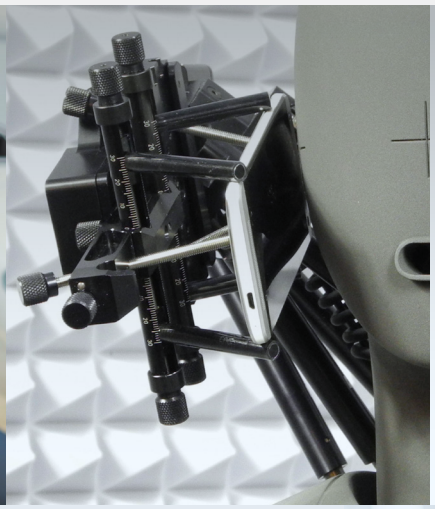
HEAD acoustics

APPLICATION NOTE



ACQUA

Establish 5G / 4G connection to *lab*CORE via Keysight E7515B UXM 5G Wireless Test Platform

Application Note

Establish 5G / 4G connection to *lab*CORE via Keysight E7515B UXM 5G Wireless Test Platform

Revision 0

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1 Introduction

1.1 Brief description

The application note describes a procedure to establish a voice call in a 5G network (VoNR) / 4G network (VoLTE) from HEAD acoustics hardware platform *lab*CORE to a 5G / 4G compatible device under test via Keysight E7515B UXM 5G Wireless Test Platform. The device under test registers via 5G / 4G network at the IMS server of the Keysight Test Platform. *lab*CORE connects to the Keysight Test Platform via wired Ethernet and also registers at its IMS server. Then, HEAD acoustics' analysis software ACQUA establishes a voice call between *lab*CORE and the device under test.

The document is written assuming that the user has an advanced knowledge of handling HEAD acoustics equipment and Keysight E7515B UXM 5G. HEAD acoustics will not respond to support requests concerning general handling and technical configuration of Keysight E7515B UXM 5G.

1.2 Reference documentation

Document name
*lab*CORE Manual
HMS II Manual
ACQUA Online Help
Keysight E7515B UXM 5G Wireless Test Platform User Manual

1.3 Acronyms and abbreviations

Acronym / abbreviation	**Description**
ACQUA	Advanced Communication Quality Analysis
AMR	Adaptive multi-rate
dB	Decibel
dBm	Decibel-milliwatts
DUT	Device under test
GBit	Gigabit
IMS	IP Multimedia Subsystem
IP	Internet Protocol
kHz	Kilohertz
LTE	Long Term Evolution
NR	New Radio
NSA	Non-Standalone
RF	Radio frequency
RTP	Real-time protocol
SA	Standalone
SIM	Subscriber identity module
VoIP	Voice over Internet Protocol
VoNR	Voice over New Radio

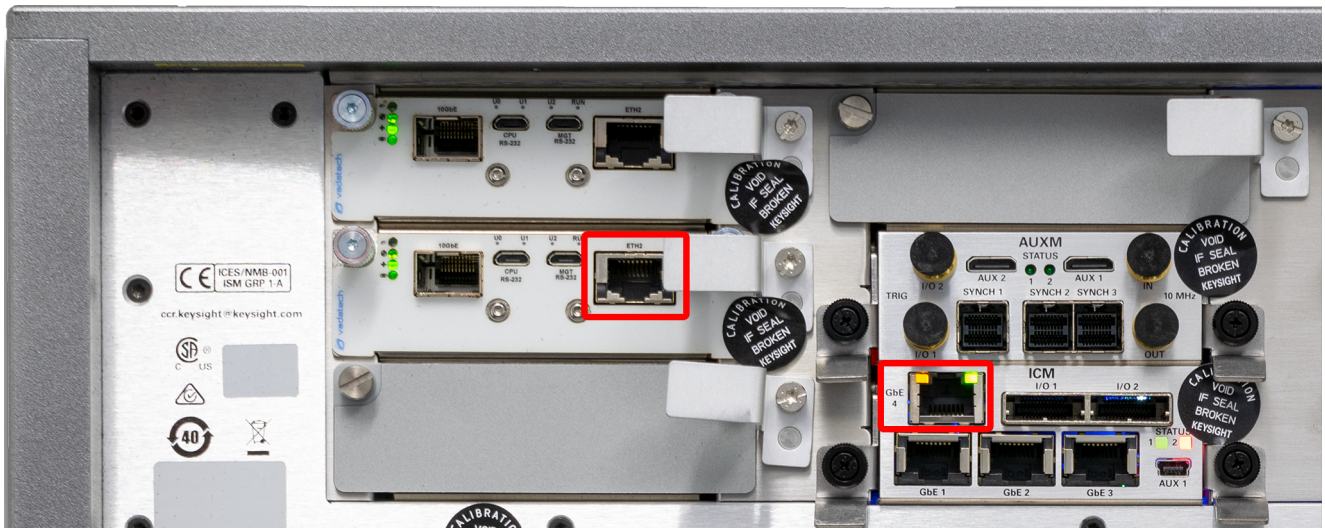
1.4 Applied interfaces at *lab*CORE & Keysight E7515B UXM 5G

1.4.1 *lab*CORE interfaces

1.4.2 Keysight E7515B UXM 5G Wireless Test Platform interfaces front panel

Type N RF antenna connector

1.4.3 Keysight E7515B UXM 5G Wireless Test Platform interfaces back panel



- ETH2 (RJ45) of VDTAMC card in slot 4
- GbE4 (RJ45) of ICM connectors
- Set IP address of ICM_GbE4 to 192.168.2.1 at the Windows network connections of Keysight E7515B UXM 5G

1.5 Equipment list

1.5.1 HEAD acoustics equipment

Required

- *lab*CORE (Code 7700), Modular multi-channel hardware platform
  - *core*BUS (Code 7710), I/O bus mainboard
  - *core*OUT-Amp2 (Code 7720), Power amplifier board
  - *core*IN-Mic4 (Code 7730), Microphone input board
  - *core*IP (Code 7770), VoIP software extension with at least one of the following voice codecs
    - ► *core*IP-AMR (Code 7772), AMR extension
    - ► *core*IP-EVS (Code 7773), EVS extension
- ACQUA (Code 6810), Advanced Communication Quality Analysis software
- HMS II.3 (Code 1230), HEAD measurement system with ear simulator and artificial mouth

Optional

- *lab*CORE extensions depending on device under test and/or application case
  - *core*IP-IMP (Code 7771), VoIP impairment extension
  - *core*BEQ (Code 7741), Binaural equalization
- Any HEAD acoustics handset positioner
  - HHP IV (Code 1406), Motorized handset positioner
  - HHP III.1 (Code 1403), Handset positioner

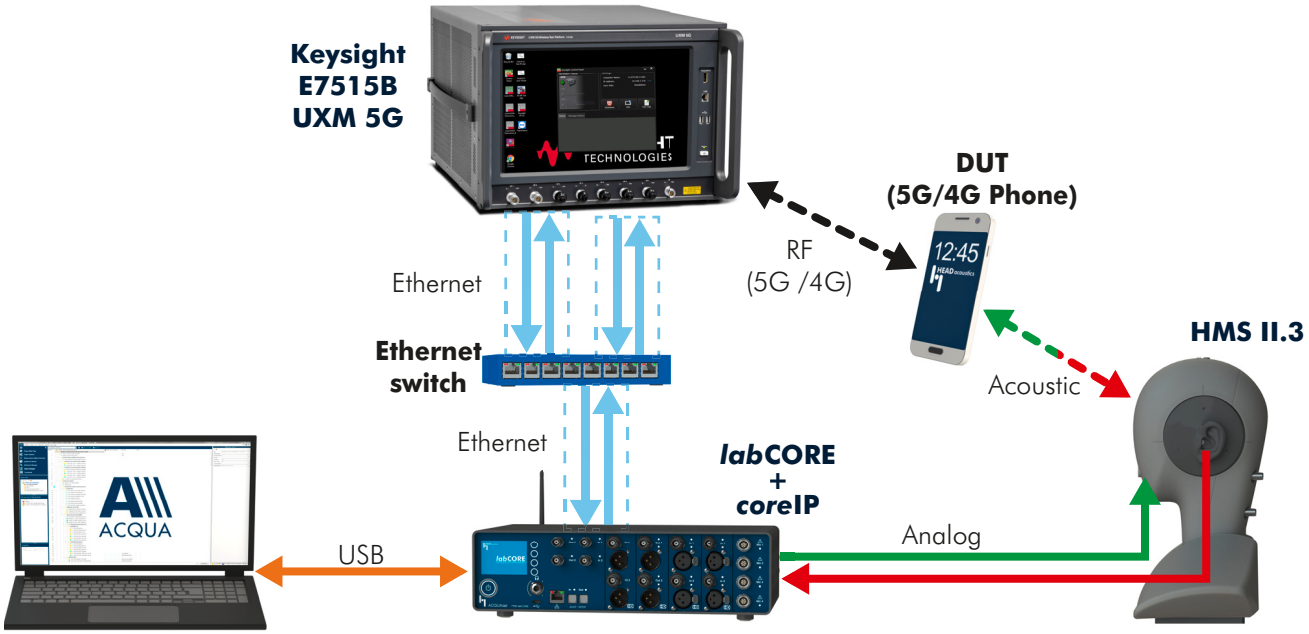
1.5.2 Keysight equipment

- Keysight E7515B UXM 5G Wireless Test Platform
- Keysight C8700200A Test Application Framework
- Keysight C8700201A IMS-SIP Server Emulator running

1.5.3 Third party equipment

- Ethernet switch (100/1000 Mbit/s)
- 3 x Ethernet cable
- RF antenna
- PC for ACQUA software
- DUT
- Test SIM card

1.6 Configuration example (exemplary)



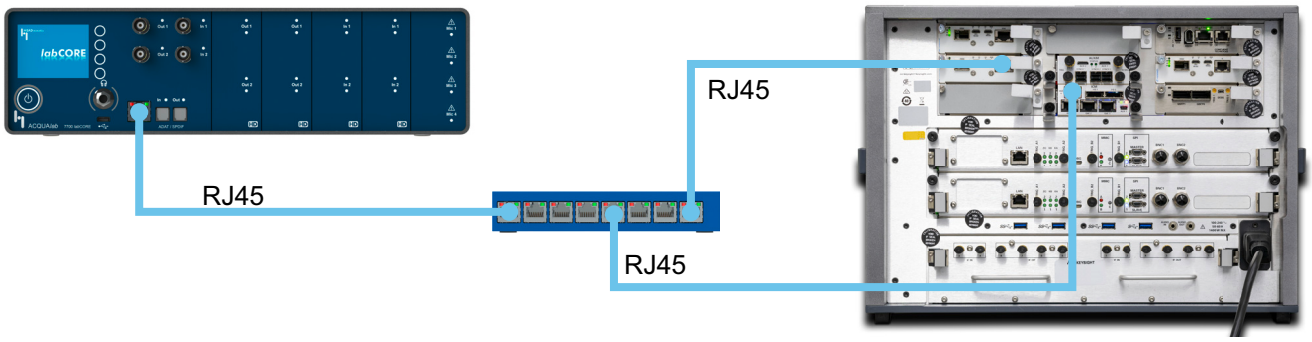
1.7 Cabling

1.7.1 Antenna

Attach the main antenna to one of the Type N connectors (e.g. RF1 is used for NR SA by default) on the front panel of the UXM5G.

If RFIO port mapping is defined in Keysight's HCCU web interface, then ensure that the selected RF port matches that used for the NR main TxRx antenna.

1.7.2 *lab*CORE to Keysight E7515B UXM 5G



- Connect one Ethernet cable to the Ethernet socket at the front panel of *lab*CORE and to one random RJ45 socket of the Ethernet switch.
- Connect one Ethernet cable to ETH2 of VDTAMC card in slot 4 at the back panel of Keysight E7515B UXM 5G and to one random RJ45 socket of the Ethernet switch.
- Connect one Ethernet cable to ICM GbE4 at the back panel of Keysight E7515B UXM 5G and to one random RJ45 socket of the Ethernet switch.

2 Keysight E7515B UXM 5G configuration

2.1 5G NR connection establishment

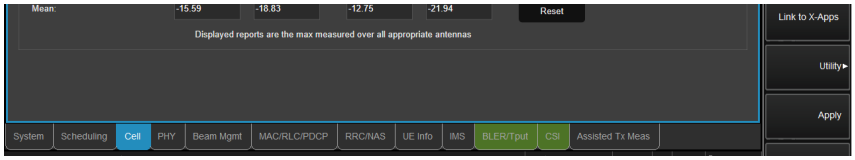
2.1.1 Preparations

- Interconnect the hardware according to chapter 1.6 and chapter 1.7
- Boot up Keysight E7515B UXM 5G
- Open Keysight HCCU on Keysight E7515B UXM 5G and select the appropriate NR Standalone scenario
- Open 5G NR Test App on Keysight E7515B UXM 5G
- Boot up PC and start ACQUA
- Boot up *lab*CORE
- Insert test SIM card into DUT and boot up DUT

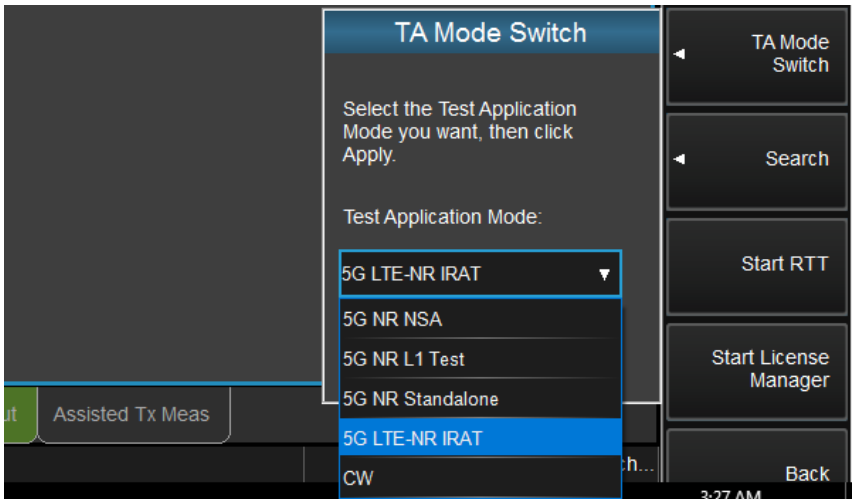
2.1.2 5G NR connection procedure – IPv4

Keysight E7515B UXM 5G

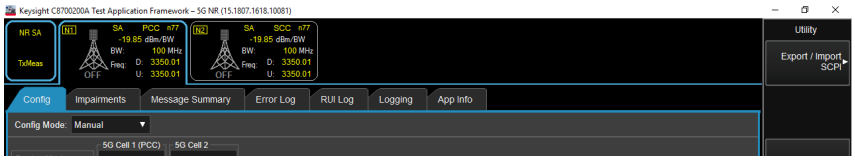
1. Select Utility.



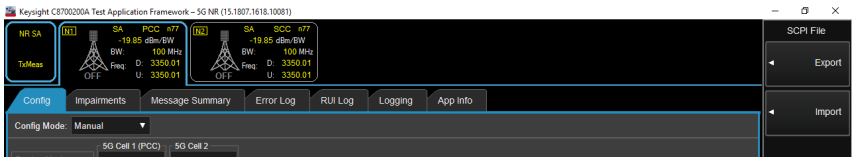
2. Select TA Mode Switch.
3. Select 5G NR Standalone.



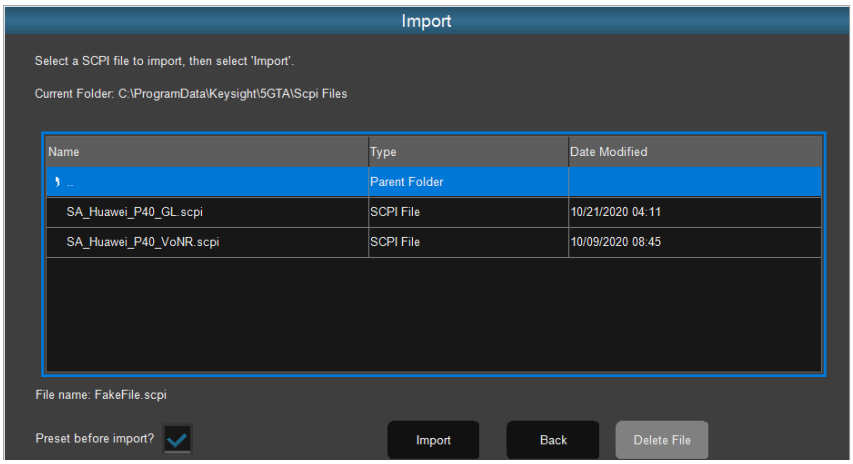
4. Select Export/Import SCPI.



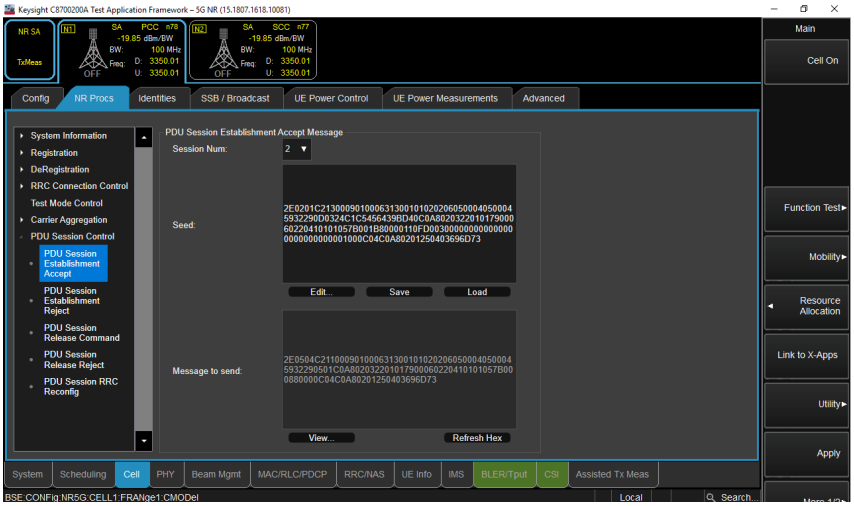
5. Select Import.



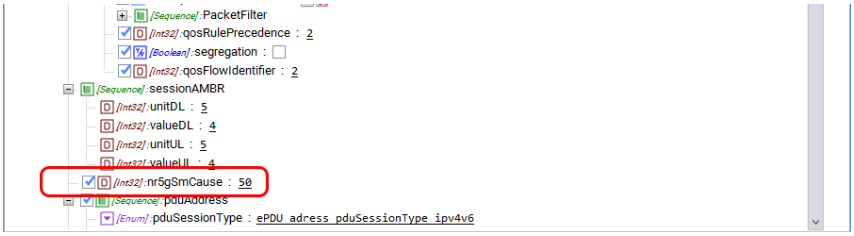
6. Browse to the directory of the SCPI file and select Import.



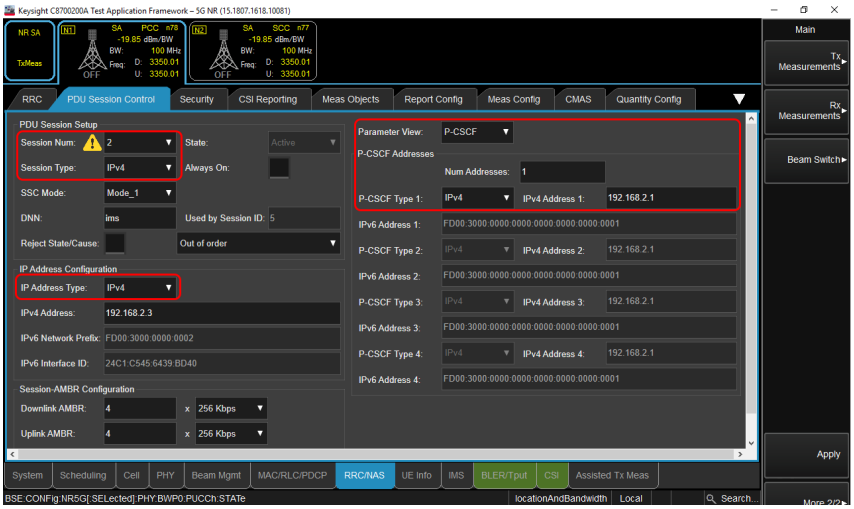
7. Go to tab Cell.
8. Got to sub tab NR Procs.
9. Expand PDU Session Control.
10. Select PDU Session Establishment Accept.
11. Select Edit.



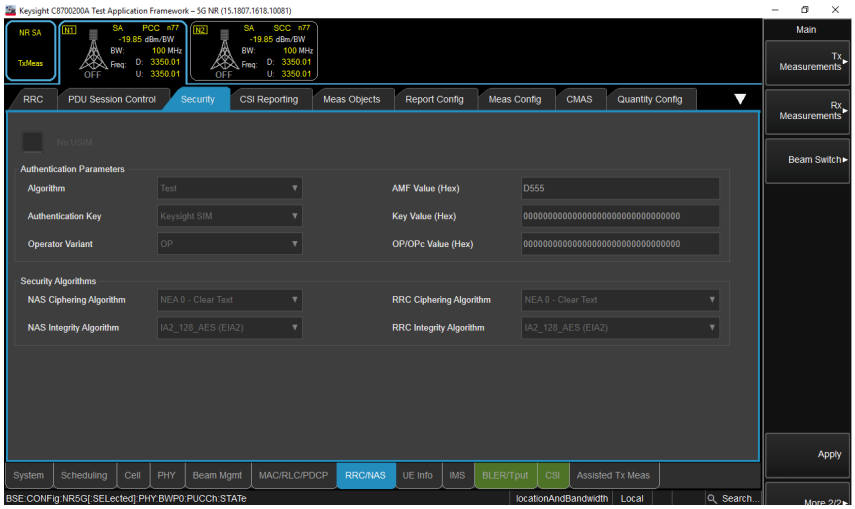
12. Check nr5gSmCause.
13. Set the value to 50.
14. Select OK.



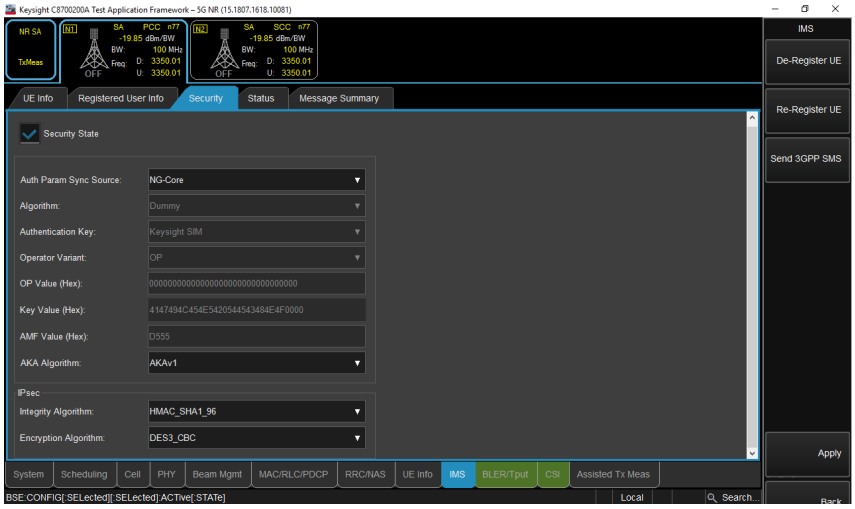
15. Go to tab RRC/NAS.
16. Go to sub tab PDU Session Control.
17. Set Session Num to 2.
18. Set Session Type to IPv4.
19. Set IP Address Type to IPv4.
20. Set Parameter View to P-CSCF.
21. Set Num Addresses to 1.
22. Set P-CSCF Type 1 to IPv4.
23. Enter appropriate IP address to IPv4 Address 1.



24. Go to sub tab Security.
25. Enable and enter the appropriate security settings if necessary.

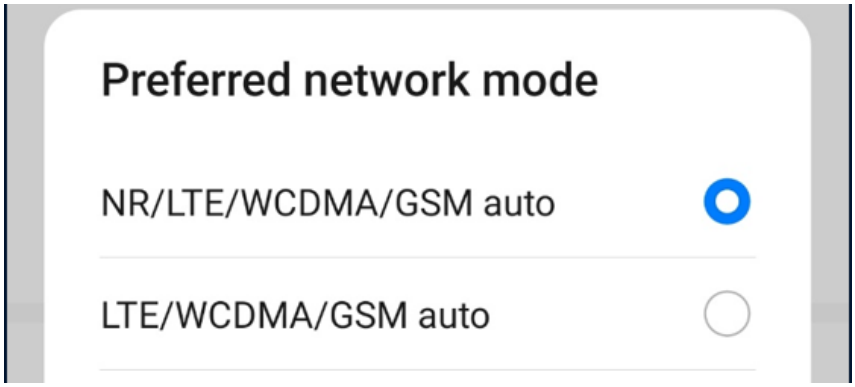


26. Go to tab IMS.
27. Go to sub tab Security.
28. Enable and enter appropriate security settings according to the applied SIM card.

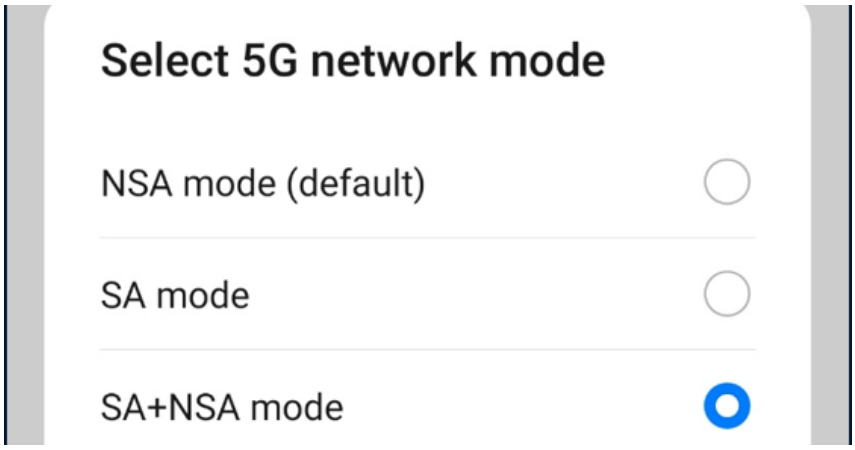


DUT (exemplary)

1. Go to Settings.
2. Set NR as preferred network.



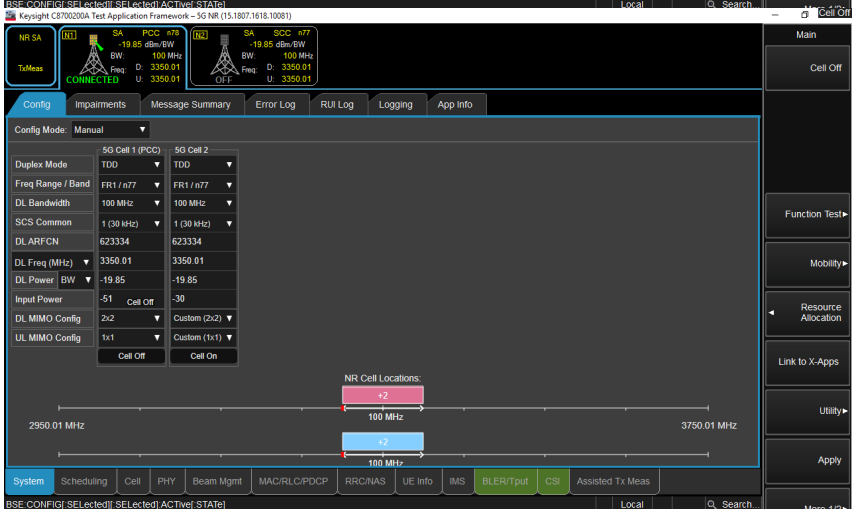
3. Set SA+NSA mode as 5G network mode.



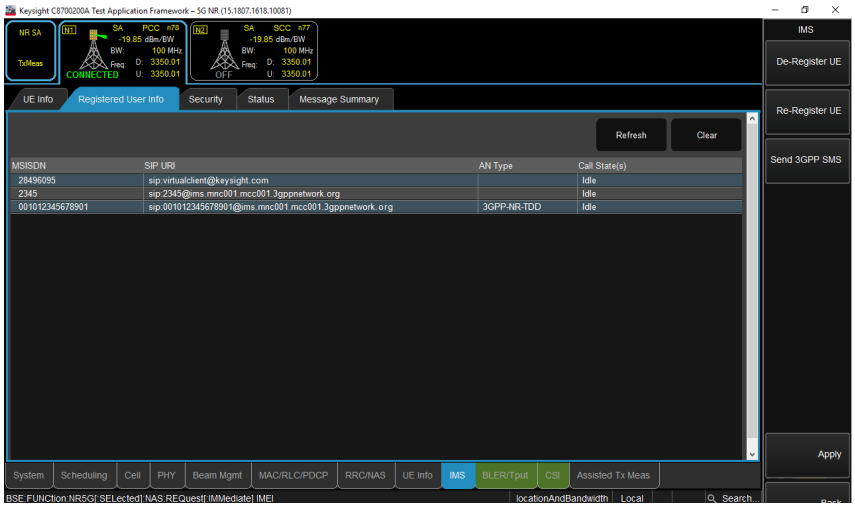
Keysight E7515B UXM 5G

1. Go to tab System.
2. Go to sub tab Config.
3. Change or verify the applied settings.

4. Turn on 5G cell.



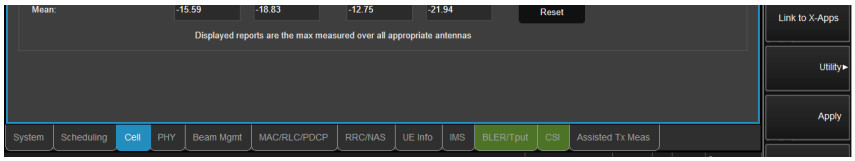
5. Go to tab IMS.
6. Go to sub tab Registered User Info.
7. Verify that the DUT has registered at the IMS server.
8. The SIP URI of the DUT is required for the call establishment with ACQUA.
9. Continue with chapter 3.1 → chapter 3.2 → chapter 3.4.



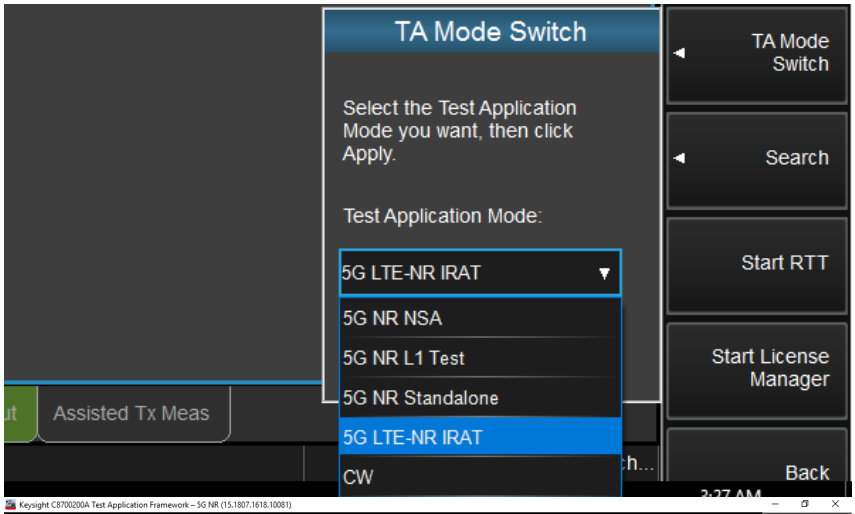
2.1.3 5G NR connection procedure – IPv6

Keysight E7515B UXM 5G

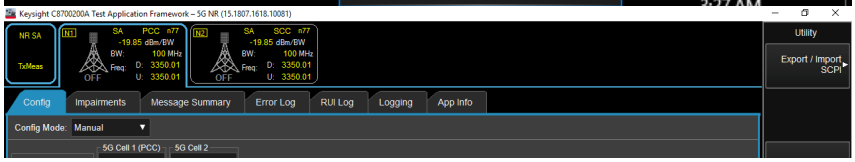
1. Select Utility.



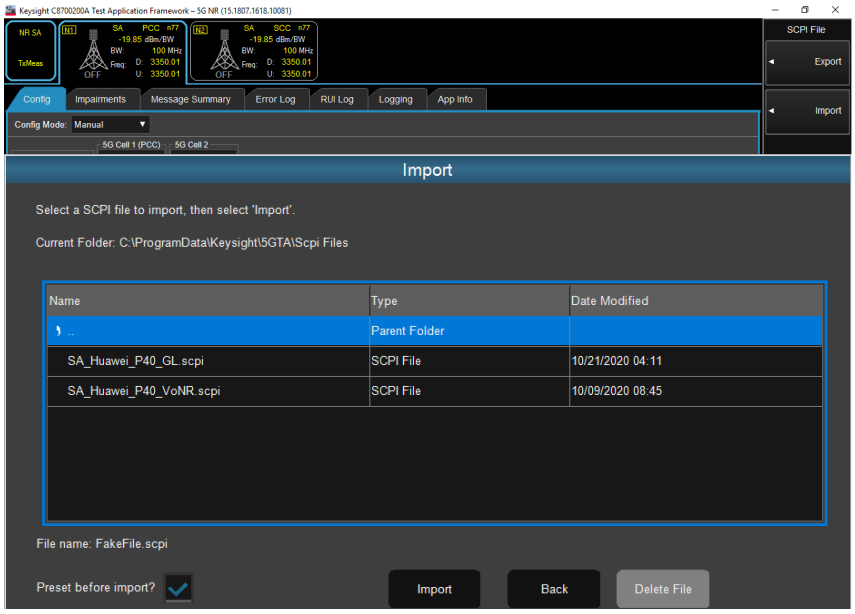
2. Select TA Mode Switch.
3. Select 5G NR Standalone.



4. Select Export/Import SCPI.

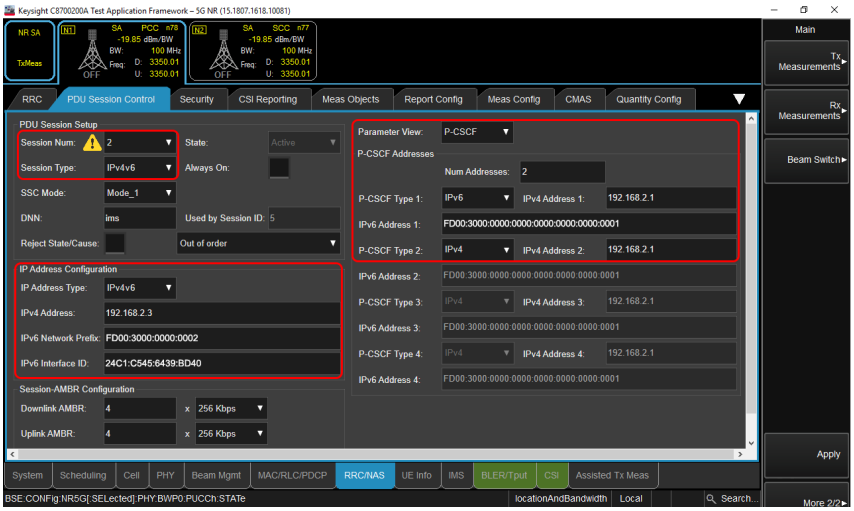


5. Select Import.

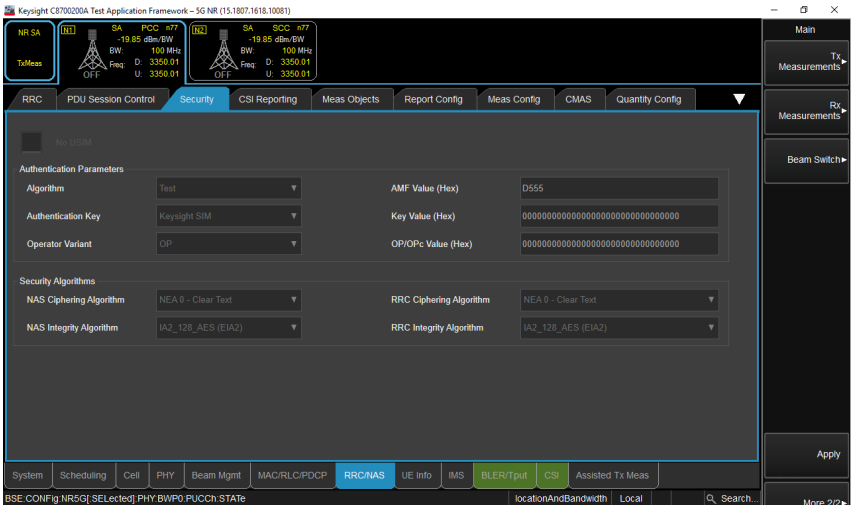


6. Browse to the directory of the SCPI file and select Import.

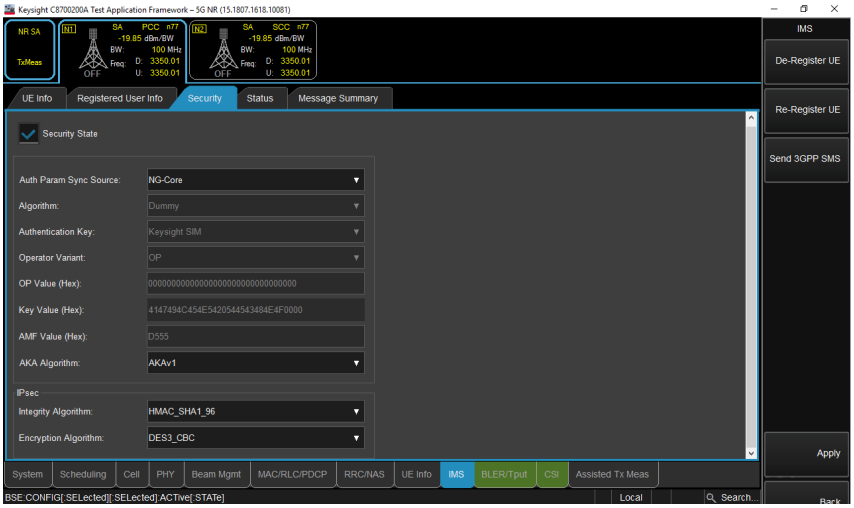
7. Go to tab RRC/NAS.
8. Go to sub tab PDU Session Control.
9. Set Session Num to 2.
10. Set Session Type to IPv4v6.
11. Set Address Type to IPv4v6.
12. Set Parameter View to P-CSCF.
13. Set Num Addresses to 2.
14. Set P-CSCF Type 1 to IPv6.
15. Enter appropriate IP address to IPv6 Address 1.



16. Go to sub tab Security.
17. Enable and enter appropriate security settings according to the applied SIM card..

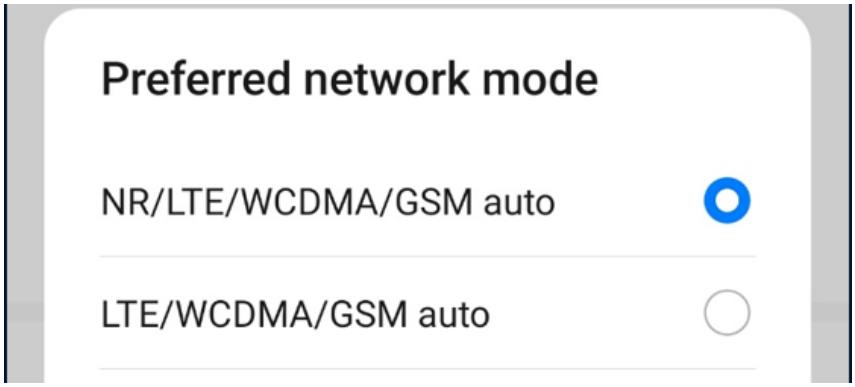


18. Go to tab IMS.
19. Go to sub tab Security.
20. Enable and enter the appropriate security settings according to applied SIM card.

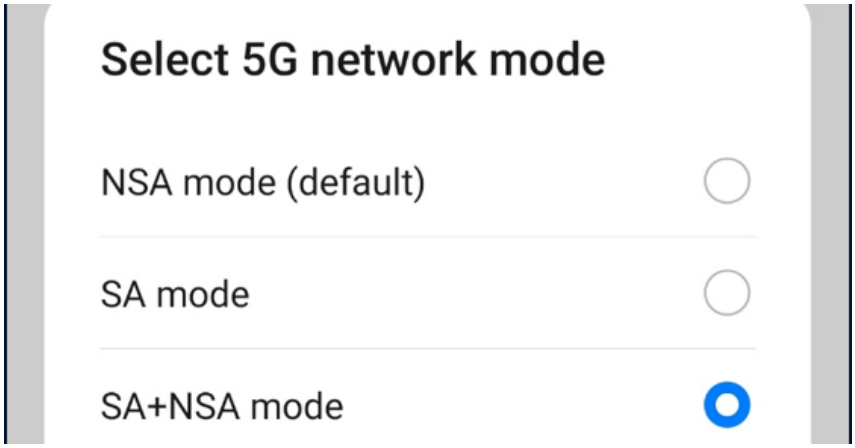


DUT (exemplary)

1. Go to Settings.
2. Set NR as preferred network.



3. Set SA+NSA mode as 5G network mode.

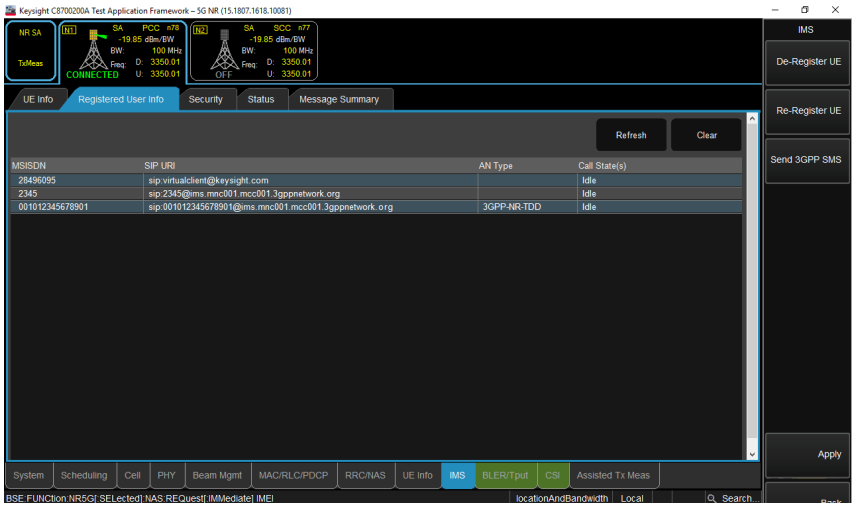


Keysight E7515B UXM 5G

1. Go to tab System.
2. Go to sub tab Config.

3. Turn on 5G cell.

4. Go to tab IMS.
5. Go to sub tab Registered User Info.
6. Verify that the DUT has registered at the IMS server.
7. The SIP URI of the DUT is required for the call establishment with ACQUA.
8. Continue with chapter 3.1 → chapter 3.3 → chapter 3.4.



2.2 4G connection establishment

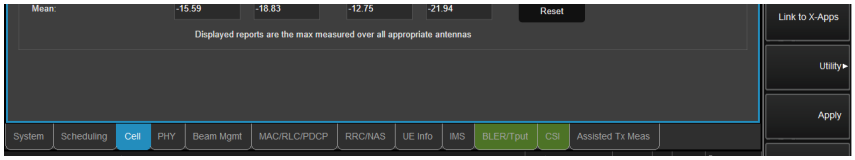
2.2.1 Preparations

- Interconnect the hardware according to chapter 1.6 and chapter 1.7
- Boot up Keysight E7515B UXM 5G
- Open Keysight HCCU on Keysight E7515B UXM 5G and select the appropriate LTE scenario
- Open 5G NR Test App on Keysight E7515B UXM 5G
- Boot up PC and start ACQUA
- Boot up *lab*CORE
- Insert test SIM card into DUT and boot up DUT

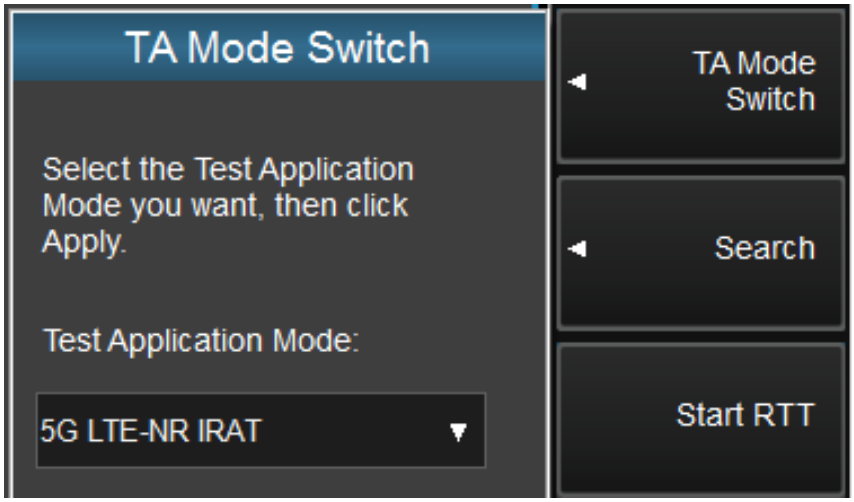
2.2.2 4G connection procedure – IPv4 & IPv6

Keysight E7515B UXM 5G

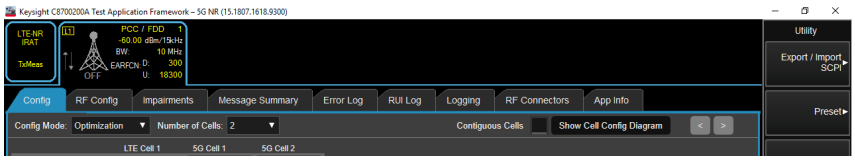
1. Select Utility.



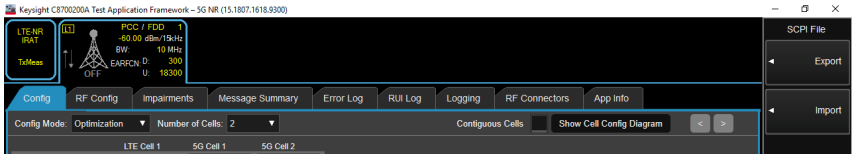
2. Select TA Mode Switch.
3. Select 5G NR LTE IRAT.



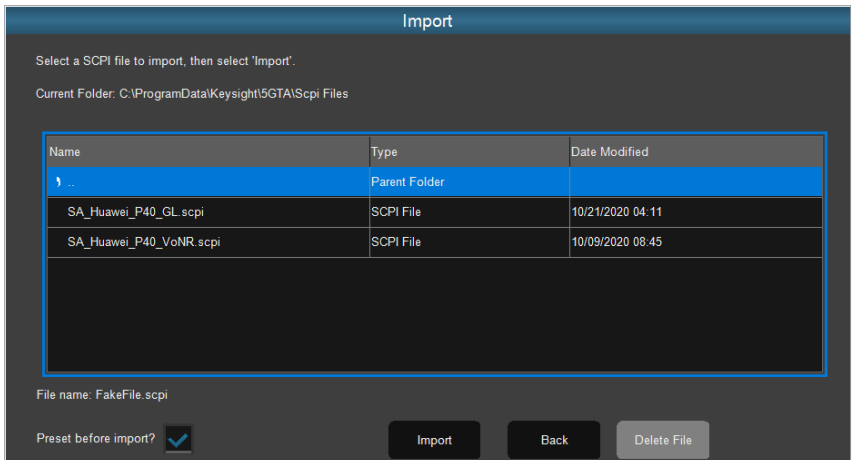
4. Select Export/Import SCPI.



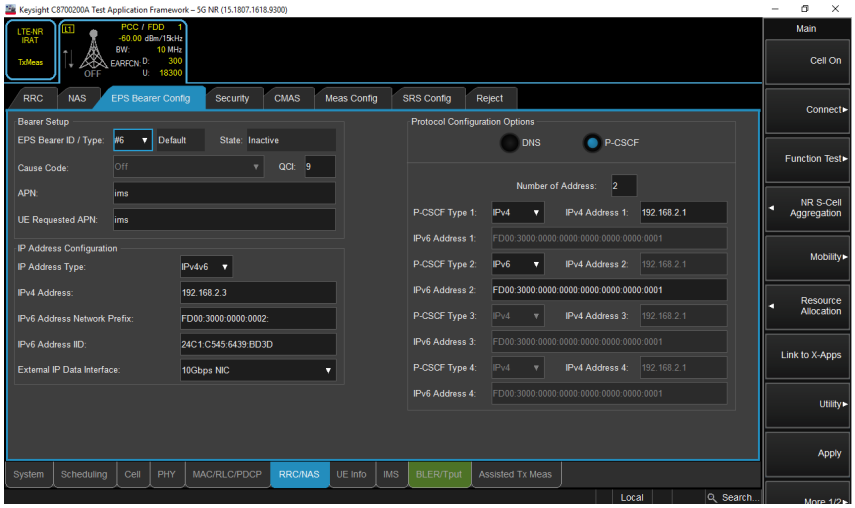
5. Select Import.



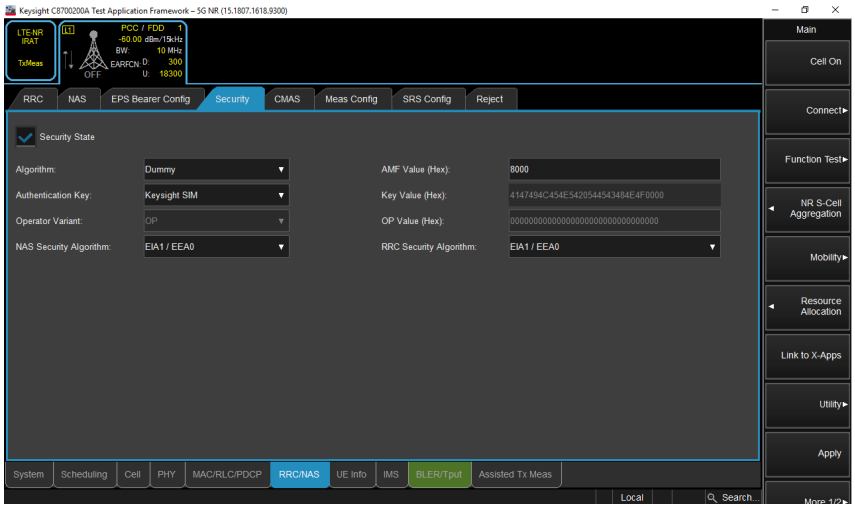
6. Browse to the directory of the SCPI file and select Import.



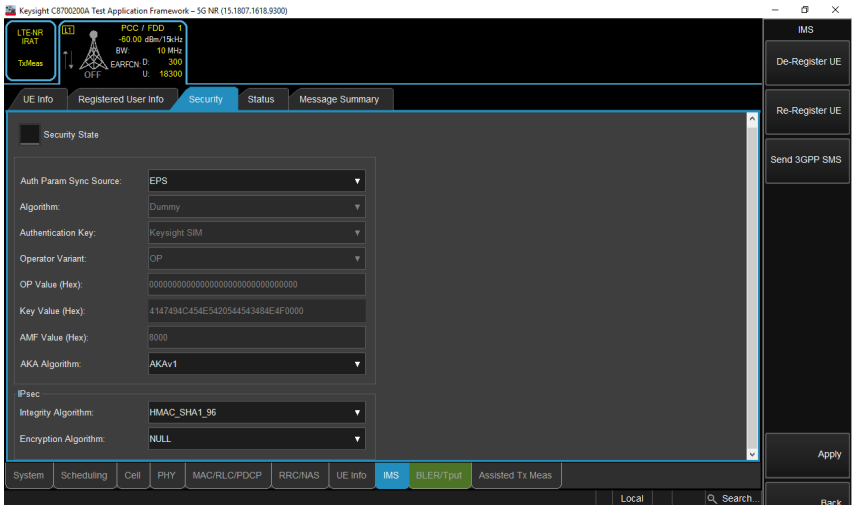
7. Go to tab RRC/NAS.
8. Go to sub tab EPS Bearer Config.
9. Set Session Num to 2.
10. Set Address Type to IPv4v6.
11. Set Protocol Configuration Options to P-CSCF.
12. Set Num Addresses to 2.
13. Set P-CSCF Type 1 to IPv4.
14. Enter appropriate IP address to IPv4 Address 1.
15. Set P-CSCF Type 2 to IPv6.
16. Enter appropriate IP address to IPv6 Address 2.



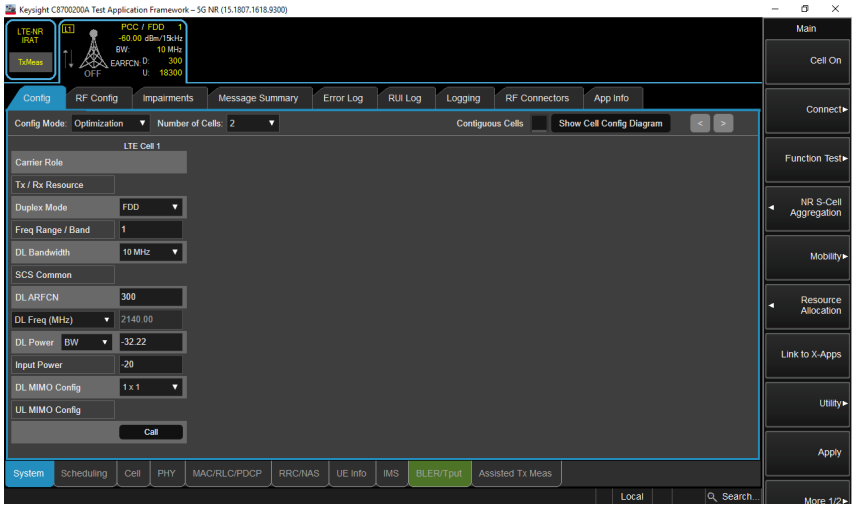
17. Go to sub tab Security.
18. Enable and enter the appropriate security settings if necessary.



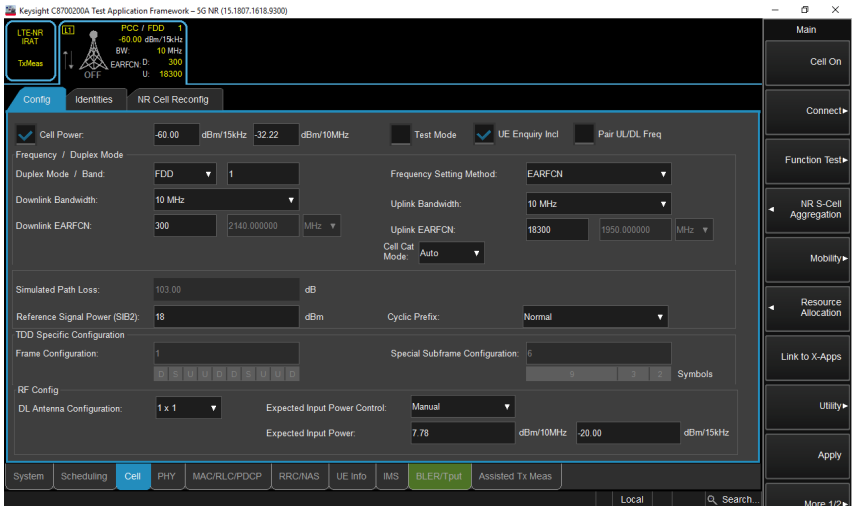
19. Go to tab IMS.
20. Go to sub tab Security.
21. Enable and enter the appropriate security settings according to applied SIM card.



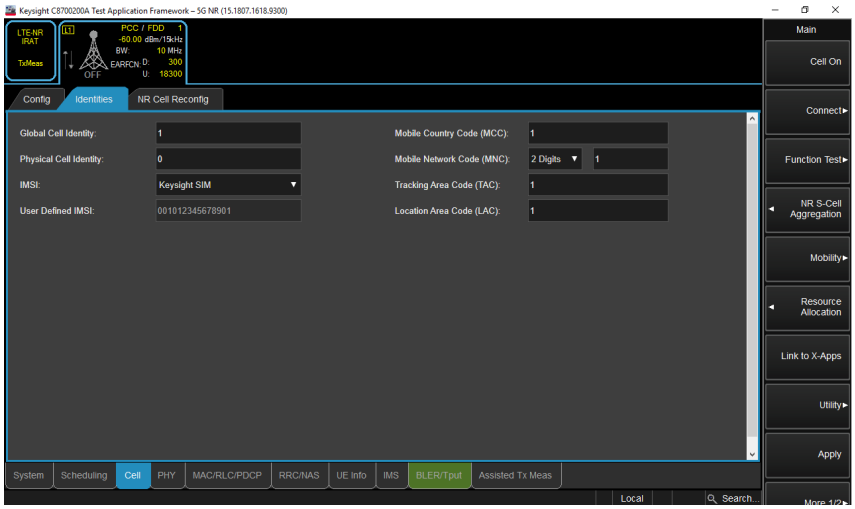
22. Go to tab System.
23. Go to sub tab Config.
24. Change or verify the applied settings.



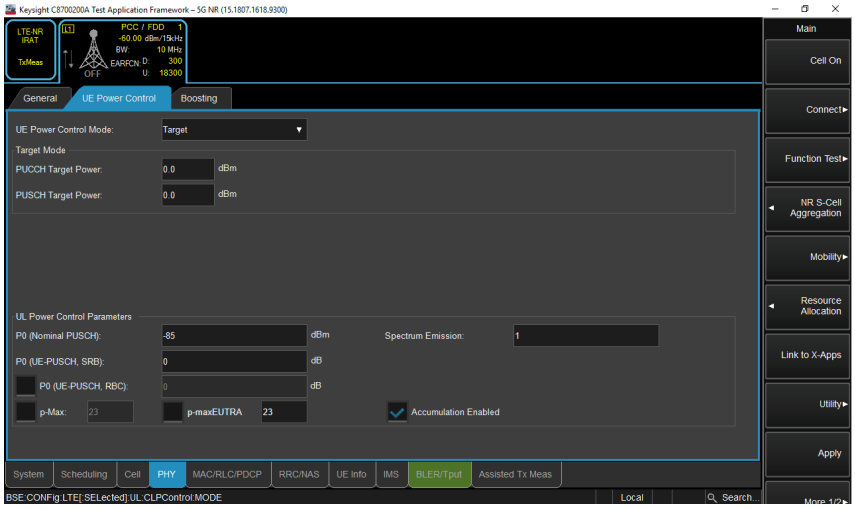
25. Go to tab Cell.
26. Go to sub tab Config.
27. Change or verify the applied settings.



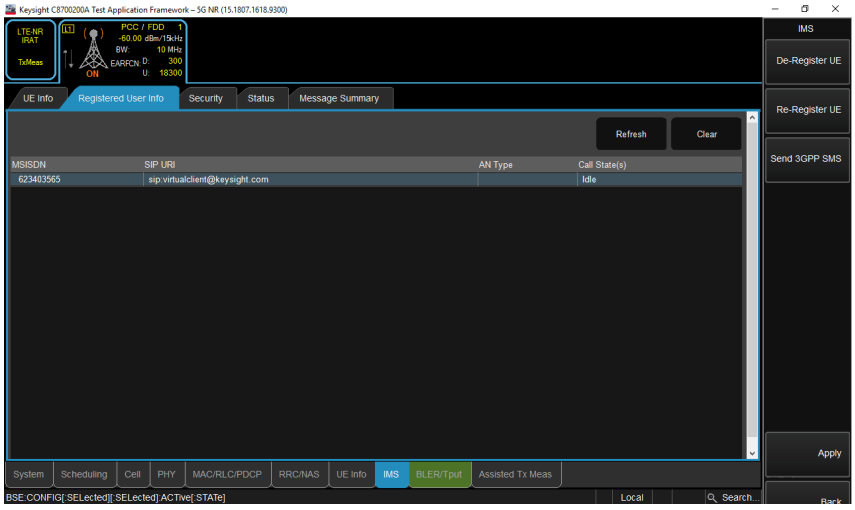
28. Go to sub tab Identities.
29. Change or verify the applied settings.



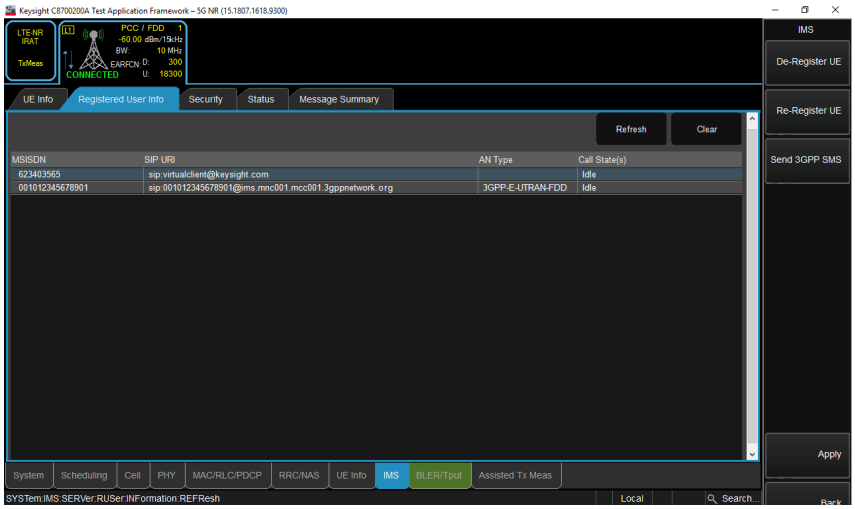
30. Go to tab PHY.
31. Go to sub tab UE Power Control.
32. Change or verify the applied settings.



33. Go to tab IMS.
34. Go to sub tab Registered User Info.
35. Turn on 4G cell.



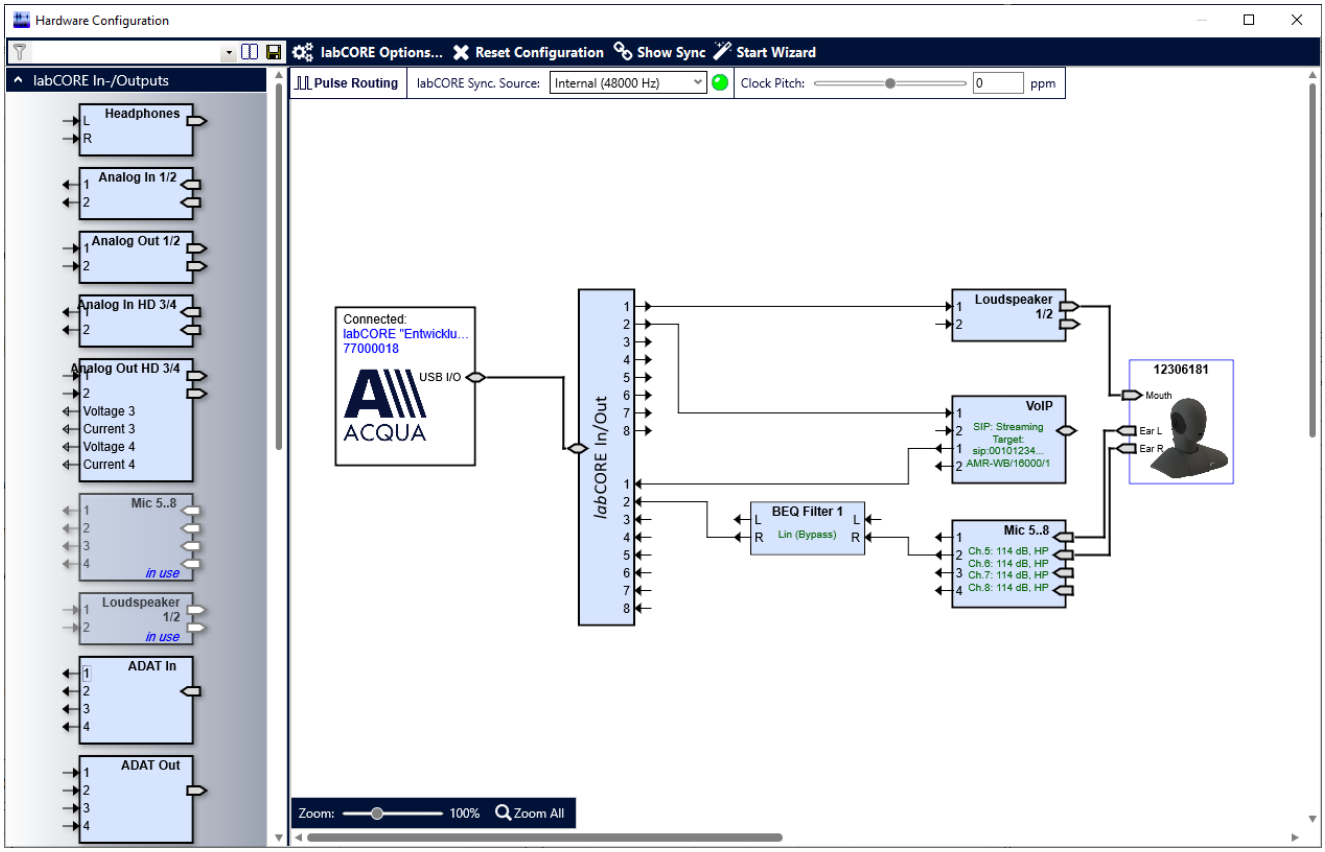
36. The DUT registers at the IMS server.
37. Continue with chapter 3.1 → chapter 3.2 / chapter 3.3 → chapter 3.4.



3 ACQUA configuration

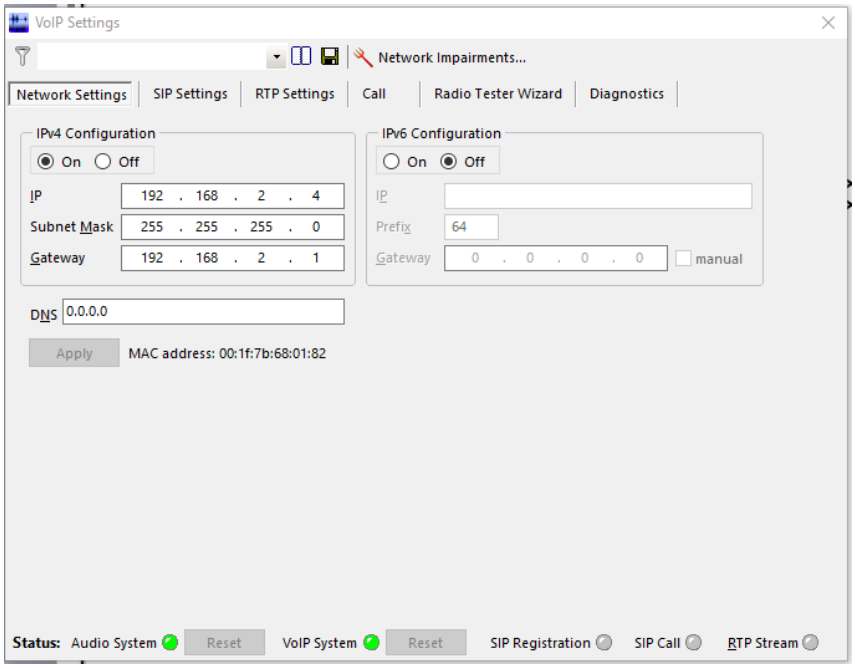
3.1 General settings

1. Start Hardware Configuration.
2. Drag and drop the blocks from the left selection area into the right configuration area. Interconnect the blocks according to the applied connections.
   Alternatively, use the Hardware Configuration Wizard.

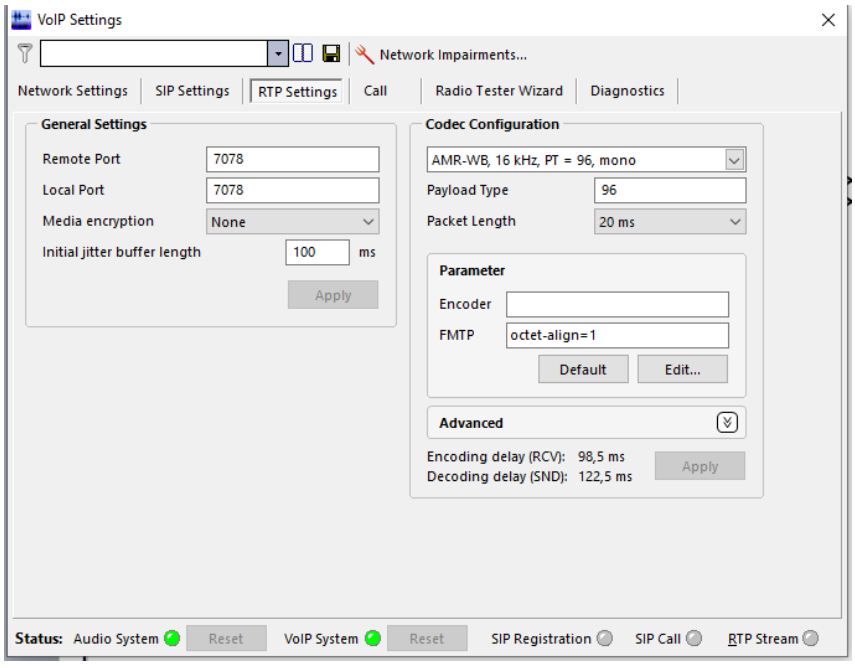


3.2 IPv4 settings

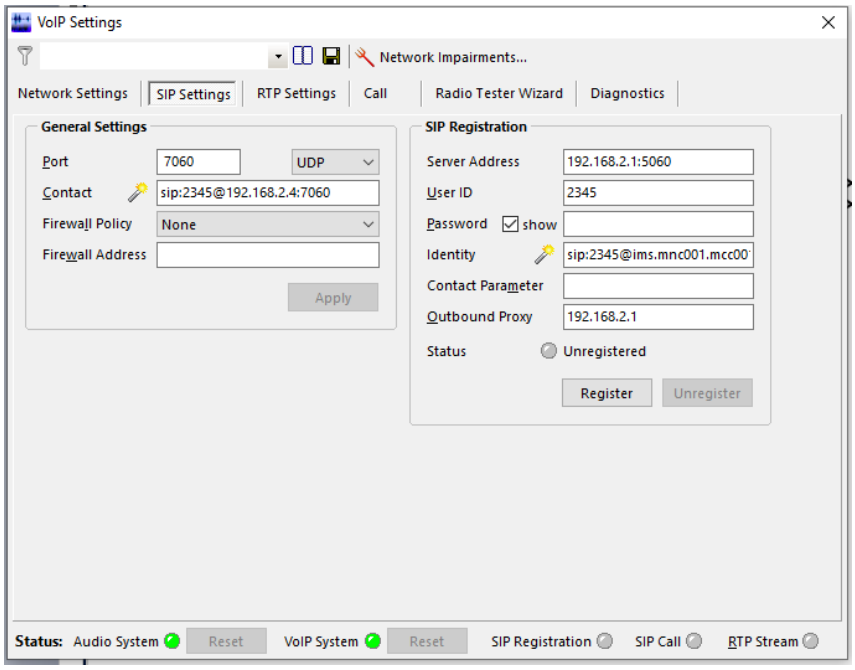
1. Open VoIP settings.
2. Go to tab Network Settings.
3. Enable IPv4 Configuration as Internet protocol.
4. Enter addresses according to Keysight E7515B UXM 5G.



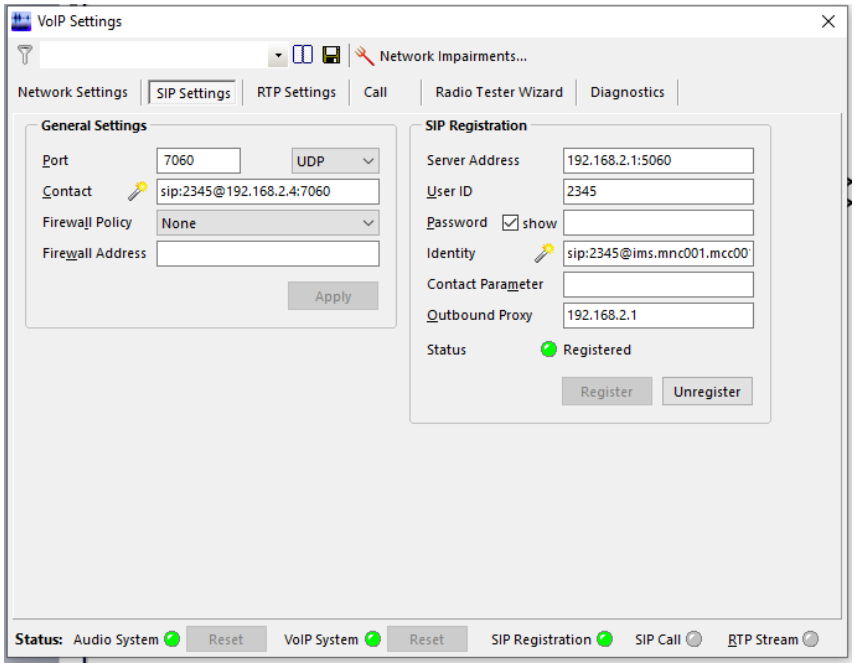
5. Got to tab RTP Settings.
6. Set the appropriate voice codec.



7. Go to tab SIP Settings.
8. Enter the settings according to P-CSCF address and domain from Keysight E7515B UXM 5G.

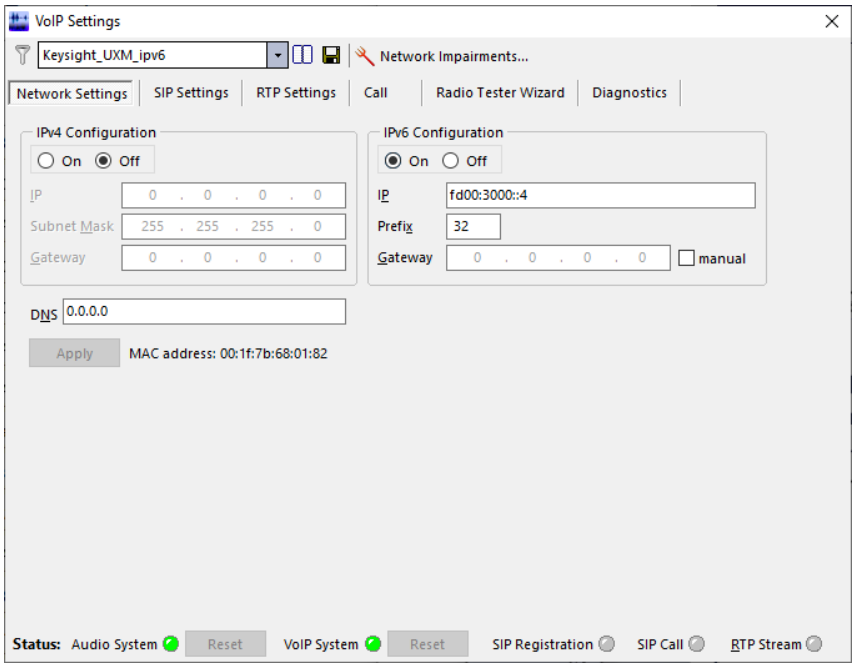


9. Select Register to register *lab*CORE to the IMS server of Keysight E7515B UXM 5G.
10. ACQUA indicates the successful registration via the green virtual LED on screen.

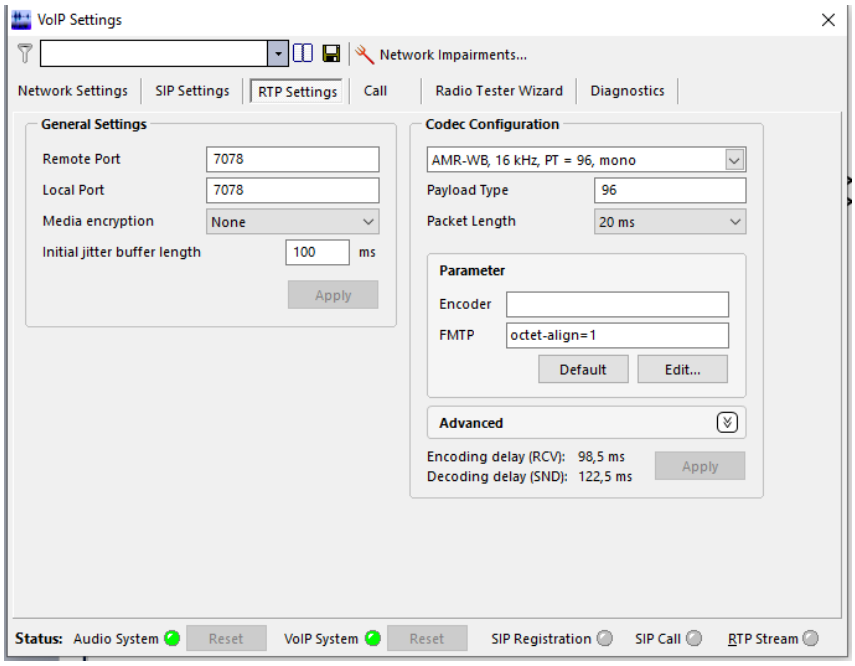


3.3 IPv6 settings

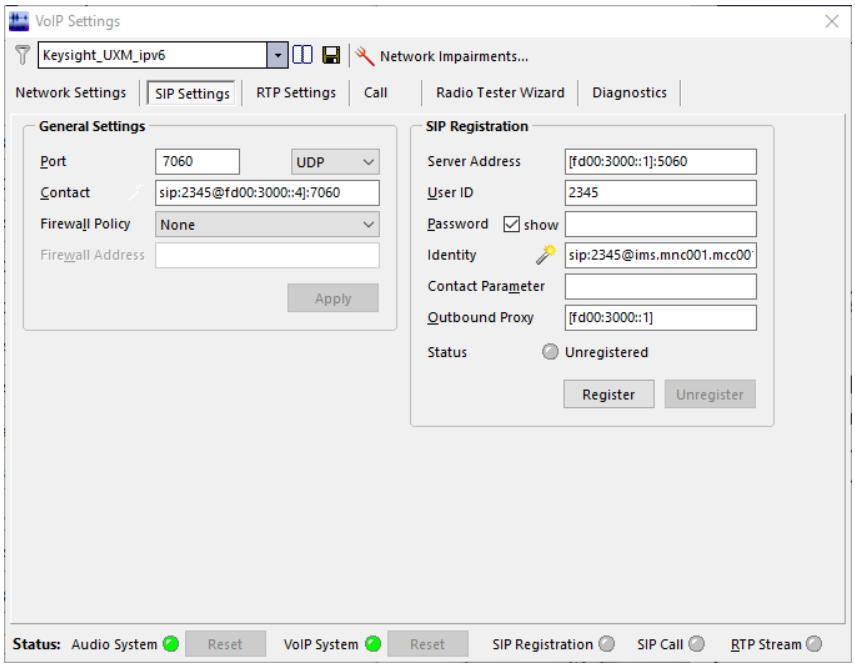
1. Open VoIP settings.
2. Go to tab Network Settings.
3. Enable IPv6 Configuration as Internet protocol.
4. Enter addresses according to Keysight E7515B UXM 5G.



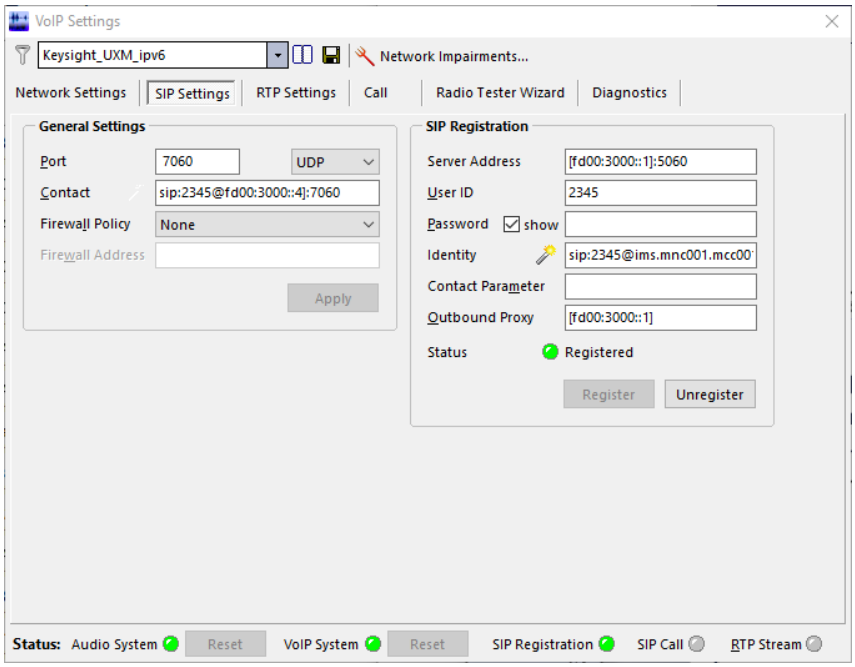
5. Got to tab RTP Settings.
6. Set the appropriate voice codec.



7. Go to tab SIP Settings.
8. Enter the settings according to P-CSCF address and domain from Keysight E7515B UXM 5G.



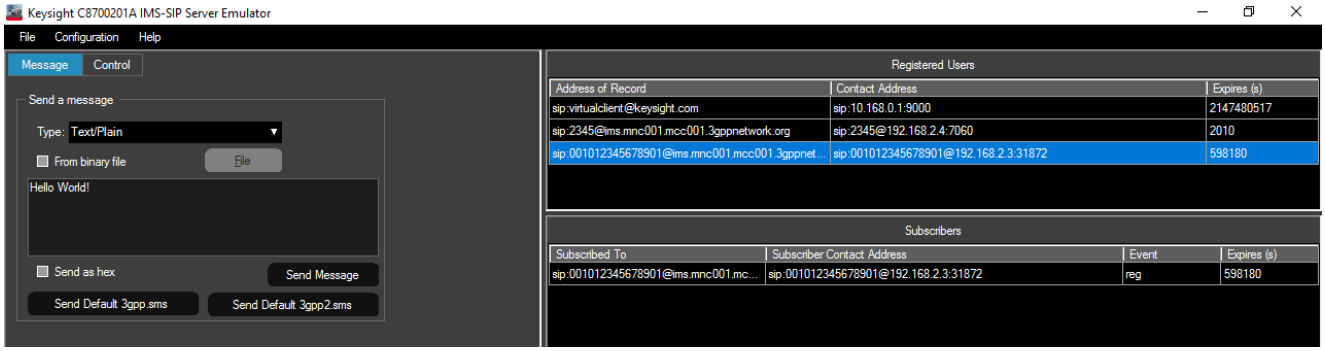
9. Select Register to register *lab*CORE to the IMS server of Keysight E7515B UXM 5G.
10. ACQUA indicates the successful registration via the green virtual LED on screen.



3.4 Call establishment

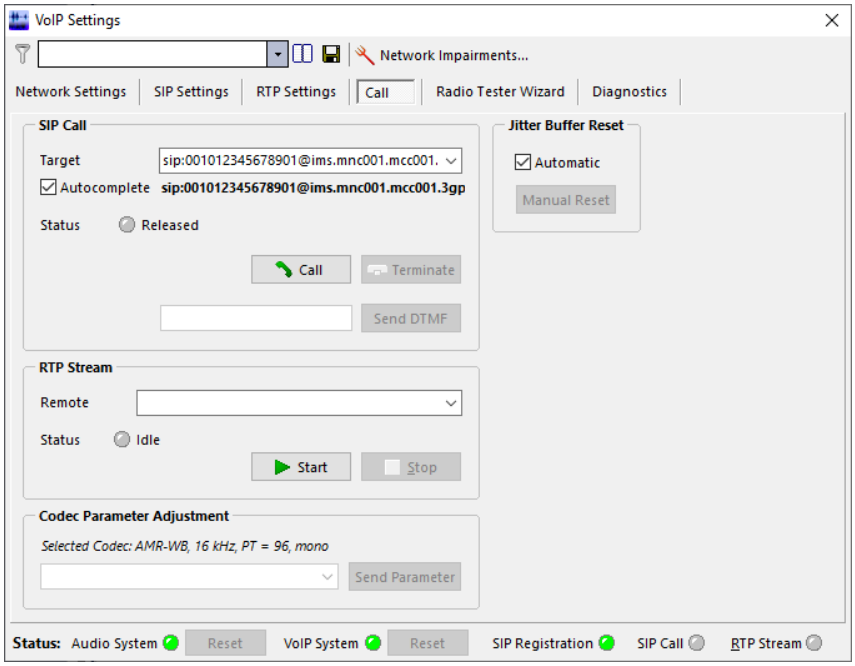
Keysight E7515B UXM 5G

Ensure that all clients are registered at the SIP / IMS server.

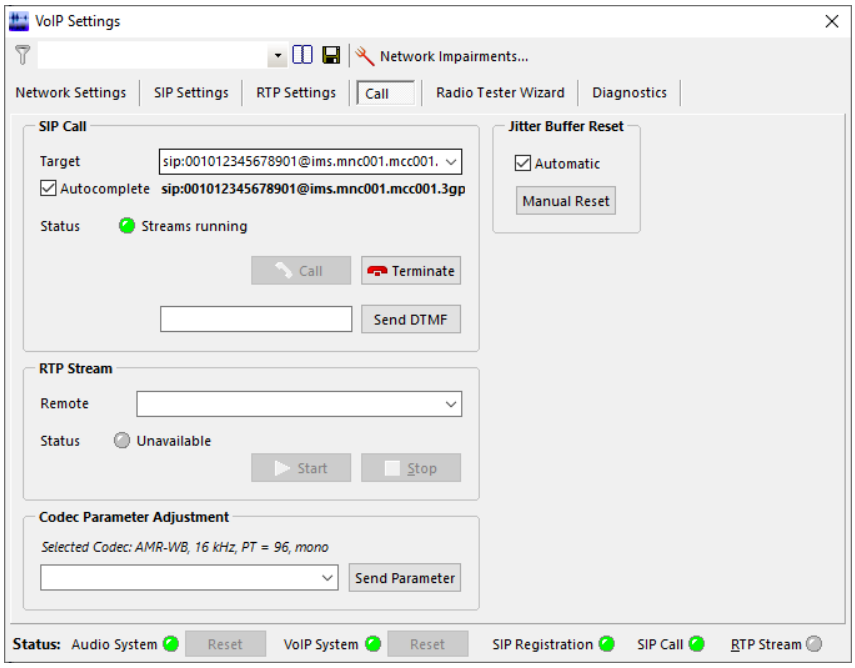


ACQUA PC

1. Go to tab Call.
2. Enable Automatic in section Jitter Buffer Reset.
3. Enter the SIP URI (SIP address) of the DUT in the textbox Target.
4. Select Call.



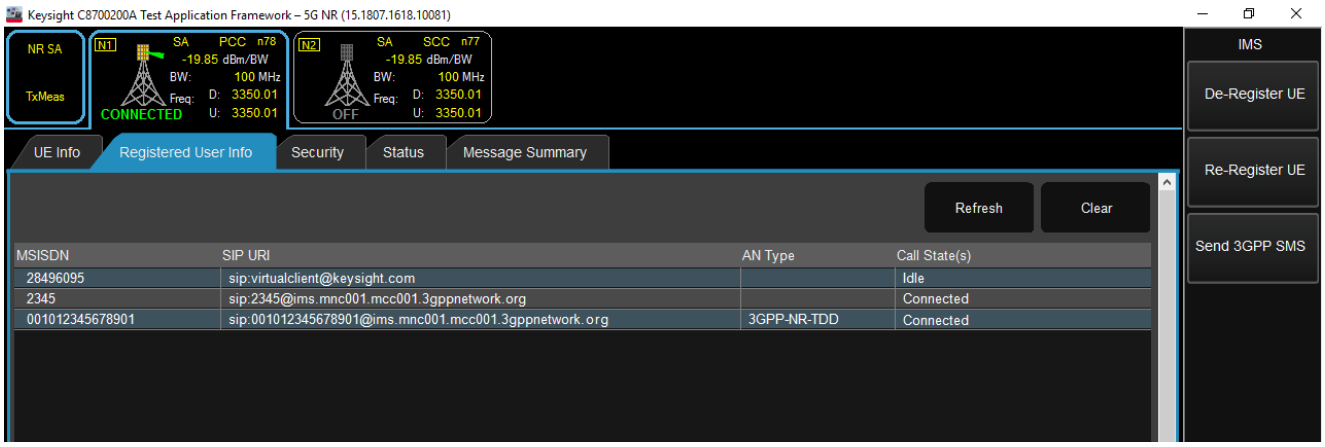
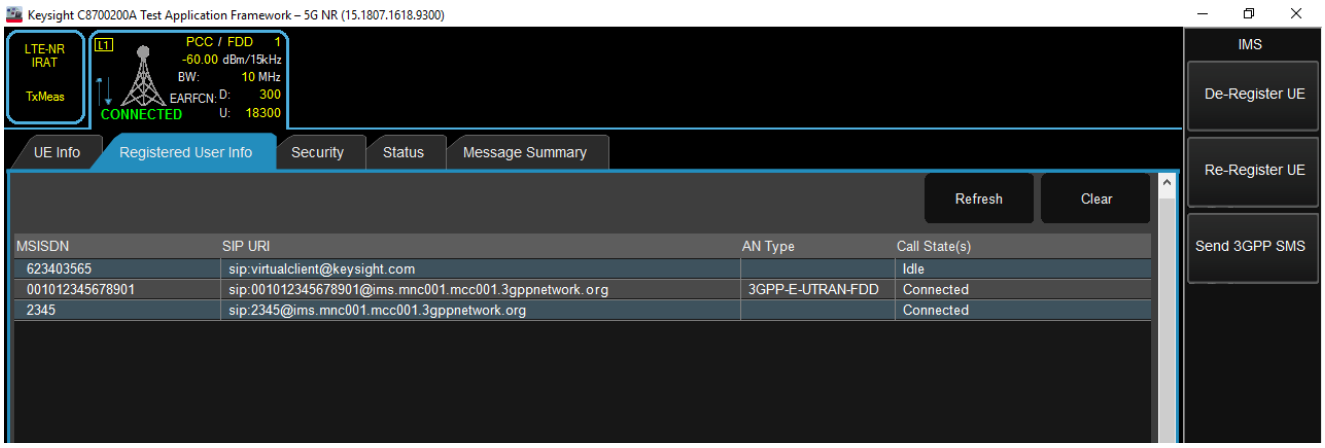
5. The status switches from Released to Streams running. The virtual LED switches from gray to green.



Keysight E7515B UXM 5G

The Call State(s) of DUT and *lab*CORE switches to Connected.

5G NR connection



LTE connection