



5G SEAGUL 5G Seamless Roaming for the Greece- Bulgaria Cross-Border Corridor

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5G SEAGUL Technical Project Manager

5G Seamless Roaming for the Greece-Bulgaria CBC^(*)

CEF-DIG-2021-5GCORRIDORS-WORKS

Main Goal

To deploy SoTA 5G network infrastructure (access, transport, core, edge) to provide seamless, uninterrupted connectivity along 473Km of the Orient/East-Med TEN-T^(**) corridor Sofia-Thessaloniki-Athens, incl. the GR-BG border-crossing of Promahonas/Kulata

Consortium

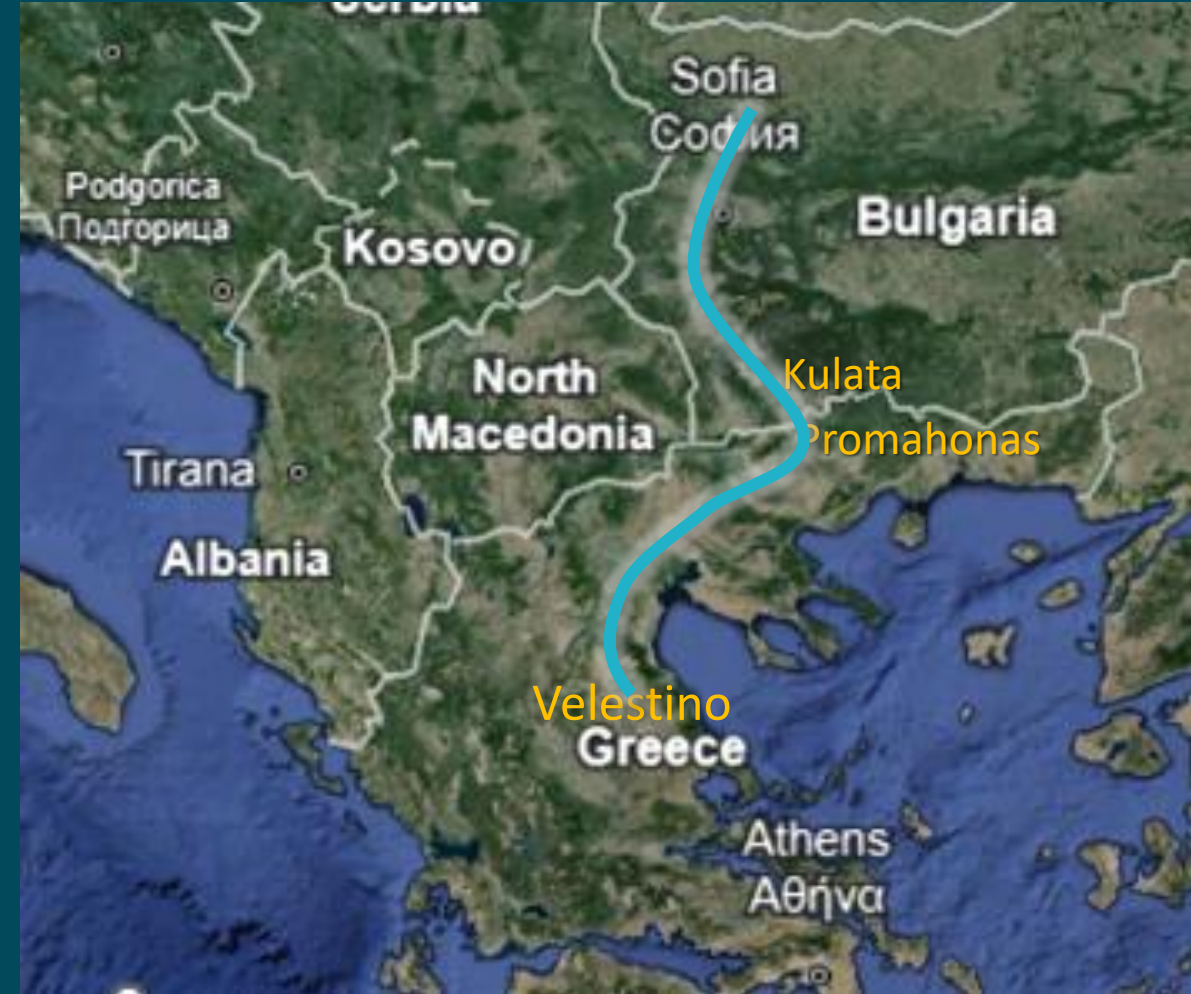
WINGS (GR), COSMOTE TELECOM (GR), A1 (BG)

Duration

3 years (1/1/2023 – 31/12/2025)

Total Budget

11, 5 m€ (50% Funding)



^(*) Cross Border Corridor, ^(**) Trans-European Transport Network

Implementation Approach

Year 1 - 2023



Year 2 - 2024

Year 3 - 2025

Uninterrupted 5G coverage @700 MHz for the 473 km GR-BG corridor & Seamless Roaming

CAM services support 20 Mbps throughput, 20 ms e2e latency and 99% reliability



- ❑ 300 Km (GR) (Velesino – Promahonas) | Upgrade of 66 BS and 12 New Sites (COSMOTE)
- ❑ 173 Km (BG) (Kulata – Sofia) | Upgrade of 39 BS, 13 New Sites (A1BG)

  28
upgrades
1 new

 29
upgrades

  29
upgrades

 2 new

  9
upgrades
11 new

 10
upgrades
11 new (6
DAS)




Phase 1: NSA Implementation

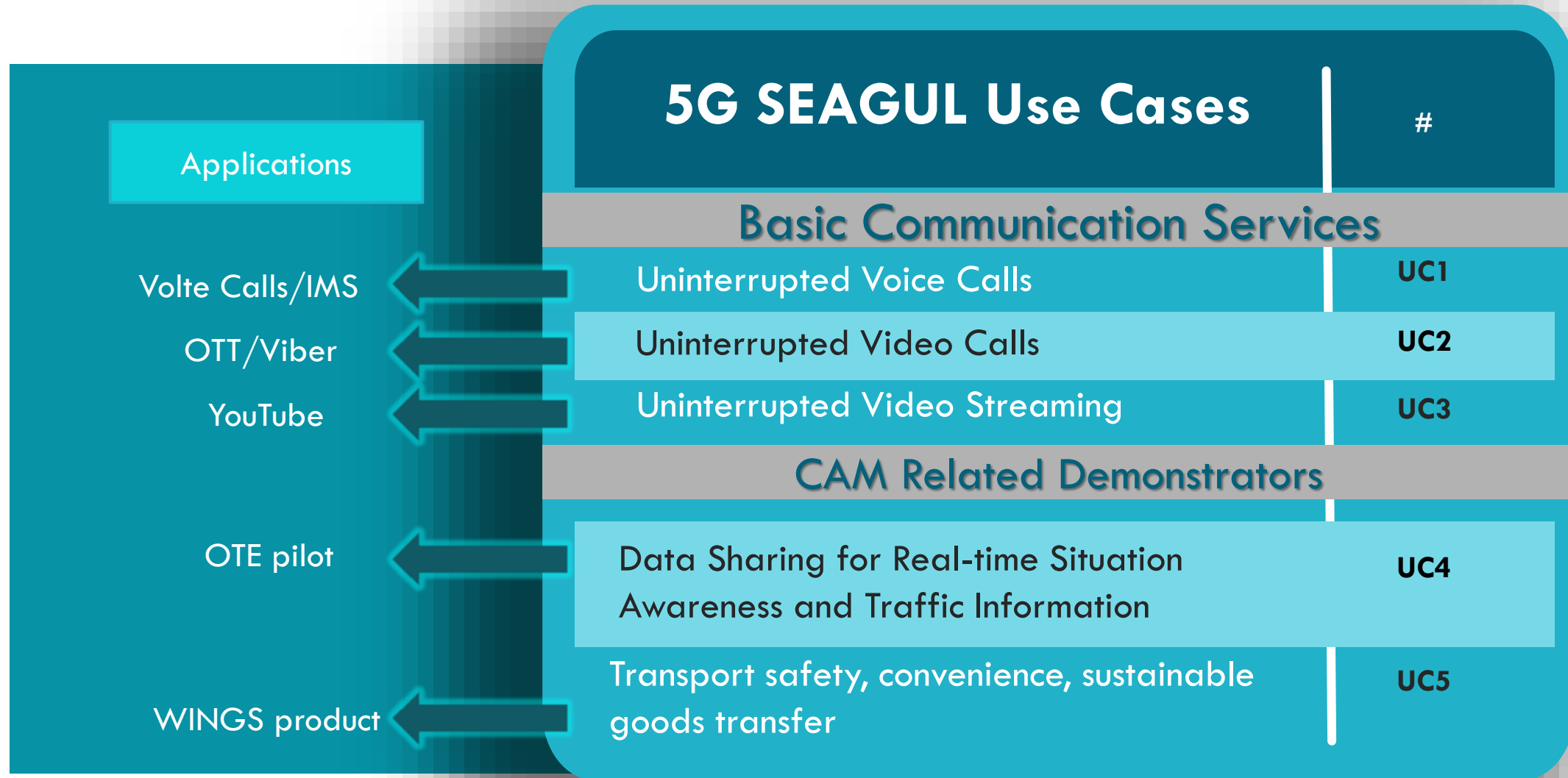
- ❑ New BG (Border Gateway) in Thessaloniki
- ❑ S1 Handover (EPLMN)
- ❑ inter-MME S10
- ❑ Direct Interconnection Thessaloniki-Sofia

Phase 2: SA Implementation

- ❑ Introduce SEPP (Security Edge Protection Proxy)
- ❑ 5G SA Roaming
- ❑ 5G SEAGUL Slice & Seamless Roaming

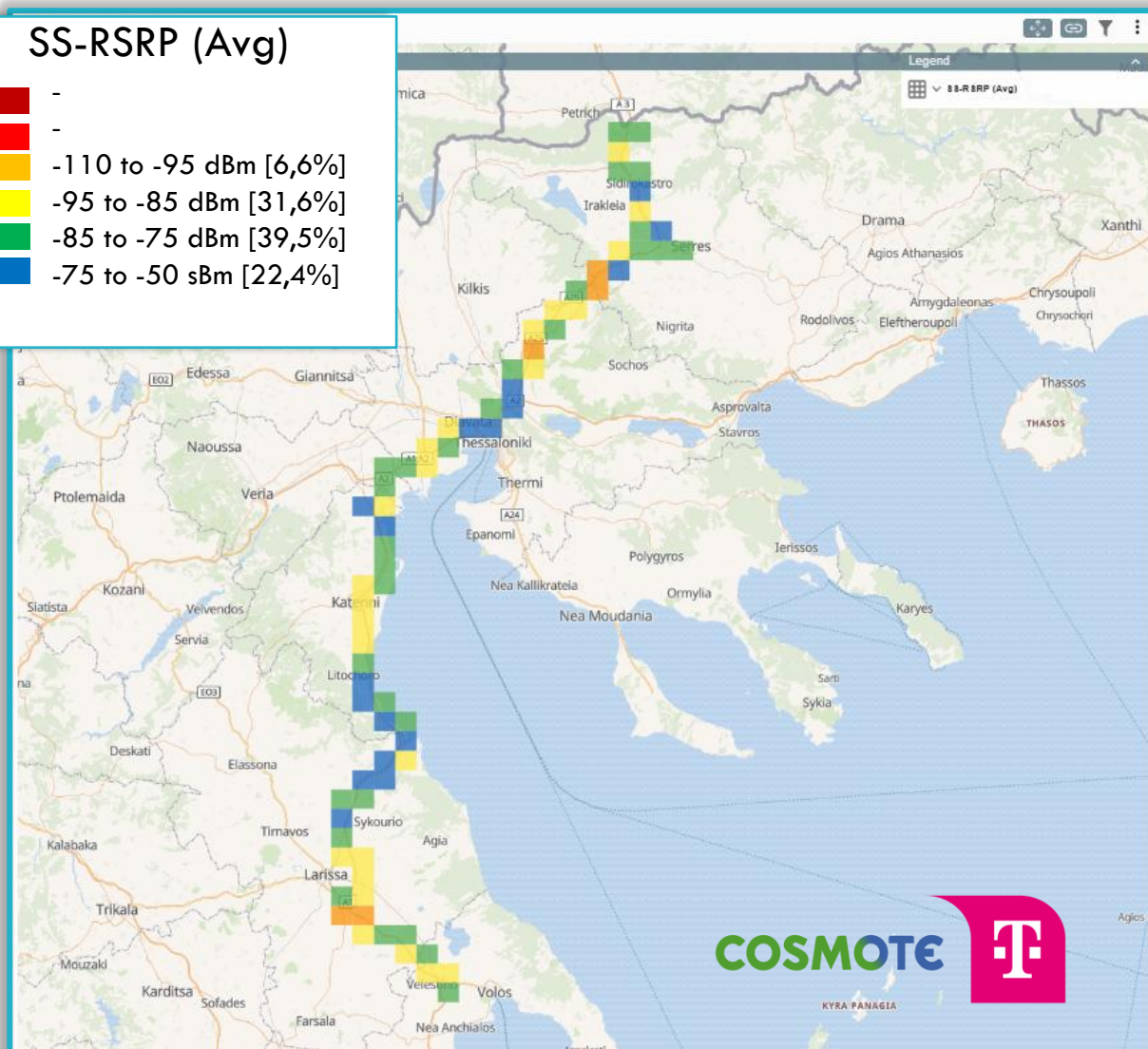
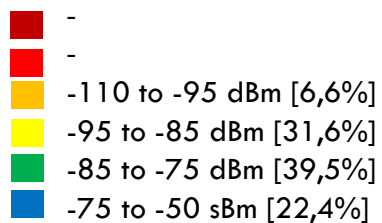
3.5 GHz for 11 km at the border (Promahonas/Kulata)

- ❑ 4 Km (GR) | 2 gNB  
- ❑ 7 Km (BG) | 2 gNBs 

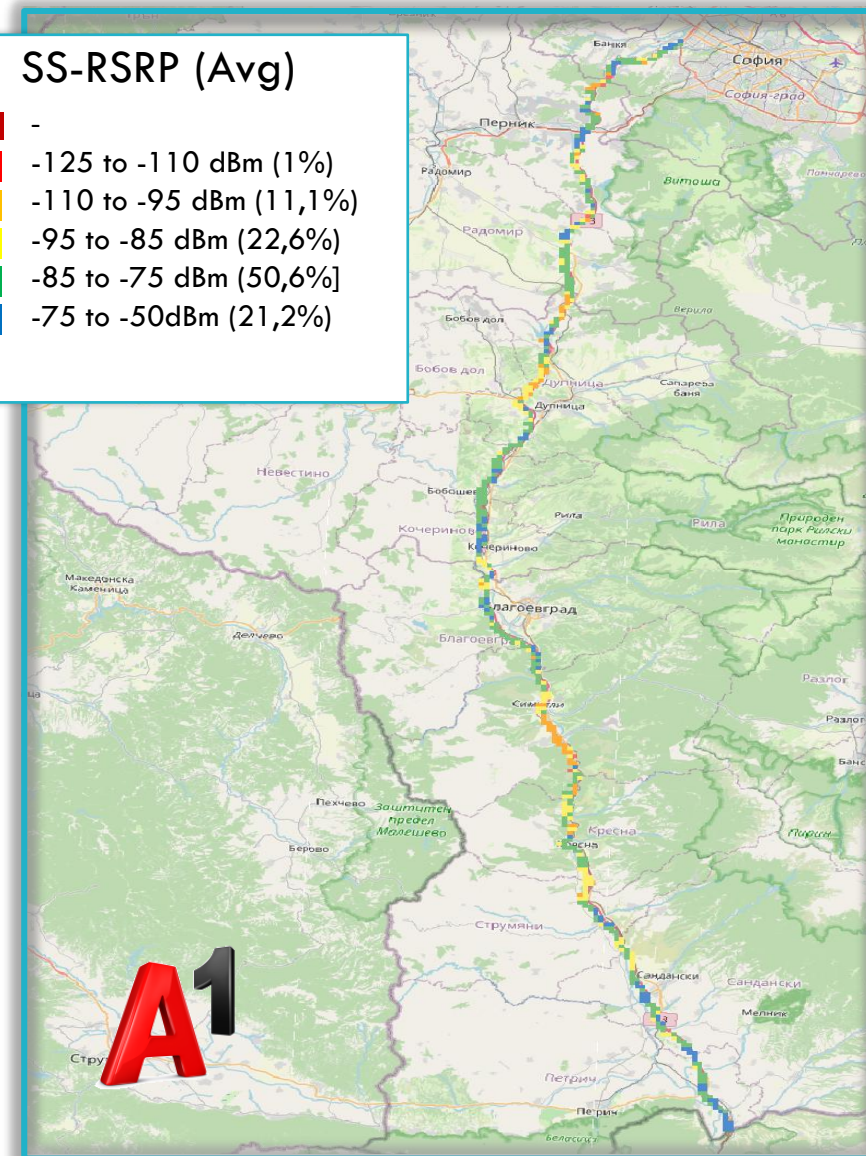
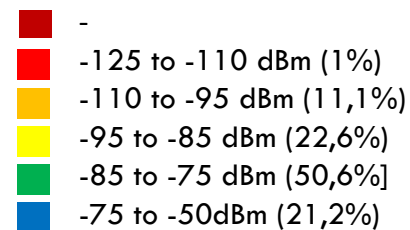


Accomplishments -5G Coverage 7/2025

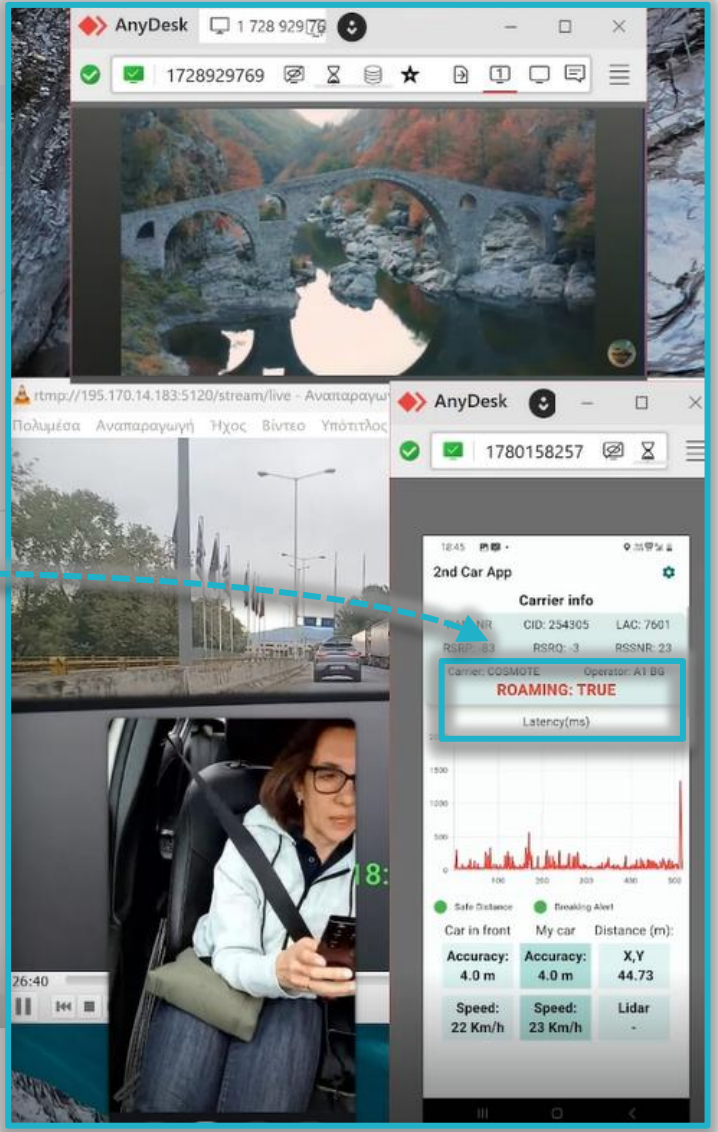
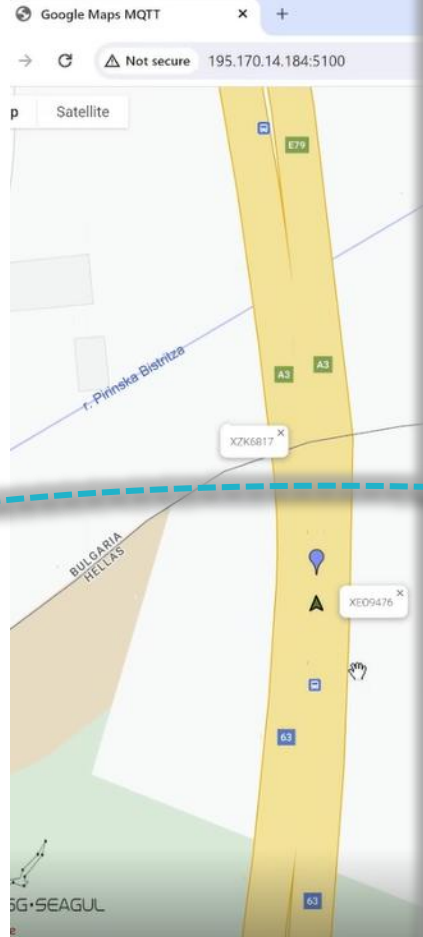
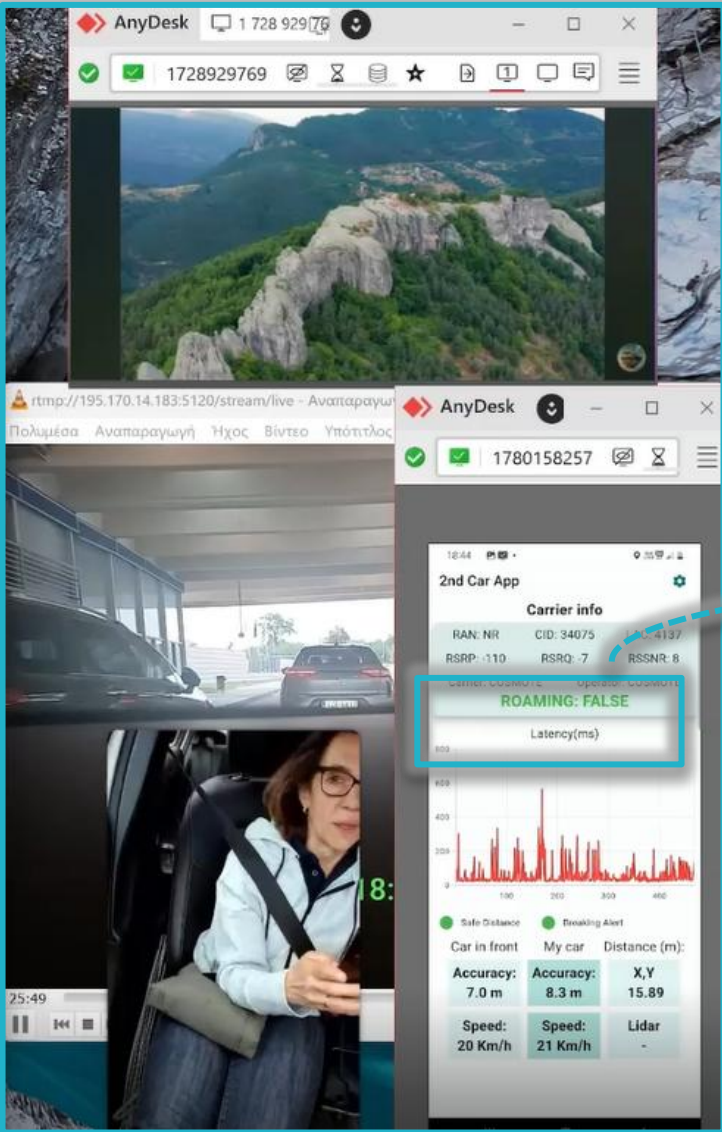
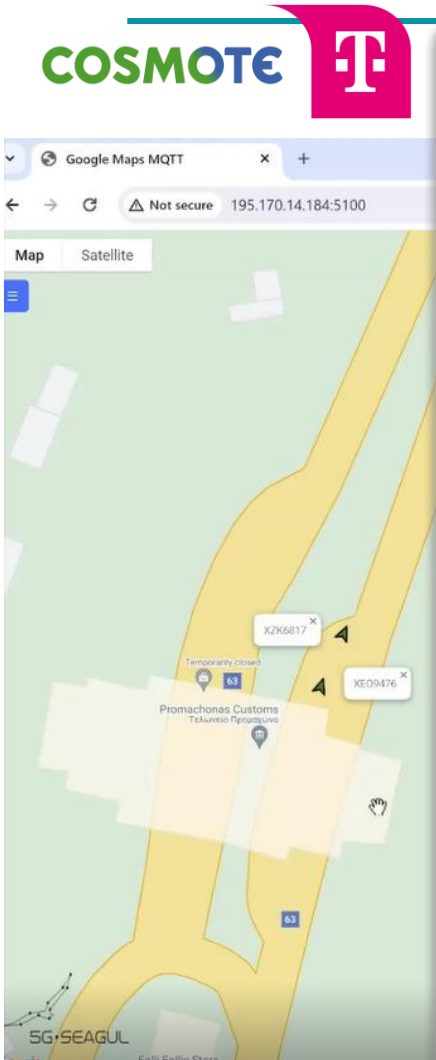
SS-RSRP (Avg)



SS-RSRP (Avg)

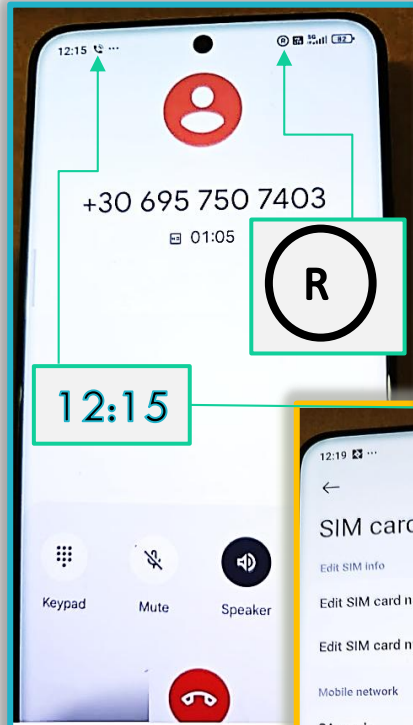


NSA Seamless Roaming – Demonstrated 4/2024

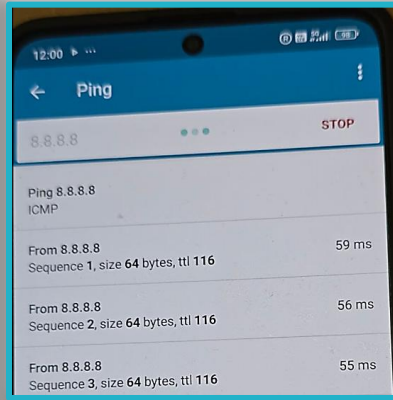


SA Roaming – Work in Progress

VoNR Call



Data Session



COSMOTEST Data and VoNR

247	12:14:32,477000	17.0.0.17	16.0.0.16	NGAP	52 InitialContextSetupResponse
249	12:14:32,478000	16.0.0.16	17.0.0.17	NGAP/N...	137 DownlinkNASTransport, Registration accept
250	12:14:32,501000	17.0.0.17	16.0.0.16	NGAP/N...	86 UplinkNASTransport, Registration complete
252	12:14:32,536000	17.0.0.17	16.0.0.16	NGAP/N...	179 UplinkNASTransport, UL NAS transport, PDU session establishment request
258	12:14:32,784000	17.0.0.17	16.0.0.16	NGAP/N...	158 UplinkNASTransport, UL NAS transport, PDU session establishment request
268	12:14:33,634000	10.0.1.94	192.168.200.182	HTTP2/...	1329 HEADERS[1]: POST /namf-comm/v1/ue-contexts/imsi-202010927417724/n1-n2-messages
271	12:14:33,636000	16.0.0.16	17.0.0.17	NGAP/N...	279 PDUSessionResourceSetupRequest, DL NAS transport, PDU session establishment ac
272	12:14:33,682000	17.0.0.17	16.0.0.16	NGAP	73 PDUSessionResourceSetupResponse
273	12:14:33,683000	192.168.239.242	10.127.12.31	HTTP2/...	883 HEADERS[2245]: POST /nsmf-pdusession/v1/sm-contexts/2470003472/modify, DATA[22
274	12:14:33,690000	10.0.1.226	192.168.200.182	HTTP2/...	1268 HEADERS[1]: POST /namf-comm/v1/ue-contexts/imsi-202010927417724/n1-n2-messages
277	12:14:33,691000	16.0.0.16	17.0.0.17	NGAP/N...	217 PDUSessionResourceSetupRequest, DL NAS transport, PDU session establishment ac
278	12:14:33,726000	17.0.0.17	16.0.0.16	NGAP	73 PDUSessionResourceSetupResponse
279	12:14:33,727000	192.168.239.242	10.127.12.31	HTTP2/...	883 HEADERS[2247]: POST /nsmf-pdusession/v1/sm-contexts/2470003473/modify, DATA[22
282	12:14:35,603000	10.0.1.94	192.168.202.191	HTTP2/...	1275 HEADERS[1]: POST /namf-comm/v1/ue-contexts/imsi-202010927417724/n1-n2-messages
285	12:14:35,605000	16.0.0.16	17.0.0.17	NGAP/N...	208 PDUSessionResourceModifyRequest, DL NAS transport, PDU session modification cc
286	12:14:35,641000	17.0.0.17	16.0.0.16	NGAP	63 PDUSessionResourceModifyResponse
287	12:14:35,643000	192.168.239.242	10.127.12.31	HTTP2/...	871 HEADERS[2249]: POST /nsmf-pdusession/v1/sm-contexts/2470003472/modify, DATA[22
289	12:14:35,666000	17.0.0.17	16.0.0.16	NGAP/N...	95 UplinkNASTransport, UL NAS transport, PDU session modification complete
293	12:16:18,094000	10.0.1.226	192.168.85.253	HTTP2/...	1175 HEADERS[3]: POST /namf-comm/v1/ue-contexts/imsi-202010927417724/n1-n2-messages
296	12:16:18,095000	16.0.0.16	17.0.0.17	NGAP/N...	107 PDUSessionResourceModifyRequest, DL NAS transport, PDU session modification cc
297	12:16:18,100000	17.0.0.17	16.0.0.16	NGAP	61 PDUSessionResourceModifyResponse
298	12:16:18,100000	192.168.239.242	10.127.12.31	HTTP2/...	869 HEADERS[2253]: POST /nsmf-pdusession/v1/sm-contexts/2470003472/modify, DATA[22
300	12:16:18,100000	16.0.0.16	17.0.0.17	NGAP/N...	95 UplinkNASTransport, UL NAS transport, PDU session modification complete
304	12:16:18,100000	16.0.0.16	17.0.0.17	NGAP	67 UEContextReleaseRequest

A1 Data

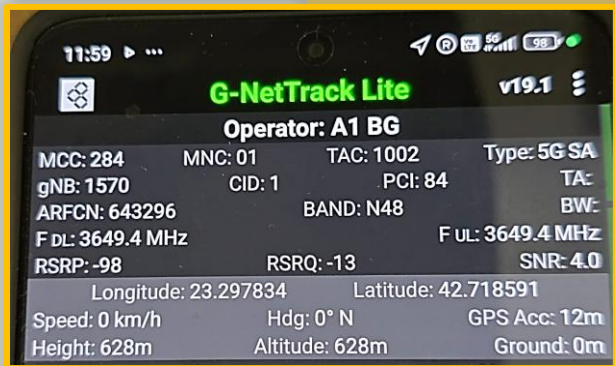
```
PDU session establishment accept (PDU session type IPv6 only allowed)

PDU session establishment accept

PDU session modification command

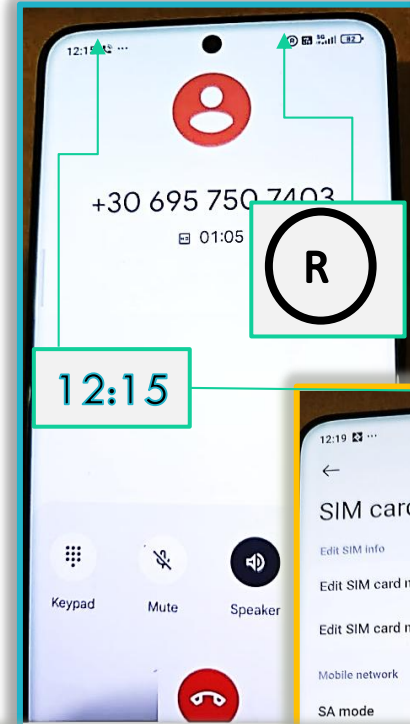
PDU session modification command
```

```
QosFlowAddOrModifyRequestList: 1 item
  Item 0
    QosFlowAddOrModifyRequestItem
      qosFlowIdentifier: 1
      qosFlowLevelQosParameters
        qosCharacteristics: nonDynamic5QI (0)
          nonDynamic5QI
            fiveQI: 1
          allocationAndRetentionPriority
            priorityLevelARP: 13
            pre-emptionCapability: may-trigger-pre-emption (1)
            pre-emptionVulnerability: pre-emptable (1)
          gBR-QosInformation
            maximumFlowBitRateDL: 52000bits/s
            maximumFlowBitRateUL: 52000bits/s
            guaranteedFlowBitRateDL: 52000bits/s
            guaranteedFlowBitRateUL: 52000bits/s
```

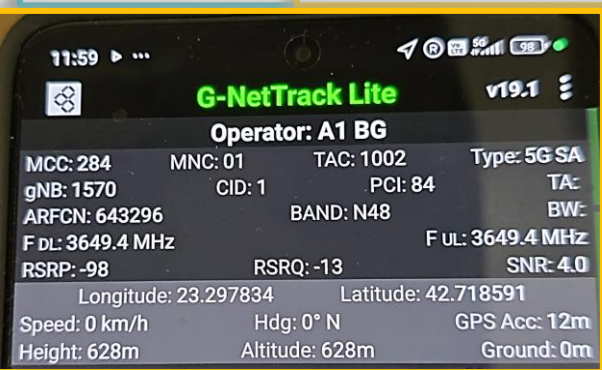
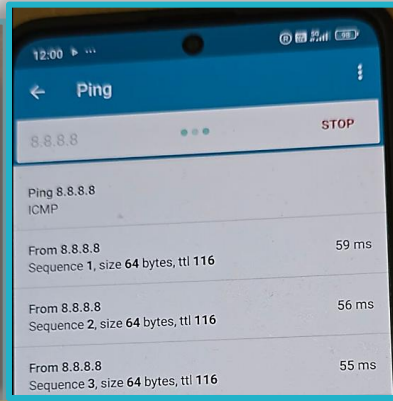


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A1 Data ✓

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298	12:16:18...	192.168.239.242	10.127.12.31	HTTP2/...	869 HEADERS[2253]: POST /nsmf-pdusession/v1/sm-contexts/2470003472/modify, DATA[22
300	12:16:1...	16.0.0.16	16.0.0.16	NGAP/N...	95 UplinkNASTransport, UL NAS transport, PDU session modification complete
304	12:1...	16.0.0.16	16.0.0.16	NGAP/N...	95 UplinkNASTransport, UL NAS transport, PDU session modification complete

PDU session establishment accept (PDU session type IPv6 only allowed)

PDU session establishment accept

PDU session modification command

PDU session modification command

```
QosFlowAddOrModifyRequestList: 1 item
  Item 0
    QosFlowAddOrModifyRequestItem
      qosFlowIdentifier: 1
      qosFlowLevelQosParameters
        qosCharacteristics: nonDynamic5QI (0)
          nonDynamic5QI
            fiveQI: 1
          allocationAndRetentionPriority
            priorityLevelARP: 13
            pre-emptionCapability: may-trigger-pre-emption (1)
            pre-emptionVulnerability: pre-emptable (1)
          gBR-QosInformation
            maximumFlowBitRateDL: 52000bits/s
            maximumFlowBitRateUL: 52000bits/s
            guaranteedFlowBitRateDL: 52000bits/s
            guaranteedFlowBitRateUL: 52000bits/s
```


5G SEAGUL CEF2 5G GR-BG CBC Project (2023-2025)



Thank You!