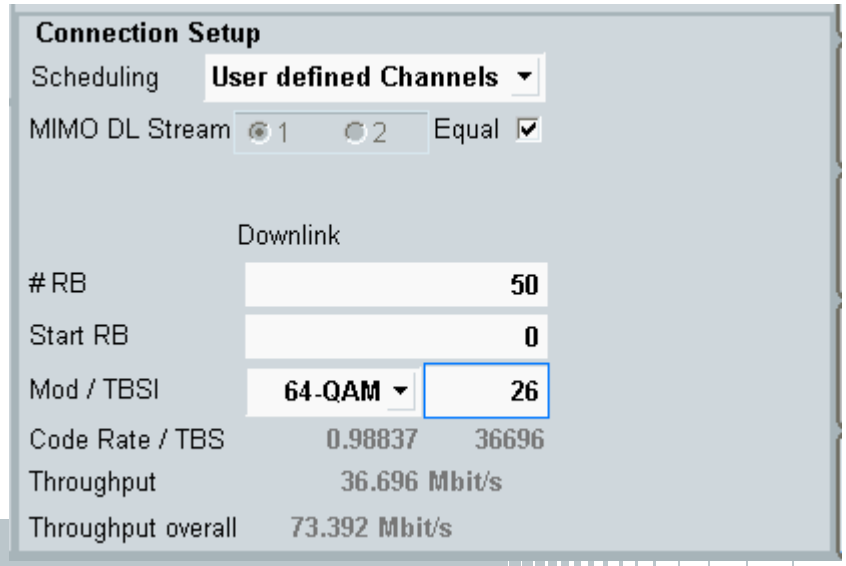
Change Scheduling to the MAX Throughput

- Change the scheduling for the PCC cell
  - From the LTE signaling screen, Press the “PCC” tab
  - For “Downlink”, change “Mod” to “64-QAM”
  - For “Downlink”, change the “TBSI” to “26”

- Change the scheduling for the SCC cell
  - From the LTE signaling screen, Press the “SCC1” tab
  - Change the “Mod” to “64-QAM”
  - Change the “TBSI” to “26”

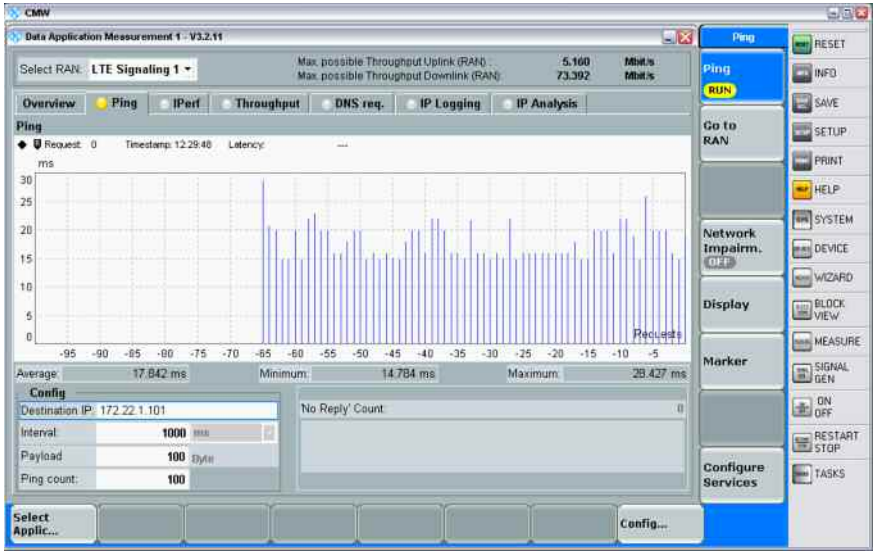
- Maximum Throughput is 2 * 73.392 Mbit/s = 146.784 Mbit/s

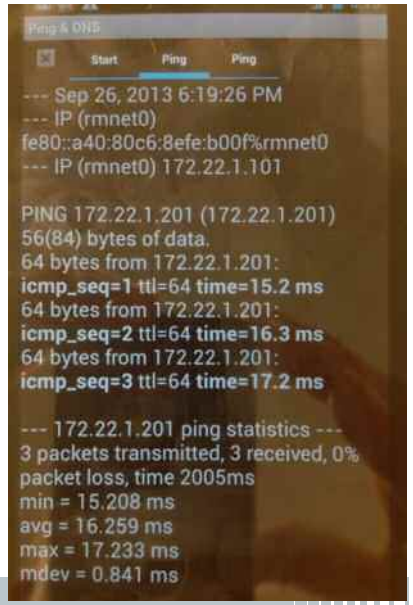




Ensure IP connectivity is established

- Ensure IP connectivity from CMW DAU to DUT
  - Press the “Data1 meas” tab from the LTE Signaling screen
  - Press the “Ping” tab
  - Under “Destination IP” set the DUT IP address (which can be read from the “UE Info” frame in the LTE Signaling view; example:172.22.1.10x)
  - Press the “Ping” hot tab
  - Press the “ON/OFF” tab
  - Observe the Ping graphical windows. Vertical bar should comes at interval of 1 s
- Stop the Ping
  - Press the “ON/OFF” tab
- Check IP Connectivity from DUT
  - Open “PING&DNS” tool
  - Enter the DAU IP address 172.22.1.201
  - Select the IP address
  - Select the “PING” application
  - Press “Go” tab
  - Ensure the Ping to the DAU comes back with valid data

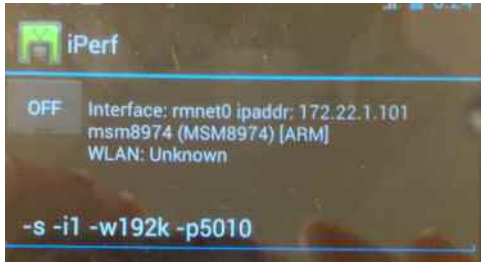


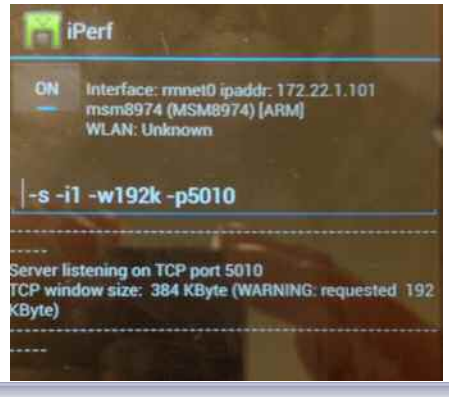


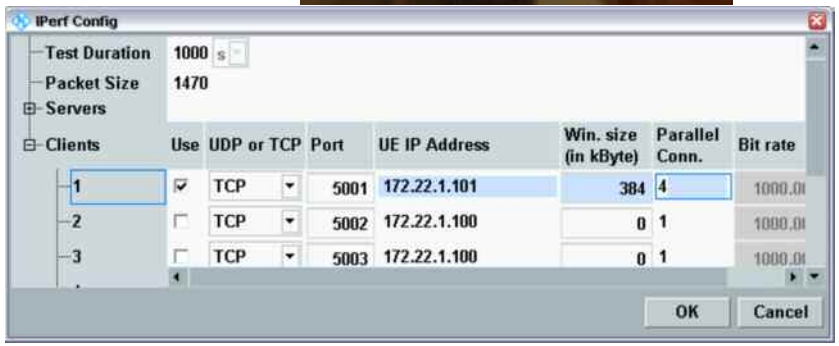
Setup DUT Iperf tool and CMW DAU Iperf Application

- Start Iperf tool on the DUT
  - Run Iperf as a server tool by entering the following parameters:
    - "-s –i1 –w192k –p5010"
  - Start Iperf by pressing the "OFF" tab
  - Locate the DUT IP address displayed in the Iperf tool (172.22.1.10x)

- Setup CMW DAU Iperf tool
  - Press the "Iperf" tab
  - Press the "Config" tab
  - Expand the "Clients" entry
  - Checkmark the "Use" from the 1st row of the Clients entry
  - Set the "UDP or TCP" to "TCP"
  - Set the "Port" to "5010"
  - Set the "UE IP Address" to 172.22.1.10x
  - Set the "Win. size (in kByte)" to "384"
  - Set the "Parallel Conn." to "4"
  - Press the "OK" tab

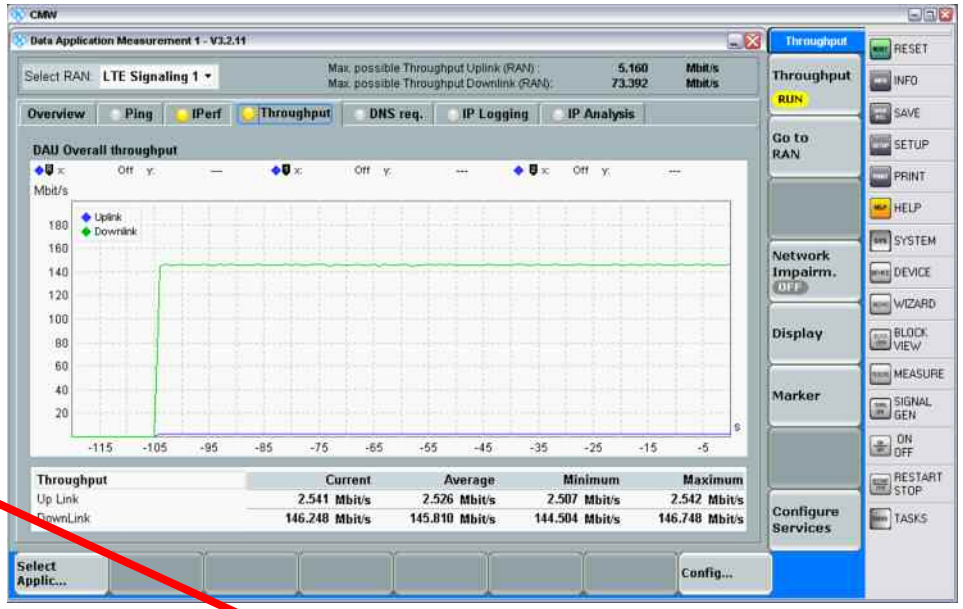


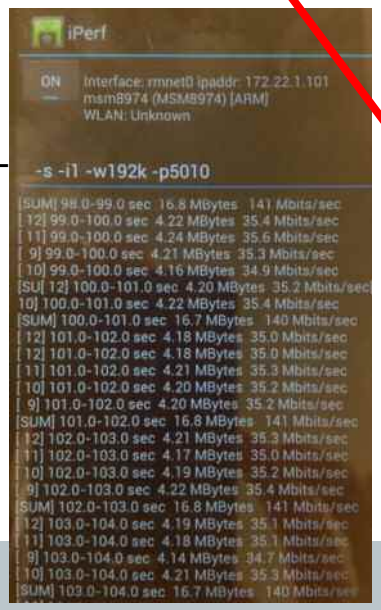


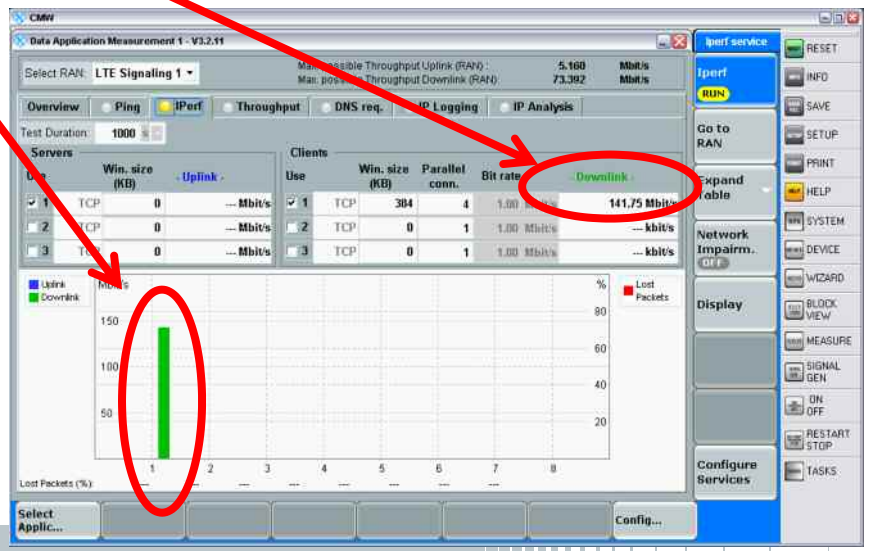


TCP/IP Throughput Test

- Start DAU Iperf Application
  - Press the “Iperf “ hot tab
  - Press the “ON/OFF” tab
  - Check that a vertical green bar shows up in the Graphical windows
  - Check that a valid Throughput is displayed in the Downlink field
- Check IP Throughput over time
  - Press the “Throughput” tab
  - Press the “Throughput” hot tab
  - Press “ON/OFF” to start the Throughput Measurement
  - Check the TCP Throughput
- Check TCP Throughput on DUT







TCP/IP Throughput Test

- Check MAC Throughput
  - Press the “Go To RAN” tab
  - Press the “LTE 1 Ext.BLER” tab from the LTE Signaling screen
  - Press the “Extended BLER“ tab
  - Press the “ON/OFF” tab
  - Check the Overall Absolute Throughput