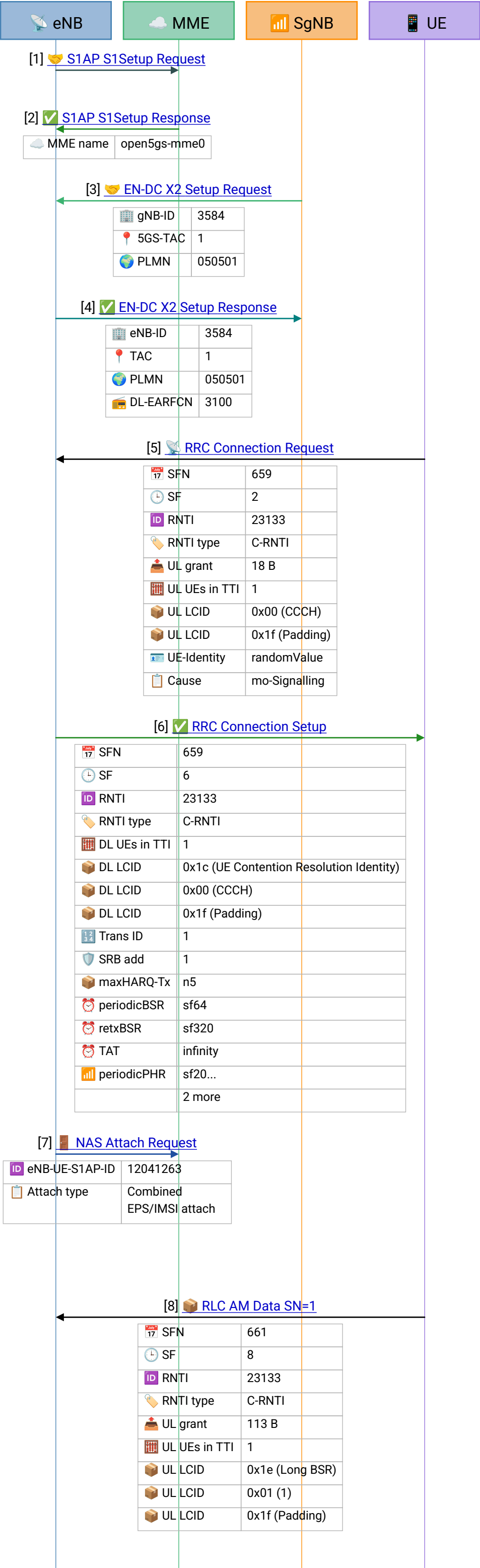
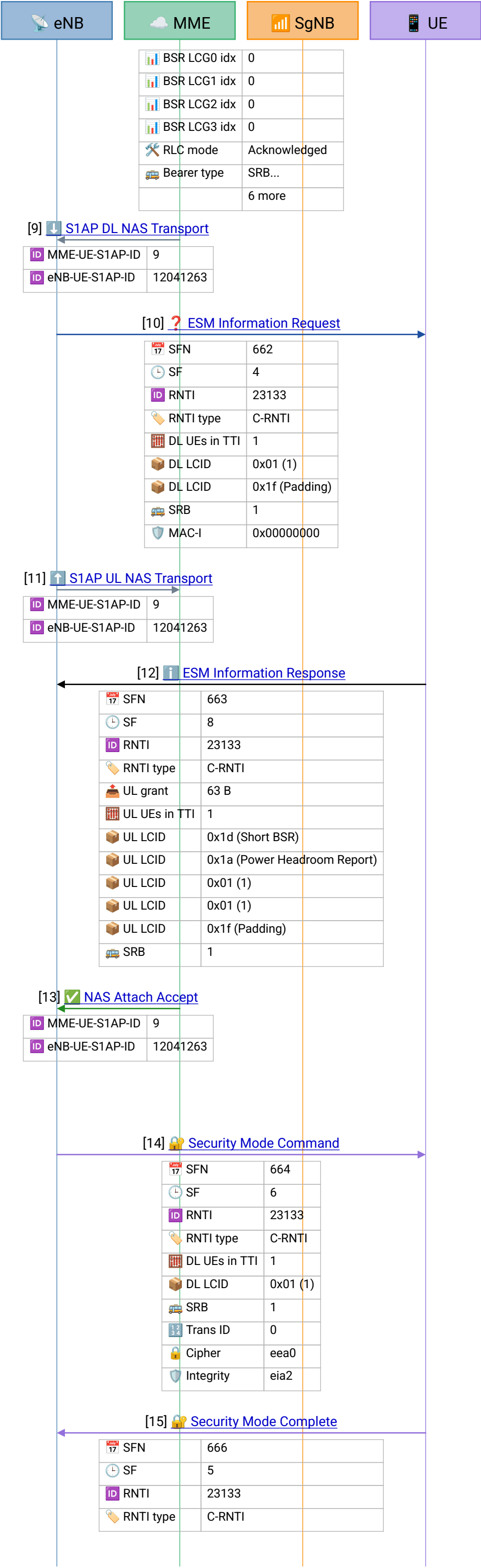
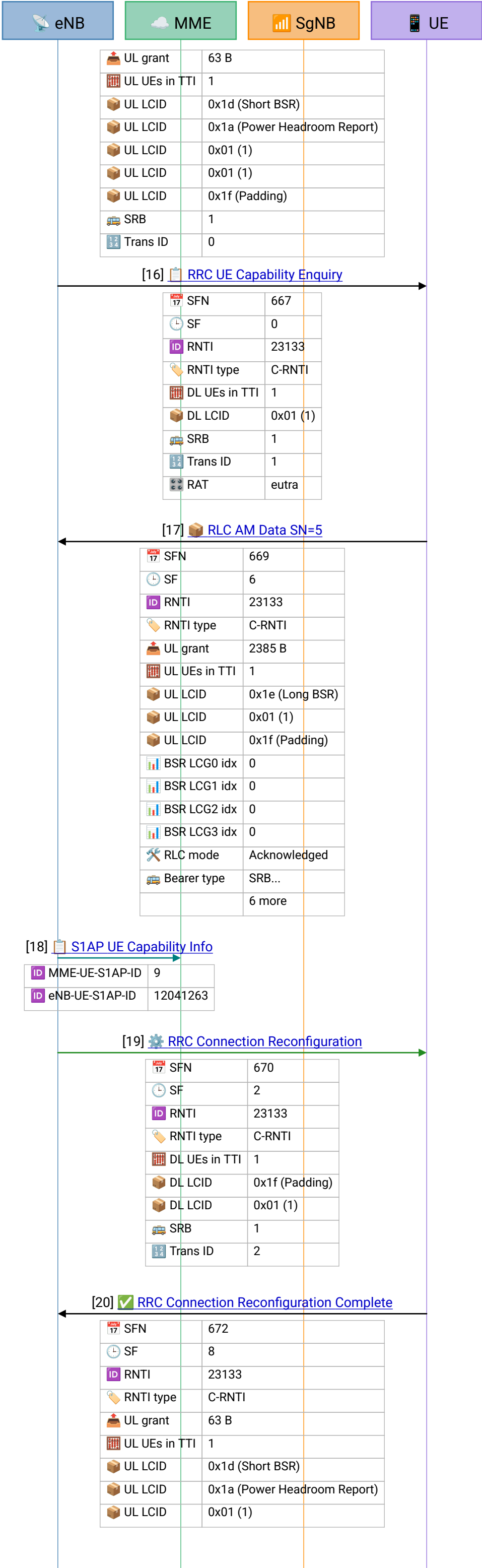
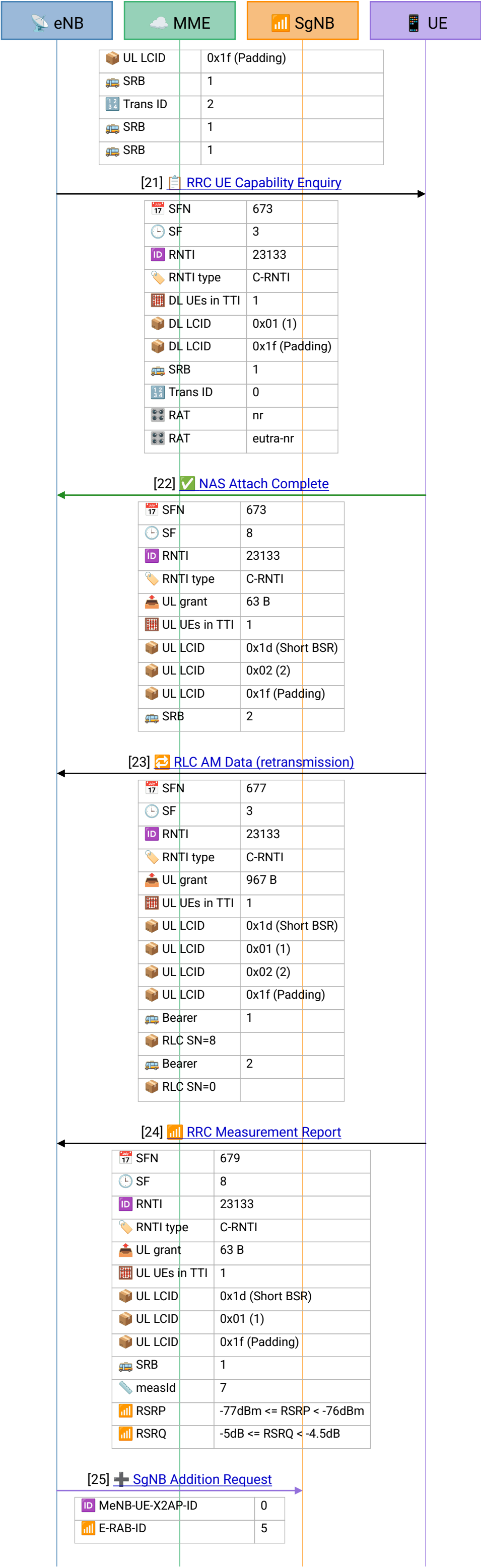










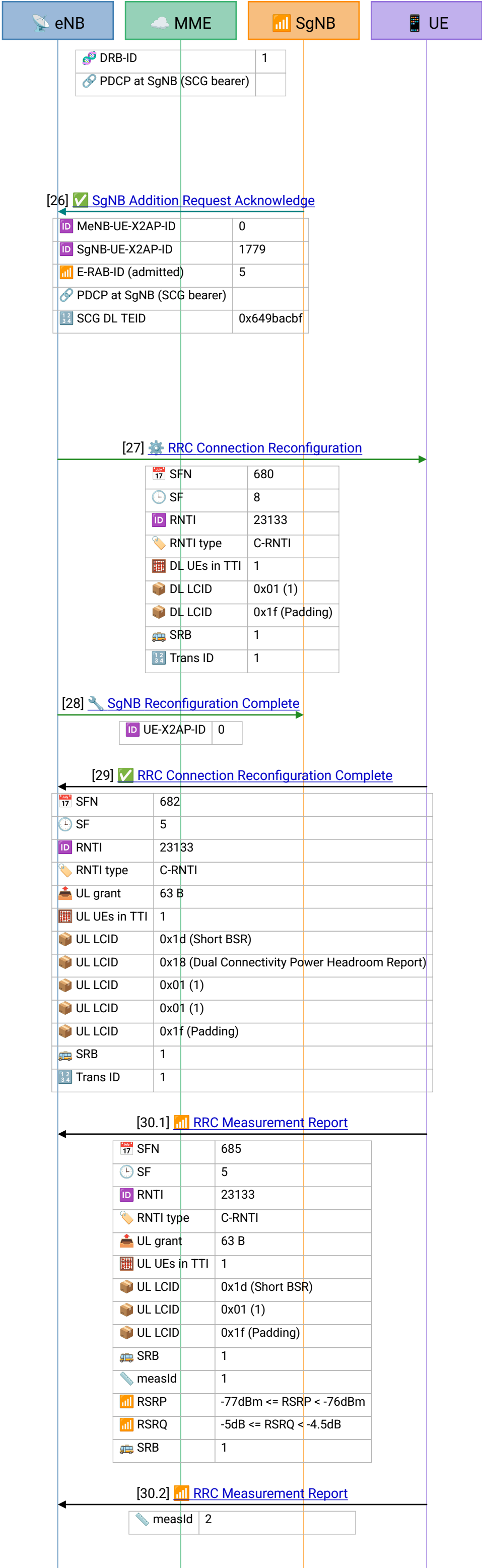
[Frame 21] A second RRC UE Capability Enquiry (transaction 0), and the EN-DC-relevant one: where frame 16 asked for eutra, this requests RAT-Type: eutra-nr and nr – the NR and MR-DC capabilities proper. Secured on SRB1 (EEA0/EIA2) . Its response is not in this capture.

[Frame 22] First uplink traffic on SRB2 (bearer 2), now that frame 19 created it. It carries the NAS Attach Complete + Activate Default EPS Bearer Context Accept – the UE confirming both the attach and the default bearer. NAS moves to SRB2 once it exists.

[Frame 23] RLC retransmission / continuation of that SRB2 uplink (RLC SN=8 and SN=0 segments in one grant). RLC-AM stitching the Attach Complete delivery back together after a poll.

[Frame 24] The 5G trigger. This is the first measurement report carrying NR. Event B1-NR (measId 7) has fired: alongside the LTE PCell result the UE reports a detected NR neighbour – PCI 0, SS-RSRP in the -91 to -90 dBm bucket, SS-RSRQ around -11 dB – inside measResultNeighCellListNR . Crossing the B1 threshold is exactly what tells the eNB "this UE can see 5G", and it reacts immediately in the next frame. Only the measId-7 sub-reports ever carry 5G measurements; measId 1 and 2 are LTE-only.

[Frame 25] Phase 4 – SgNB Addition (adding the 5G leg). X2AP SgNB Addition Request (procedure id-sgNBAdditionPreparation). The master eNB, which owns the UE, asks the secondary gNB to allocate NR radio resources for E-RAB 5 / DRB 1. It hands over the S-KgNB security key (derived from K_eNB), the UE's NR security capabilities, and the en-DC-ResourceConfiguration . The UE-association is one-sided so far: the request



carries only the MeNB-UE-X2AP-ID – the gNB mints its own ID in the Acknowledge. Watch the bearer shape: resource-configuration here is sgNBPDcPpresent , so PDCP is placed at the gNB – an SgNB-terminated (SCG) bearer, not the MCG-anchored split bearer (PDCP kept at the MeNB) shown in the companion X2AP walkthrough. Because the bearer now terminates at the gNB, the request also carries the S-GW's uplink S1-U endpoint (s1-UL-GTPtunnelEndpoint, 0x00000010) , so the gNB can send this bearer's uplink straight to the core. The MeNBtoSgNBContainer carries the LTE-side RRC context as a CG-ConfigInfo .

[Frame 26] X2AP SgNB Addition Request Acknowledge – a successful outcome of the same procedure. Where the Request was the eNB's ask, this is the gNB's admit, and two things complete here:

- **The UE-association becomes a pair.** The gNB mints its own SgNB-UE-X2AP-ID (1779) to sit beside the MeNB-UE-X2AP-ID – the two IDs both nodes now use for every later X2AP message about this UE.
- **The user-plane endpoint is set.** The gNB returns its downlink GTP-TEID for the SCG leg, 0x649bacbf – where the serving gateway's downlink data for E-RAB 5 must now be sent. Frame 31's E-RAB Modification hands exactly this TEID to the MME.

The SgNBtoMeNBContainer carries the NR RRCReconfiguration as an RRC CG-Config – the reply container, distinct from the CG-ConfigInfo the eNB sent outbound in frame 25. The eNB forwards it to the UE in frame 27; the EN-DC secondary cell group is now prepared.

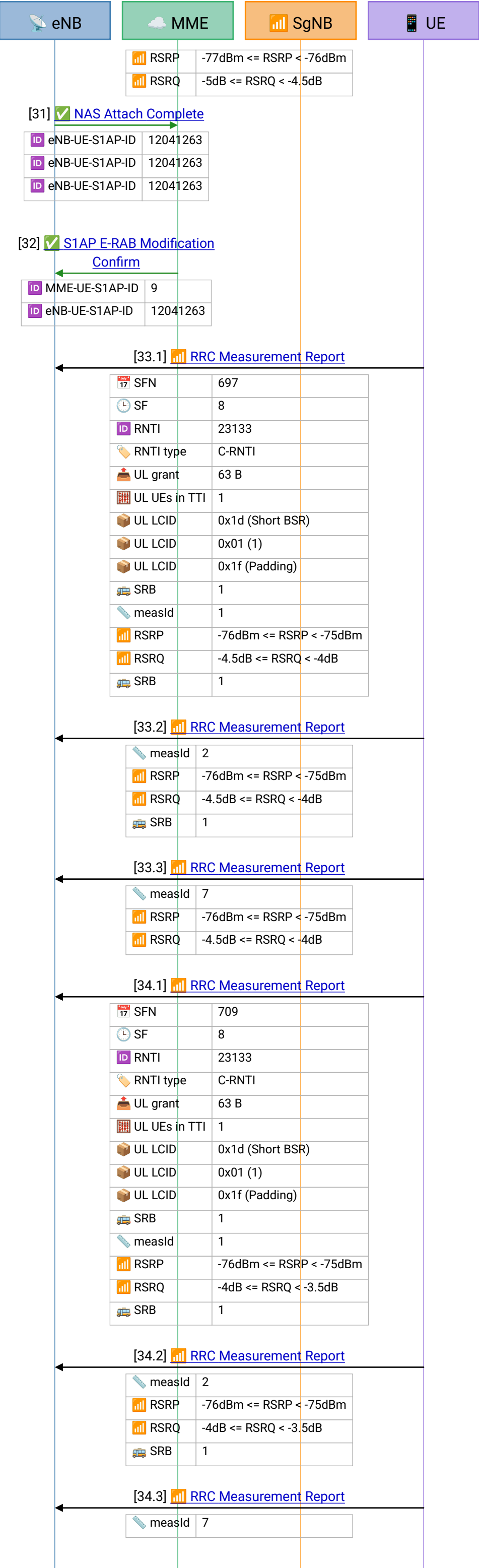
[Frame 27] RRC Connection Reconfiguration, this time carrying the SCG. The eNB forwards the gNB's NR config to the UE: nr-SecondaryCellGroupConfig (band n78, p-NR-FR1 20 dBm, SSB and CSI reporting) plus nr-RadioBearerConfig1 . It also releases LTE DRB 1 (drb-ToReleaseList) – the bearer the attach had set up for EPS bearer 5 in frame 19 – and re-adds that bearer on the SCG, so the default bearer's radio leg and its PDCP migrate from the eNB to the gNB. This is the message that actually tells the UE to add the 5G secondary cell.

[Frame 28] X2AP SgNB Reconfiguration Complete. The eNB tells the gNB the UE is applying the SCG configuration, so the gNB can consider the secondary cell group active (TS 36.423).

[Frame 29] RRC Connection Reconfiguration Complete – and this uplink message embeds the NR RRCReconfigurationComplete (the SCG-complete) inside the LTE completion. Note the MAC now carries a Dual Connectivity Power Headroom Report (LCID 0x18): concrete on-air evidence that the UE is now operating two cell groups. EN-DC is established.

[Frame 30.1] Periodic measurement reports resume: measId 1 (the RSRP+RSRQ heartbeat on the LTE serving cell). RSRP sits in the -77 to -76 dBm bucket. This sub carries no NR – it is an E-UTRA-only object.

[Frame 30.2] measId 2 – the event-A1 report (serving cell above its RSRP threshold). Also E-UTRA-only; no 5G measurement here.



[Frame 31] Phase 5 – user-plane rehoming. This S1AP frame bundles three PDUs: `InitialContextSetupResponse`, the uplink NAS Attach Complete, and – the NSA-specific one – an `E-RABModificationIndication` (procedure 50). That last PDU tells the MME the downlink S1-U endpoint for E-RAB 5 has moved: user data should now go to the gNB's GTP-TEID from frame 26, not the eNB. Only the downlink needs this step – the uplink endpoint reached the gNB in the SgNB Addition Request (frame 25) – so both directions of E-RAB 5 now bypass the eNB.

[Frame 32] S1AP E-RABModificationConfirm. The MME confirms the rehome, so the S-GW starts sending this bearer's downlink user data to the gNB. With the control plane (attach) and the user plane (E-RAB moved to NR) both in place, the EN-DC data path is fully live.

[Frame 33.1] Phase 6 — steady-state measurement reporting. From here the UE emits a periodic bundle roughly every 120 ms, each frame carrying three sub-reports: measId 1, measId 2 and measId 7. This is sub 1 (measId 1) — the LTE serving-cell heartbeat, RSRP now improving into the -76 to -75 dBm bucket.

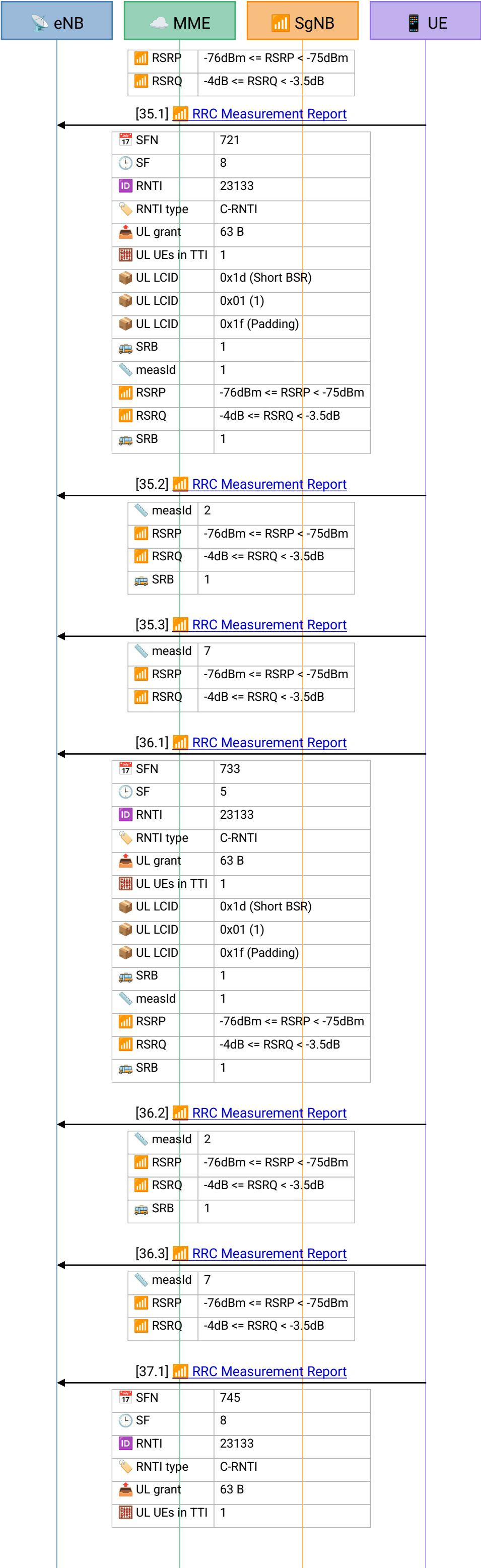
[Frame 33.2] measId 2 (event A1) – LTE serving above threshold. E-UTRA-only.

[Frame 33.3] measId 7 (event B1-NR) – **the only sub that carries 5G**. The NR neighbour (PCI 0) is reported at SS-RSRP around -92 to -91 dBm. These recurring measId-7 reports are how the eNB keeps confirming the NR leg is still viable while EN-DC is up.

[Frame 34.1] Periodic bundle, sub 1 – measId 1 LTE serving heartbeat (RSRP -76 to -75 dBm). E-UTRA-only.

[Frame 34.2] measId 2 (event A1), LTE serving. No NR.

[Frame 34.3] measId 7 (event B1-NR) – carries the 5G neighbour (PCI 0, SS-RSRP near -92 dBm).



[Frame 35.1] Periodic bundle, sub 1 — measId 1 LTE serving heartbeat. E-UTRA-only.

[Frame 35.2] measId 2 (event A1), LTE serving. No NR.

[Frame 35.3] measId 7 (event B1-NR) — the 5G-carrying sub-report (NR PCI 0).

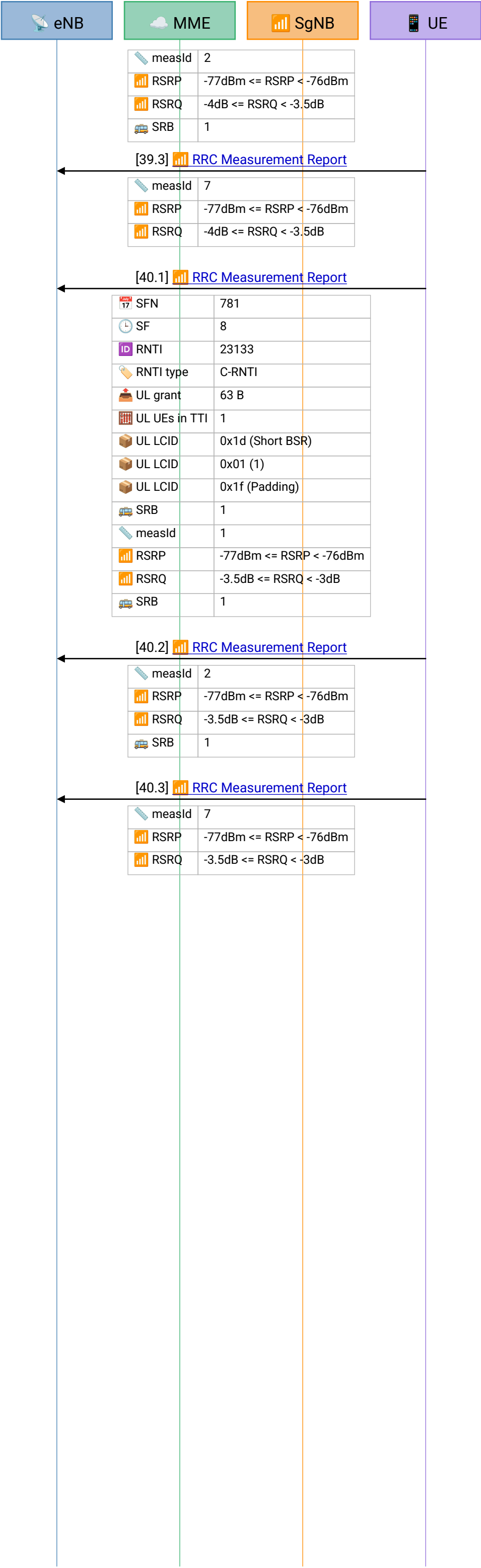
[Frame 36.1] Periodic bundle, sub 1 — measId 1 LTE serving heartbeat. E-UTRA-only.

[Frame 36.2] measId 2 (event A1), LTE serving. No NR.

[Frame 36.3] measId 7 (event B1-NR) — the 5G-carrying sub-report (NR PCI 0).

[Frame 37.1] Periodic bundle, sub 1 — measId 1 LTE serving heartbeat. E-UTRA-only.

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