📱 UE | 📡 gNB

[2.1] 📤 UL LCID 52 (CCCH (48 bits))

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:52 6 bytes
📦 Subheader	Padding 24 bytes

[Frame 2.1] Msg3 — the UE speaks for the first time. `LCID 52` is UL-SCH shorthand for *CCCH of size 48 bits* (TS 38.321 Table 6.2.1-2), and it is the only logical channel a UE may use before the network has agreed who it is. The subheader carries no length field, because 48 bits *is* the length: six bytes, `1b34056b1846`, which decode as an RRC `RRCSetupRequest` with `ue-Identity` randomValue `b34056b184` and `establishmentCause` mo-Signalling.

Those six bytes are the whole point of the next frame. Several UEs can pick the same random-access preamble in the same slot, be given the same uplink grant, and transmit Msg3 on top of one another. Nothing so far has singled this UE out. Remember the byte string.

[2.2] 📤 UL LCID 63 (Padding)

[Frame 2.2] 24 bytes of padding, `LCID 63`. The grant that carried Msg3 was sized by the Random Access Response — a message this session does not contain, because it is addressed to RA-RNTI `0x0500` rather than to a UE identity. The scheduler had no idea how large the UE's first message would be, so the fit is approximate and MAC fills the remainder. This is the first of 57 uplink padding subheaders.

[3.1] 🤝 Contention Resolution

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0

[Frame 3.1] Msg4 — contention resolution. The gNB sends back a *UE Contention Resolution Identity* MAC control element whose payload is `1b34056b1846`: a byte-for-byte echo of the CCCH SDU the UE sent 0.708 ms earlier.

TS 38.321 §5.1.5 makes the rule explicit. A UE receiving this control element compares it against the CCCH SDU it transmitted in Msg3. On a match it declares contention resolution successful, stops `ra-ContentionResolutionTimer`, and — for a random access started from idle — promotes the Temporary C-RNTI it was given in the Random Access Response into its own C-RNTI. Any UE that transmitted a *different* Msg3 sees a mismatch, loses, and starts random access again.

One wrinkle worth naming, because it is easy to misread off the diagram. The Random Access Response in frame 1 assigns Temporary C-RNTI `0x1001`, yet every frame from Msg3 onward is stamped C-RNTI `0x8000` in the capture's own MAC-NR context. The promotion is therefore *not* visible here as a change in the RNTI field. You read contention resolution from the identity echo, not from the identifier.

[3.2] 📥 DL LCID 62 (UE Contention Resolution Identity)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	Contention Resolution
📦 Subheader	LCID:0 214 bytes

[Frame 3.2] The same control element seen as a subheader: `LCID 62` on DL-SCH is *UE Contention Resolution Identity* (TS 38.321 Table 6.2.1-1) — a fixed-size control element with a six-octet payload and no length field.

This double arrow is a reading habit worth acquiring early. Every Short BSR, every Single-Entry PHR and both Contention Resolution elements in this flow are drawn twice: once as a dedicated control-element arrow with the fields expanded, and once as the generic per-LCID arrow that shows where the element sat in the MAC PDU. 105 of the session's 475 arrows are that second copy, so the real PDU count is 370 subheaders.

[3.3] 📥 DL LCID 0 (CCCH)

📏 SDU len	214
📦 Subheader	Padding 0 bytes

[Frame 3.3] And multiplexed behind the control element, in the same transport block: `LCID 0` — CCCH on DL-SCH — carrying a 214-byte SDU. That SDU is the RRC `RRCSetup`, the message that gives the UE SRB 1 and, as this walk keeps coming back to, the entire MAC configuration it will run for the rest of the connection.

This is MAC's job stated in one frame. Contention resolution and connection setup are two unrelated procedures at two different layers, and MAC delivers them in one transmission because it can: a MAC PDU is a concatenation of subheaders, and each subheader independently names either a logical channel or a control element (TS 38.321 §6.1.2).

Note the order — control element first, SDU second. That is the downlink rule, and the uplink's is the mirror image. Watch for it in the next frame.

[3.4] 📥 DL LCID 63 (Padding)

[Frame 3.4] The padding subheader that closes the block — and the first instance of a pattern that holds for the whole session. It is `LCID 63` with **zero** bytes after it: one byte of R/R/LCID and nothing more. Add up every downlink padding subheader in these 144 frames and you get 64 of them and **0 bytes** of padding payload. The uplink total is 30955 bytes. The last section of this walk is about why.

[4.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0

[Frame 4.1] The first Buffer Status Report — and it asks for nothing. A Short BSR on Logical Channel Group 0 with buffer-size index 0, which the 5-bit level table in TS 38.321 §6.1.3.1 defines as literally `BS = 0`. That reads like a wasted control element until you notice what shares the transport block with it. The UE had one RLC PDU queued, the grant was large enough to take it whole, and MAC assembled both into the same PDU. By the time the buffer-size field was

📱 UE	📡 gNB

📏 BS idx	0

filled in, the buffer it describes had already been emptied into the very frame carrying it. A BSR is a snapshot of what is *left over*, not of what is being sent.

55 of the session's 66 Short BSRs say exactly this.

[4.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 4.2] The first Power Headroom Report. A Single-Entry PHR (`LCID 57`, TS 38.321 §6.1.3.8) with Power Headroom index 57 and Pcmax,c,f index 52, which the dissector expands to *26 dB <= PH < 28 dB* and *22 dBm <= Pcmax,f,c < 23 dBm.* Power headroom is the gap between the power the UE is permitted to use and the power it actually used for this transmission. A large positive headroom tells the scheduler it can hand this UE a wider grant or a denser modulation without pushing it past its limit; a headroom near zero says the UE is already at the wall and a bigger grant would only produce errors. It is the power-domain counterpart of the BSR: the BSR says *how much I have to send,* the PHR says *how hard I can push.* All 37 PHRs in this session report the identical pair of indices. Nothing about this UE's power situation changes for the whole capture.

[4.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:1 108 bytes
📏 SDU len	108
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 4.3] The data this frame exists to carry: `LCID 1`, a 108-byte SDU. On DL-SCH and UL-SCH alike, LCIDs 1 to 32 are dedicated logical channels — `LCID 1` is SRB 1's DCCH here. The common control channel sits outside that range: `LCID 0` on DL-SCH and `LCID` 52 on UL-SCH (TS 38.321 Tables 6.2.1-1 and 6.2.1-2). Everything else from 33 upward is a control element or padding.

Inside the SDU, Wireshark reads an RLC-AM data PDU with `SN=0` and the poll bit set, wrapping PDCP `SN=0`, wrapping an RRC `rrcSetupComplete`, wrapping a NAS Registration Request. Five layers in 108 bytes — MAC, RLC, PDCP, RRC and NAS. MAC sees none of the four above it: to MAC this is an opaque octet string that arrived on logical channel 1.

[4.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 4.4] The Short BSR in its subheader position — second of the four subheaders in this PDU, and placed *after* the SDU rather than before it.

That is not an implementation quirk. TS 38.321 §6.1.2 puts uplink control elements after all SDUs and before the padding, and downlink control elements before all SDUs. Compare the previous frame, where the Contention Resolution element came first. Both orders hold across all 144 frames of this session without a single exception, and where a BSR and a PHR appear together the BSR always comes first.

[4.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 508 bytes

[Frame 4.5] The Single-Entry PHR in its subheader position, third of four — last control element, immediately before the padding.

[4.6] 📤 UL LCID 63 (Padding)

[Frame 4.6] 508 bytes of padding, and the assembled MAC PDU in full. Four subheaders in one transport block: one logical-channel SDU, two control elements, one padding. That is the complete MAC multiplexing repertoire, in the first uplink transmission after contention resolution.

TS 38.321 §5.4.3.1 is the clause being executed here — multiplexing and assembly. The padding is not slack the UE chose to leave: a transport block is a fixed size once granted, and MAC must fill it exactly.

[5.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 5.1] The downlink answers in three bytes. `LCID 1`, SDU length 3 — an RLC STATUS PDU with ACK_SN=1, acknowledging the SDU that went up in the previous frame.

Three-byte SDUs on `LCID 1` and `LCID 4` recur constantly in this session; they are almost always RLC status reports. When you see one sharing a transport block with a data SDU on the same LCID, you are watching RLC hand MAC two PDUs at once and MAC pack both.

[5.2] 📥 DL LCID 63 (Padding)

[Frame 5.2] A padding subheader with nothing after it. The gNB sized this downlink transport block to the three bytes it actually had, so no payload is wasted. Compare the 508 bytes the uplink burned one frame ago.

[6.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1

[Frame 6.1] The first Timing Advance Command. `LCID 61` on DL-SCH is *Timing Advance Command* (TS 38.321 §6.1.3.4): a one-byte control element carrying a 2-bit TAG ID and a 6-bit command. Here TAG ID 0, command **31.** Note the LCID collision, because it catches people out. `LCID 61` means *Short BSR* on UL-SCH and *Timing Advance Command* on DL-SCH. The LCID space is direction-specific: the same five bits mean different things depending on which way the transport block is going.

📱 UE	📡 gNB

📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

Timing advance is how a cell keeps every UE's uplink arriving inside the same symbol boundary despite different propagation delays — the further away the UE, the earlier it must transmit. TS 38.213 §4.2 defines this control element's value as a *relative* adjustment around a midpoint of 31, so a command of 31 asks for no change at all.

All 23 Timing Advance Commands in this session carry 31, and they arrive on a metronome. Watch for them again at frames 120 to 127.

[6.2] 📥 DL LCID 63 (Padding)

[7.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:1 53 bytes
📏 SDU len	53
📦 Subheader	Padding 0 bytes

[Frame 7.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[7.2] 📥 DL LCID 63 (Padding)

[8.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📏 BS idx	0

[Frame 8.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[8.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 8.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[8.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 8.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[8.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 8.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[8.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 613 bytes

[Frame 8.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[8.6] 📤 UL LCID 63 (Padding)

[Frame 8.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[9.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📏 BS idx	0

[Frame 9.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[9.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI

[Frame 9.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

📱 UE | 📡 gNB

📱 UE ID	1
♻️ HARQ	2
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[9.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:1 39 bytes
📏 SDU len	39
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 9.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[9.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 9.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[9.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 577 bytes

[Frame 9.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[9.6] 📤 UL LCID 63 (Padding)

[Frame 9.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[10.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 10.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[10.2] 📥 DL LCID 63 (Padding)

[11.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	LCID:1 29 bytes
📏 SDU len	29
📦 Subheader	Padding 0 bytes

[Frame 11.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[11.2] 📥 DL LCID 63 (Padding)

[12.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📏 BS idx	0

[Frame 12.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[12.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 12.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[12.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000

[Frame 12.3] Two SDUs on the same logical channel, one transport block. This one is three bytes — an RLC status report. The next subheader along is 85 bytes of RLC data. Both are `LCID 1`. MAC neither knows nor cares that they came from the same RLC entity, or that one is control and one is data. It was handed two PDUs on logical channel 1

📱 UE	📡 gNB

🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	LCID:1 85 bytes

and it emitted two subheaders. Each subheader carries its own length field, which is the only reason the receiver can tell where one ends and the next begins.

[12.4] 📤 UL LCID 1 (1) →

📏 SDU len	85
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 12.4] The 85-byte half of the pair. Multiplexing two SDUs of one logical channel is the commonest shape in this trace after the bare BSR-plus-padding frame: 7 uplink frames carry two `LCID 1` SDUs and 4 carry two `LCID 4` SDUs.

[12.5] 📤 UL LCID 61 (Short BSR) →

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 12.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[12.6] 📤 UL LCID 57 (Single Entry PHR) →

📦 Subheader	Padding 526 bytes

[Frame 12.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[12.7] 📤 UL LCID 63 (Padding) →

[Frame 12.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[13.1] 📥 DL LCID 1 (1) ←

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 13.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[13.2] 📥 DL LCID 63 (Padding) ←

[14] 📥 DL LCID 1 (1) ←

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	LCID:1 34 bytes
📏 SDU len	34

[Frame 14] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[15.1] 📊 Short BSR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📏 BS idx	0

[Frame 15.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[15.2] 📶 Single-Entry PHR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 15.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[15.3] 📤 UL LCID 1 (1) →

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	LCID:1 21 bytes

[Frame 15.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE | 📡 gNB

[15.4] 📤 UL LCID 1 (1)

📏 SDU len	21
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 15.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[15.5] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 15.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[15.6] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 590 bytes

[Frame 15.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[15.7] 📤 UL LCID 63 (Padding)

[Frame 15.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[16.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 16.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[16.2] 📥 DL LCID 63 (Padding)

[17.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:1 11 bytes
📏 SDU len	11
📦 Subheader	Padding 0 bytes

[Frame 17.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[17.2] 📥 DL LCID 63 (Padding)

[18.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📏 BS idx	0

[Frame 18.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[18.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 18.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[18.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	LCID:1 10 bytes

[Frame 18.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[18.4] 📤 UL LCID 1 (1)

📏 SDU len	10
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 18.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

[18.5] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 18.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[18.6] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 601 bytes

[Frame 18.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[18.7] 📤 UL LCID 63 (Padding)

[Frame 18.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[19.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 19.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[19.2] 📥 DL LCID 63 (Padding)

[20] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:1 16 bytes
📏 SDU len	16

[Frame 20] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[21.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6

[Frame 21.1] The first Buffer Status Report that actually asks for something. LCG 0, buffer-size index 16, which the level table in TS 38.321 §6.1.3.1 reads as *1038 < BS <= 1446* bytes still queued after this transmission.

This is the BSR doing its real job. The UE has just been asked for its radio capabilities — a message far too large for one uplink grant — so RLC has cut it up and MAC is sending the first slice. The BSR riding alongside tells the scheduler that between one and one-and-a-half kilobytes remain, and the scheduler grants again immediately.

Follow the index down across the next two frames: 16, then 13, then 0. That three-step drain is the entire feedback loop in miniature.

[21.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 21.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[21.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	LCID:1 611 bytes

[Frame 21.3] The three-byte RLC status report riding along at the front of the PDU.

[21.4] 📤 UL LCID 1 (1)

📏 SDU len	611
📦 Subheader	Short BSR LCG ID=0 BS=16

[Frame 21.4] 611 bytes on LCID 1 — the first slice of the capability report, and the largest single logical-channel SDU the uplink has carried so far.

[21.5] 📤 UL LCID 61 (Short BSR)

📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 21.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

[21.6] 📤 UL LCID 57 (Single Entry PHR)

[Frame 21.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[22.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7

[Frame 22.1] Index 13 — the queue is draining. *384 < BS <= 535* bytes left, 5.992 ms after the previous report. The scheduler granted, the UE sent, and the buffer shrank by roughly the size of the grant.

Note what is *missing* from this frame: there is no Power Headroom Report. The PHR runs on its own timer rather than riding every grant, which is why the session has 66 BSRs but only 37 PHRs.

[22.2] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	LCID:1 619 bytes
📏 SDU len	619
📦 Subheader	Short BSR LCG ID=0 BS=13

[Frame 22.2] 619 bytes on `LCID 1` — the largest logical-channel SDU the uplink ever carries in this session. Frames 51, 79 and 96 all reach the same 619, which is the first hint that the DU is handing out one fixed uplink grant size all session long.

[22.3] 📤 UL LCID 61 (Short BSR)

[Frame 22.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[23.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8
📏 BS idx	0

[Frame 23.1] Back to zero, 0.999 ms later. Index 0: the capability report is fully out and nothing is queued. Three grants, three reports, and the scheduler now knows it can stop.

Except it does not stop, not immediately. The next five frames are the price of a control loop running on stale information.

[23.2] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8
📦 Subheader	LCID:1 447 bytes
📏 SDU len	447
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 23.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[23.3] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	Padding 171 bytes

[Frame 23.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[23.4] 📤 UL LCID 63 (Padding)

[Frame 23.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[24.1] 📥 DL LCID 1 (1)

[Frame 24.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[24.2] 📥 DL LCID 63 (Padding)

[25.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	9
📏 BS idx	0

[Frame 25.1] A grant with nothing to put in it. No logical-channel SDU at all: a Short BSR reporting `BS = 0`, and then padding.

The gNB committed this block on the strength of a report that was already two frames out of date. By the time the UE could use it, the buffer had been empty since the previous frame. MAC cannot decline a grant and it cannot send a short transport block, so it sends the only thing it has — a Short BSR — and fills the rest.

[25.2] 📤 UL LCID 61 (Short BSR)

[Frame 25.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority

📱 UE	📡 gNB

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	9
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

template)

[25.3] 📤 UL LCID 63 (Padding)

[Frame 25.3] 621 bytes of padding, every byte the constant `0x21`. 18 uplink frames in this session carry exactly this figure, and 23 of the 68 uplink frames carry no logical-channel data whatsoever.

Set 621 beside the 619-byte maximum SDU from frame 22 and the picture is complete: one grant size, offered over and over, whether or not the UE has anything to put in it.

[26.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	10
📏 BS idx	0

[Frame 26.1] The same again, exactly 1.000 ms later. Frames 25, 26, 27, 28 and 29 are five consecutive transport blocks at one-millisecond spacing, each carrying a Short BSR that says zero.

The one-millisecond cadence is not the scheduler being clumsy — it is configured, in a message you have already read. Frame 3's `RRCSetup` set `periodicBSR-Timer` to `sf1`: one subframe, the shortest value the TS 38.331 enumeration offers.

[26.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	10
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 26.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[26.3] 📤 UL LCID 63 (Padding)

[Frame 26.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[27.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📏 BS idx	0

[Frame 27.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[27.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 27.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[27.3] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 27.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[27.4] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 618 bytes

[Frame 27.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[27.5] 📤 UL LCID 63 (Padding)

[Frame 27.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

[28.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📏 BS idx	0

[Frame 28.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[28.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 28.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[28.3] 📤 UL LCID 63 (Padding)

[Frame 28.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[29.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📏 BS idx	0

[Frame 29.1] The run ends. Frames 25 to 29 between them delivered five Short BSRs, five padding subheaders, and not one byte of user or signaling data.

This is the honest face of uplink scheduling. The gNB cannot see the UE's buffer; it can only see reports about that buffer's recent past, and it must commit airtime before the report it is acting on can be confirmed. Over-granting is the cheaper mistake, so over-granting is what you get.

[29.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 29.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[29.3] 📤 UL LCID 63 (Padding)

[Frame 29.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[30] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	LCID:1 64 bytes
📏 SDU len	64

[Frame 30] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[31.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	14
📏 BS idx	0

[Frame 31.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[31.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	14
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 31.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[31.3] 📤 UL LCID 1 (1)

📐 Radio	FDD

[Frame 31.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	14
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	LCID:1 21 bytes

[31.4] 📤 UL LCID 1 (1) (UE → gNB)

[Frame 31.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📏 SDU len	21
📦 Subheader	Short BSR LCG ID=0 BS=0

[31.5] 📤 UL LCID 61 (Short BSR) (UE → gNB)

[Frame 31.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[31.6] 📤 UL LCID 57 (Single Entry PHR) (UE → gNB)

[Frame 31.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📦 Subheader	Padding 590 bytes

[31.7] 📤 UL LCID 63 (Padding) (UE → gNB)

[Frame 31.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[32.1] 📥 DL LCID 1 (1) (gNB → UE)

[Frame 32.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[32.2] 📥 DL LCID 63 (Padding) (gNB → UE)

[33.1] 📥 DL LCID 61 (Timing Advance Command) (gNB → UE)

[Frame 33.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[33.2] 📥 DL LCID 63 (Padding) (gNB → UE)

[34.1] 📥 DL LCID 61 (Timing Advance Command) (gNB → UE)

[Frame 34.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[34.2] 📥 DL LCID 63 (Padding) (gNB → UE)

[35.1] 📥 DL LCID 61 (Timing Advance Command) (gNB → UE)

[Frame 35.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[35.2] 📥 DL LCID 63 (Padding) (gNB → UE)

[36.1] 📊 Short BSR (UE → gNB)

[Frame 36.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000

📱 UE | 📡 gNB

🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	15
📏 BS idx	0

[36.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	15
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 36.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[36.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	15
📦 Subheader	LCID:1 103 bytes
📏 SDU len	103
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 36.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[36.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 36.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[36.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 513 bytes

[Frame 36.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[36.6] 📤 UL LCID 63 (Padding)

[Frame 36.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[37.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 37.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[37.2] 📥 DL LCID 63 (Padding)

[38.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:1 165 bytes
📏 SDU len	165
📦 Subheader	Padding 0 bytes

[Frame 38.1] The reconfiguration that mints a new logical channel. A 165-byte SDU on LCID 1, decoding to an RRC Reconfiguration. Two entries in it matter to MAC:

- `logicalChannelIdentity 4, servedRadioBearer drb-Identity 1, priority 1, bucketSizeDuration ms50, logicalChannelGroup 1, schedulingRequestID 0`
- `logicalChannelIdentity 2, priority 3, bucketSizeDuration ms50, logicalChannelGroup 0, schedulingRequestID 0`

The Logical Channel Group is the field to hold on to. A Buffer Status Report does not report per logical channel — it reports per *group* — and this frame is where the mapping is decided. From here on, a BSR naming LCG 1 is talking about the data bearer and one naming LCG 0 is talking about signaling. Every LCG 1 report in the session appears after this frame.

Note also what this message does **not** contain: `mac-CellGroupConfig` is absent. MAC itself is never reconfigured after frame 3.

[38.2] 📥 DL LCID 63 (Padding)

[39.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI

[Frame 39.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

📱 UE	📡 gNB

📱 UE ID	1
♻️ HARQ	0
📏 BS idx	0

[39.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 39.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[39.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	LCID:1 10 bytes

[Frame 39.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[39.4] 📤 UL LCID 1 (1)

📏 SDU len	10
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 39.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[39.5] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 39.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[39.6] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 601 bytes

[Frame 39.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[39.7] 📤 UL LCID 63 (Padding)

[Frame 39.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[40.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 40.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[40.2] 📥 DL LCID 63 (Padding)

[41.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📏 BS idx	0

[Frame 41.1] The first uplink after the data bearer opens, and its BSR still reads LCG 0, index 0.

[41.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 41.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[41.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI

[Frame 41.3] LCID 4 appears for the first time — a 55-byte SDU on the logical channel frame 38 created three frames ago. Underneath it Wireshark reads an RLC-AM PDU on DRB 1 with an 18-bit sequence number, a PDCP PDU, and an SDAP header carrying QoS Flow Identifier 2.

📱 UE | 📡 gNB

📱 UE ID	1
♻️ HARQ	1
📦 Subheader	LCID:4 55 bytes
📏 SDU len	55
📦 Subheader	Short BSR LCG ID=0 BS=0

To MAC this is simply logical channel 4 rather than logical channel 1. The multiplexing rules, the subheader format and the control elements are identical; only the number changed. 38 uplink and 29 downlink subheaders in this session carry `LCID 4`.

[41.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 41.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[41.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 561 bytes

[Frame 41.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[41.6] 📤 UL LCID 63 (Padding)

[Frame 41.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[42.1] 📤 DL LCID 4 (4)

[Frame 42.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[42.2] 📤 DL LCID 63 (Padding)

[43] 📤 DL LCID 4 (4)

[Frame 43] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:4 94 bytes
📏 SDU len	94

[44.1] 📊 Short BSR

[Frame 44.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📏 BS idx	0

[44.2] 📶 Single-Entry PHR

[Frame 44.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[44.3] 📤 UL LCID 4 (4)

[Frame 44.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Short BSR LCG ID=0 BS=0

[44.4] 📤 UL LCID 61 (Short BSR)

[Frame 44.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

📱 UE	📡 gNB

[44.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 613 bytes

[Frame 44.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[44.6] 📤 UL LCID 63 (Padding)

[Frame 44.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[45.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 45.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[45.2] 📥 DL LCID 63 (Padding)

[46.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 46.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[46.2] 📥 DL LCID 63 (Padding)

[47.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📏 BS idx	0

[Frame 47.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[47.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 47.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[47.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:4 87 bytes
📏 SDU len	87
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 47.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[47.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 47.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[47.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 529 bytes

[Frame 47.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[47.6] 📤 UL LCID 63 (Padding)

[Frame 47.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[48.1] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI

[Frame 48.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[48.2] 📥 DL LCID 63 (Padding)

[49] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	LCID:4 78 bytes
📏 SDU len	78

[Frame 49] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[50.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4

[Frame 50.1] A Buffer Status Report on Logical Channel Group 1. Index 16 — *1038 < BS <= 1446* bytes queued — and this time the queue belongs to the data bearer, because frame 38 put `LCID 4` in LCG 1.

That distinction is what makes grouping useful. The gNB now knows not just *how much* the UE has to send but *what kind:* signaling backlog and user-plane backlog arrive as separately numbered reports, and a scheduler that wants to protect latency-sensitive signaling can act on them differently.

[50.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 50.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[50.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	LCID:4 67 bytes

[Frame 50.3] Three SDUs and two control elements in one transport block — the busiest PDU shape in the session. This is the first of the three, a three-byte RLC status report on `LCID 4`. Only 13 of the 144 frames reach five subheaders, and this is one of them. There is no padding subheader at all: three SDUs plus the BSR plus the PHR filled the grant exactly.

[50.4] 📤 UL LCID 4 (4)

📏 SDU len	67
📦 Subheader	LCID:4 542 bytes

[Frame 50.4] 67 bytes on `LCID 4`, the second of three.

[50.5] 📤 UL LCID 4 (4)

📏 SDU len	542
📦 Subheader	Short BSR LCG ID=1 BS=16

[Frame 50.5] 542 bytes on `LCID 4`, the third — and the reason the BSR alongside still had something to report. RLC had more queued than the grant could take, so it segmented, and MAC packed what fitted.

Read the five subheaders in order and the assembly rule is plain: SDU, SDU, SDU, Short BSR, PHR. Uplink control elements come after every SDU (TS 38.321 §6.1.2), and the BSR is deliberately the second-to-last thing built, so it can describe the buffer *after* the scheduler's grant has been consumed.

[50.6] 📤 UL LCID 61 (Short BSR)

📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 50.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[50.7] 📤 UL LCID 57 (Single Entry PHR)

[Frame 50.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[51.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5

[Frame 51.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

📱 UE	📡 gNB

[51.2] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:4 619 bytes
📏 SDU len	619
📦 Subheader	Short BSR LCG ID=1 BS=14

[Frame 51.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[51.3] 📤 UL LCID 61 (Short BSR)

[Frame 51.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[52.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6

[Frame 52.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[52.2] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	LCID:4 116 bytes
📏 SDU len	116
📦 Subheader	LCID:4 501 bytes

[Frame 52.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[52.3] 📤 UL LCID 4 (4)

📏 SDU len	501
📦 Subheader	Short BSR LCG ID=1 BS=3

[Frame 52.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[52.4] 📤 UL LCID 61 (Short BSR)

[Frame 52.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[53.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📏 BS idx	0

[Frame 53.1] Index 0 again. The LCG 1 burst that began at frame 50 has drained in four frames — and frames 54, 56, 57 and 58 that follow are the same over-granted, BSR-plus-padding blocks you saw at frames 25 to 29. The pattern is not specific to signaling; it repeats every time a burst ends.

[53.2] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	LCID:4 21 bytes
📏 SDU len	21
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 53.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[53.3] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	Padding 598 bytes

[Frame 53.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[53.4] 📤 UL LCID 63 (Padding)

[Frame 53.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[54.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8
📏 BS idx	0

[Frame 54.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

📱 UE	📡 gNB

[54.2] 📤 UL LCID 61 (Short BSR) →

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 54.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[54.3] 📤 UL LCID 63 (Padding) →

[Frame 54.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[55.1] 📥 DL LCID 4 (4) ←

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	LCID:4 66 bytes

[Frame 55.1] The downlink's version of multiplexing: two `LCID 4` SDUs in one transport block, three bytes and 66 bytes. Same mechanism, opposite direction — and, as always in this direction, no padding payload behind them.

[55.2] 📥 DL LCID 4 (4) ←

📏 SDU len	66
📦 Subheader	Padding 0 bytes

[55.3] 📥 DL LCID 63 (Padding) ←

[56.1] 📊 Short BSR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	9
📏 BS idx	0

[Frame 56.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[56.2] 📶 Single-Entry PHR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	9
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 56.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[56.3] 📤 UL LCID 61 (Short BSR) →

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	9
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 56.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[56.4] 📤 UL LCID 57 (Single Entry PHR) →

📦 Subheader	Padding 618 bytes

[Frame 56.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[56.5] 📤 UL LCID 63 (Padding) →

[Frame 56.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[57.1] 📊 Short BSR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	10
📏 BS idx	0

[Frame 57.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

📱 UE	📡 gNB

[57.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	10
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 57.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[57.3] 📤 UL LCID 63 (Padding)

[Frame 57.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[58.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📏 BS idx	0

[Frame 58.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[58.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 58.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[58.3] 📤 UL LCID 63 (Padding)

[Frame 58.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[59.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📏 BS idx	0

[Frame 59.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[59.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 59.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[59.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 59.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[59.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 59.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[59.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 613 bytes

[Frame 59.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[59.6] 📤 UL LCID 63 (Padding)

[Frame 59.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority

📱 UE	📡 gNB

template)

[60.1] 📤 DL LCID 61 (Timing Advance Command) (gNB → UE)

[Frame 60.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[60.2] 📤 DL LCID 63 (Padding) (gNB → UE)

[61.1] 📤 DL LCID 61 (Timing Advance Command) (gNB → UE)

[Frame 61.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[61.2] 📤 DL LCID 63 (Padding) (gNB → UE)

[62.1] 📤 DL LCID 4 (4) (gNB → UE)

[Frame 62.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:4 794 bytes
📏 SDU len	794
📦 Subheader	Padding 0 bytes

[62.2] 📤 DL LCID 63 (Padding) (gNB → UE)

[63.1] 📊 Short BSR (UE → gNB)

[Frame 63.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📏 BS idx	0

[63.2] 📶 Single-Entry PHR (UE → gNB)

[Frame 63.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[63.3] 📤 UL LCID 4 (4) (UE → gNB)

[Frame 63.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	LCID:4 67 bytes

[63.4] 📤 UL LCID 4 (4) (UE → gNB)

[Frame 63.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📏 SDU len	67
📦 Subheader	Short BSR LCG ID=0 BS=0

[63.5] 📤 UL LCID 61 (Short BSR) (UE → gNB)

[Frame 63.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

📱 UE	📡 gNB

[63.6] 📤 UL LCID 57 (Single Entry PHR) →

📦 Subheader	Padding 544 bytes

[Frame 63.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[63.7] 📤 UL LCID 63 (Padding) →

[Frame 63.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

← [64.1] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 64.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

← [64.2] 📥 DL LCID 63 (Padding)

← [65.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 65.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

← [65.2] 📥 DL LCID 63 (Padding)

[66.1] 📊 Short BSR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	14
📏 BS idx	0

[Frame 66.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[66.2] 📶 Single-Entry PHR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	14
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 66.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[66.3] 📤 UL LCID 4 (4) →

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	14
📦 Subheader	LCID:4 67 bytes
📏 SDU len	67
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 66.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[66.4] 📤 UL LCID 61 (Short BSR) →

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 66.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[66.5] 📤 UL LCID 57 (Single Entry PHR) →

📦 Subheader	Padding 549 bytes

[Frame 66.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[66.6] 📤 UL LCID 63 (Padding) →

[Frame 66.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

← [67.1] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000

[Frame 67.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[67.2] 📥 DL LCID 63 (Padding)

[68.1] 📥 DL LCID 4 (4)

[Frame 68.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	LCID:4 66 bytes
📏 SDU len	66
📦 Subheader	Padding 0 bytes

[68.2] 📥 DL LCID 63 (Padding)

[69.1] 📥 DL LCID 4 (4)

[Frame 69.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:4 66 bytes
📏 SDU len	66
📦 Subheader	Padding 0 bytes

[69.2] 📥 DL LCID 63 (Padding)

[70.1] 📊 Short BSR

[Frame 70.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	15
📏 BS idx	0

[70.2] 📶 Single-Entry PHR

[Frame 70.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	15
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[70.3] 📤 UL LCID 4 (4)

[Frame 70.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	15
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	LCID:4 67 bytes

[70.4] 📤 UL LCID 4 (4)

[Frame 70.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📏 SDU len	67
📦 Subheader	Short BSR LCG ID=0 BS=0

[70.5] 📤 UL LCID 61 (Short BSR)

[Frame 70.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[70.6] 📤 UL LCID 57 (Single Entry PHR)

[Frame 70.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📦 Subheader	Padding 544 bytes

📱 UE	📡 gNB

[70.7] 📤 UL LCID 63 (Padding) (UE → gNB)

[Frame 70.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[71.1] 📥 DL LCID 4 (4) (gNB → UE)

[Frame 71.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[71.2] 📥 DL LCID 63 (Padding) (gNB → UE)

[72.1] 📊 Short BSR (UE → gNB)

[Frame 72.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📏 BS idx	0

[72.2] 📶 Single-Entry PHR (UE → gNB)

[Frame 72.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[72.3] 📤 UL LCID 4 (4) (UE → gNB)

[Frame 72.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:4 111 bytes
📏 SDU len	111
📦 Subheader	Short BSR LCG ID=0 BS=0

[72.4] 📤 UL LCID 61 (Short BSR) (UE → gNB)

[Frame 72.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[72.5] 📤 UL LCID 57 (Single Entry PHR) (UE → gNB)

[Frame 72.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📦 Subheader	Padding 505 bytes

[72.6] 📤 UL LCID 63 (Padding) (UE → gNB)

[Frame 72.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[73.1] 📥 DL LCID 4 (4) (gNB → UE)

[Frame 73.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[73.2] 📥 DL LCID 63 (Padding) (gNB → UE)

[74.1] 📥 DL LCID 61 (Timing Advance Command) (gNB → UE)

[Frame 74.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1

📱 UE | 📡 gNB

♻️ HARQ	5
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[74.2] 📥 DL LCID 63 (Padding)

[75.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📏 BS idx	0

[Frame 75.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[75.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 75.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[75.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	LCID:4 111 bytes
📏 SDU len	111
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 75.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[75.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 75.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[75.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 505 bytes

[Frame 75.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[75.6] 📤 UL LCID 63 (Padding)

[Frame 75.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[76.1] 📥 DL LCID 4 (4)

[Frame 76.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[76.2] 📥 DL LCID 63 (Padding)

[77.1] 📥 DL LCID 4 (4)

[Frame 77.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	LCID:4 102 bytes
📏 SDU len	102
📦 Subheader	Padding 0 bytes

[77.2] 📥 DL LCID 63 (Padding)

[78.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI

[Frame 78.1] The largest thing the UE ever asks for. LCG 1, buffer-size index 17 — *1446 < BS <= 2014* bytes still queued after this transmission, the highest index anywhere in the session.

Follow it forward: frame 79 reports index 16, frame 80

📱 UE	📡 gNB

📱 UE ID	1
♻️ HARQ	2

reports 14, frame 81 reports 0. Four grants to clear a two-kilobyte backlog, at roughly one grant per millisecond.

[78.2] 📶 Single-Entry PHR

[Frame 78.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[78.3] 📤 UL LCID 4 (4)

[Frame 78.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	LCID:4 91 bytes

[78.4] 📤 UL LCID 4 (4)

[Frame 78.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📏 SDU len	91
📦 Subheader	LCID:4 518 bytes

[78.5] 📤 UL LCID 4 (4)

[Frame 78.5] 518 bytes on `LCID 4`, the third SDU of another five-subheader PDU.

📏 SDU len	518
📦 Subheader	Short BSR LCG ID=1 BS=17

[78.6] 📤 UL LCID 61 (Short BSR)

[Frame 78.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📦 Subheader	PHR PH=57 PCMAX_f_c=52

[78.7] 📤 UL LCID 57 (Single Entry PHR)

[Frame 78.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[79.1] 📊 Short BSR

[Frame 79.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3

[79.2] 📤 UL LCID 4 (4)

[Frame 79.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:4 619 bytes
📏 SDU len	619
📦 Subheader	Short BSR LCG ID=1 BS=16

[79.3] 📤 UL LCID 61 (Short BSR)

[Frame 79.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[80.1] 📊 Short BSR

[Frame 80.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4

[80.2] 📤 UL LCID 4 (4)

[Frame 80.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4

📱 UE | 📡 gNB

📦 Subheader	LCID:4 164 bytes
📏 SDU len	164
📦 Subheader	LCID:4 453 bytes

[80.3] 📤 UL LCID 4 (4)

[Frame 80.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📏 SDU len	453
📦 Subheader	Short BSR LCG ID=1 BS=14

[80.4] 📤 UL LCID 61 (Short BSR)

[Frame 80.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[81.1] 📊 Short BSR

[Frame 81.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📏 BS idx	0

[81.2] 📤 UL LCID 4 (4)

[Frame 81.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:4 543 bytes
📏 SDU len	543
📦 Subheader	Short BSR LCG ID=0 BS=0

[81.3] 📤 UL LCID 61 (Short BSR)

[Frame 81.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📊 BSR LCG0 idx	0
📦 Subheader	Padding 75 bytes

[81.4] 📤 UL LCID 63 (Padding)

[Frame 81.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[82.1] 📊 Short BSR

[Frame 82.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📏 BS idx	0

[82.2] 📤 UL LCID 61 (Short BSR)

[Frame 82.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[82.3] 📤 UL LCID 63 (Padding)

[Frame 82.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[83.1] 📊 Short BSR

[Frame 83.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📏 BS idx	0

[83.2] 📶 Single-Entry PHR

[Frame 83.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7

📱 UE	📡 gNB

📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[83.3] 📤 UL LCID 61 (Short BSR) →

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 83.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[83.4] 📤 UL LCID 57 (Single Entry PHR) →

📦 Subheader	Padding 618 bytes

[Frame 83.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[83.5] 📤 UL LCID 63 (Padding) →

[Frame 83.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[84.1] 📥 DL LCID 4 (4) ←

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	LCID:4 90 bytes

[Frame 84.1] The downlink closes the burst with two SDUs of its own — three bytes of RLC status and 90 bytes of data.

[84.2] 📥 DL LCID 4 (4) ←

📏 SDU len	90
📦 Subheader	Padding 0 bytes

[84.3] 📥 DL LCID 63 (Padding) ←

[85.1] 📊 Short BSR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8
📏 BS idx	0

[Frame 85.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[85.2] 📤 UL LCID 61 (Short BSR) →

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 85.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[85.3] 📤 UL LCID 63 (Padding) →

[Frame 85.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[86.1] 📊 Short BSR →

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	9
📏 BS idx	0

[Frame 86.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[86.2] 📤 UL LCID 61 (Short BSR) →

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1

[Frame 86.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

♻️ HARQ	9
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[86.3] 📤 UL LCID 63 (Padding)

[Frame 86.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[87.1] 📊 Short BSR

[Frame 87.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	10
📏 BS idx	0

[87.2] 📤 UL LCID 61 (Short BSR)

[Frame 87.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	10
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[87.3] 📤 UL LCID 63 (Padding)

[Frame 87.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[88.1] 📥 DL LCID 61 (Timing Advance Command)

[Frame 88.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[88.2] 📥 DL LCID 63 (Padding)

[89.1] 📊 Short BSR

[Frame 89.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📏 BS idx	0

[89.2] 📶 Single-Entry PHR

[Frame 89.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[89.3] 📤 UL LCID 4 (4)

[Frame 89.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Short BSR LCG ID=0 BS=0

[89.4] 📤 UL LCID 61 (Short BSR)

[Frame 89.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

📱 UE	📡 gNB

[89.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 613 bytes

[Frame 89.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[89.6] 📤 UL LCID 63 (Padding)

[Frame 89.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[90.1] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	LCID:4 1226 bytes
📏 SDU len	1226
📦 Subheader	Padding 0 bytes

[Frame 90.1] A 1226-byte downlink SDU, carried whole. One subheader, one logical channel, no control elements, and a zero-byte padding subheader behind it.

Compare the uplink's ceiling of 619 bytes. The difference is not a protocol limit. The gNB sizes its own transport blocks against a buffer it can see directly, while the uplink runs on a grant fixed before the UE's data existed.

[90.2] 📥 DL LCID 63 (Padding)

[91.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📏 BS idx	0

[Frame 91.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[91.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 91.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[91.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	LCID:4 91 bytes

[Frame 91.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[91.4] 📤 UL LCID 4 (4)

📏 SDU len	91
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 91.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[91.5] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 91.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[91.6] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 520 bytes

[Frame 91.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[91.7] 📤 UL LCID 63 (Padding)

[Frame 91.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[92.1] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 92.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

[92.2] 📥 DL LCID 63 (Padding)

[93.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 93.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[93.2] 📥 DL LCID 63 (Padding)

[94.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 94.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[94.2] 📥 DL LCID 63 (Padding)

[95.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13

[Frame 95.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[95.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 95.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[95.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📦 Subheader	LCID:4 616 bytes
📏 SDU len	616
📦 Subheader	Short BSR LCG ID=1 BS=15

[Frame 95.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[95.4] 📤 UL LCID 61 (Short BSR)

📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 95.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[95.5] 📤 UL LCID 57 (Single Entry PHR)

[Frame 95.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[96.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	14

[Frame 96.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[96.2] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	14
📦 Subheader	LCID:4 619 bytes
📏 SDU len	619

[Frame 96.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE | 📡 gNB

📦 Subheader	Short BSR LCG ID=1 BS=13

[96.3] 📤 UL LCID 61 (Short BSR)

[Frame 96.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[97.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	15
📏 BS idx	0

[Frame 97.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[97.2] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	15
📦 Subheader	LCID:4 66 bytes
📏 SDU len	66
📦 Subheader	LCID:4 335 bytes

[Frame 97.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[97.3] 📤 UL LCID 4 (4)

📏 SDU len	335
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 97.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[97.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	Padding 215 bytes

[Frame 97.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[97.5] 📤 UL LCID 63 (Padding)

[Frame 97.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[98.1] 📤 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 98.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[98.2] 📤 DL LCID 63 (Padding)

[99.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📏 BS idx	0

[Frame 99.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[99.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 99.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[99.3] 📤 UL LCID 63 (Padding)

[Frame 99.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[100.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI

[Frame 100.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

📱 UE | 📡 gNB

📱 UE ID	1
♻️ HARQ	1
📏 BS idx	0

[100.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 100.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[100.3] 📤 UL LCID 63 (Padding)

[Frame 100.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[101.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📏 BS idx	0

[Frame 101.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[101.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 101.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[101.3] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 101.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[101.4] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 618 bytes

[Frame 101.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[101.5] 📤 UL LCID 63 (Padding)

[Frame 101.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[102] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	LCID:4 90 bytes
📏 SDU len	90

[Frame 102] A 90-byte downlink SDU with no padding subheader at all — the transport block ended exactly where the SDU did. 12 downlink frames in this session do this.

[103.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📏 BS idx	0

[Frame 103.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[103.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD

[Frame 103.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[103.3] 📤 UL LCID 63 (Padding)

[Frame 103.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[104.1] 📊 Short BSR

[Frame 104.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📏 BS idx	0

[104.2] 📤 UL LCID 61 (Short BSR)

[Frame 104.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[104.3] 📤 UL LCID 63 (Padding)

[Frame 104.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[105.1] 📊 Short BSR

[Frame 105.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📏 BS idx	0

[105.2] 📶 Single-Entry PHR

[Frame 105.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[105.3] 📤 UL LCID 4 (4)

[Frame 105.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Short BSR LCG ID=0 BS=0

[105.4] 📤 UL LCID 61 (Short BSR)

[Frame 105.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[105.5] 📤 UL LCID 57 (Single Entry PHR)

[Frame 105.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📦 Subheader	Padding 613 bytes

[105.6] 📤 UL LCID 63 (Padding)

[Frame 105.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[106.1] 📥 DL LCID 4 (4)

[Frame 106.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority

📱 UE | 📡 gNB

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	LCID:4 590 bytes
📏 SDU len	590
📦 Subheader	Padding 0 bytes

template)

[106.2] 📥 DL LCID 63 (Padding)

[107.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📏 BS idx	0

[Frame 107.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[107.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 107.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[107.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	LCID:4 91 bytes

[Frame 107.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[107.4] 📤 UL LCID 4 (4)

📏 SDU len	91
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 107.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[107.5] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 107.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[107.6] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 520 bytes

[Frame 107.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[107.7] 📤 UL LCID 63 (Padding)

[Frame 107.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[108.1] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 108.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[108.2] 📥 DL LCID 63 (Padding)

[109] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1

[Frame 109] The largest MAC SDU in the capture: 1438 bytes on `LCID 4`**.** A single subheader in a single transport block, no control element, no padding.

Underneath, RLC is segmenting: this is the first segment of sequence number 11, poll bit clear. MAC neither knows nor cares — it received one 1438-byte octet string on logical channel 4 and emitted one subheader. Every segmentation decision RLC makes on the layer above is really a reaction to

📱 UE	📡 gNB	

♻️ HARQ	2
📦 Subheader	LCID:4 1438 bytes
📏 SDU len	1438

how much room MAC's scheduler offered.

[110.1] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	LCID:4 69 bytes
📏 SDU len	69
📦 Subheader	LCID:4 1367 bytes

[Frame 110.1] 69 bytes, completing the SDU that frame 109 started...

[110.2] 📥 DL LCID 4 (4)

📏 SDU len	1367

[Frame 110.2] ...and 1367 bytes starting the next, in the same transport block. Two RLC sequence numbers in flight at once, told apart by nothing but their subheader lengths.

[111.1] 📥 DL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	LCID:4 140 bytes
📏 SDU len	140
📦 Subheader	LCID:4 578 bytes

[Frame 111.1] 140 bytes, then 578 in the next subheader, then a zero-byte padding subheader. The downlink burst that began at frame 109 ends here having moved more than three kilobytes in three transmissions and wasted nothing.

[111.2] 📥 DL LCID 4 (4)

📏 SDU len	578
📦 Subheader	Padding 0 bytes

[111.3] 📥 DL LCID 63 (Padding)

[112.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📏 BS idx	0

[Frame 112.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[112.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 112.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[112.3] 📤 UL LCID 4 (4)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 112.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[112.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 112.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[112.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 613 bytes

[Frame 112.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[112.6] 📤 UL LCID 63 (Padding)

[Frame 112.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

[113.1] 📊 Short BSR (UE → gNB)

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8

[Frame 113.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[113.2] 📶 Single-Entry PHR (UE → gNB)

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 113.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[113.3] 📤 UL LCID 4 (4) (UE → gNB)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	8
📦 Subheader	LCID:4 616 bytes
📏 SDU len	616
📦 Subheader	Short BSR LCG ID=1 BS=12

[Frame 113.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[113.4] 📤 UL LCID 61 (Short BSR) (UE → gNB)

📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 113.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[113.5] 📤 UL LCID 57 (Single Entry PHR) (UE → gNB)

[Frame 113.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[114.1] 📊 Short BSR (UE → gNB)

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	9
📏 BS idx	0

[Frame 114.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[114.2] 📤 UL LCID 4 (4) (UE → gNB)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	9
📦 Subheader	LCID:4 376 bytes
📏 SDU len	376
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 114.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[114.3] 📤 UL LCID 61 (Short BSR) (UE → gNB)

📊 BSR LCG0 idx	0
📦 Subheader	Padding 242 bytes

[Frame 114.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[114.4] 📤 UL LCID 63 (Padding) (UE → gNB)

[Frame 114.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[115.1] 📤 DL LCID 4 (4) (gNB → UE)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	LCID:4 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 115.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[115.2] 📤 DL LCID 63 (Padding) (gNB → UE)

📱 UE	📡 gNB

[116.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	10
📏 BS idx	0

[Frame 116.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[116.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	10
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 116.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[116.3] 📤 UL LCID 63 (Padding)

[Frame 116.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[117.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📏 BS idx	0

[Frame 117.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[117.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	11
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 117.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[117.3] 📤 UL LCID 63 (Padding)

[Frame 117.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[118.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📏 BS idx	0

[Frame 118.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[118.2] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	12
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	Padding 621 bytes

[Frame 118.2] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[118.3] 📤 UL LCID 63 (Padding)

[Frame 118.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[119.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📏 BS idx	0

[Frame 119.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

📱 UE	📡 gNB

[119.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 119.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[119.3] 📤 UL LCID 61 (Short BSR)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	13
📦 Subheader	Short BSR LCG ID=0 BS=0
📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 119.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[119.4] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 618 bytes

[Frame 119.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[119.5] 📤 UL LCID 63 (Padding)

[Frame 119.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[120.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 120.1] The metronome, with nothing left to time. A Timing Advance Command on TAG 0 with value 31 — the fourteenth of this connection.

Frames 6, 33, 34, 35, 45, 46, 60, 61, 65, 74, 88, 93, 94 and then 120 through 127 make 21 Timing Advance Commands on the first connection. Every consecutive interval among them falls between **599.957 ms and 600.032 ms.** Every one carries **31,** the value TS 38.213 §4.2 defines as no adjustment.

Now read frame 3's `tag-Config` again: `tag-Id 0`, `timeAlignmentTimer` **infinity.** A Timing Advance Command restarts that timer (TS 38.321 §5.2), but a timer set to infinity never expires, so there is nothing to restart. These commands correct no timing and refresh no deadline.

[120.2] 📥 DL LCID 63 (Padding)

[121.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 121.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[121.2] 📥 DL LCID 63 (Padding)

[122.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	0
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 122.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[122.2] 📥 DL LCID 63 (Padding)

[123.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	1
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 123.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE | 📡 gNB

[123.2] 📥 DL LCID 63 (Padding)

[124.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	2
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 124.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[124.2] 📥 DL LCID 63 (Padding)

[125.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	3
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 125.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[125.2] 📥 DL LCID 63 (Padding)

[126.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	4
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 126.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[126.2] 📥 DL LCID 63 (Padding)

[127.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	5
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 127.1] The twenty-first and last Timing Advance Command of this connection — 600.004 ms after the previous one, still TAG 0, still 31.

Frames 120 through 127 are eight of them back to back with no other traffic on the link at all. If you want a single run that says *this is an emulator, not a moving handset,* this is it: zero timing correction, zero power variation, and a timer that cannot expire.

[127.2] 📥 DL LCID 63 (Padding)

[128] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	6
📦 Subheader	LCID:1 10 bytes
📏 SDU len	10

[Frame 128] The release, and a transport block with one thing in it. A 10-byte SDU on `LCID 1` — the RRC Release — with no BSR, no PHR and not even a padding subheader. Ten bytes granted, ten bytes sent.

[129] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	1
♻️ HARQ	7
📦 Subheader	LCID:1 10 bytes
📏 SDU len	10

[Frame 129] The identical PDU again, 44.894 ms later: same LCID, same 10 bytes, no control elements. Nothing at the MAC layer explains the repeat. MAC's own retransmission mechanism is HARQ, which lives below this capture's visibility and never surfaces a duplicate here.

The cause is one layer up. RLC-AM polled with frame 128, got no status report back, and its `t-PollRetransmit` timer fired. From MAC's point of view a second, unrelated 10-byte SDU simply arrived on logical channel 1.

[131.1] 📤 UL LCID 52 (CCCH (48 bits))

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2

[Frame 131.1] A second connection begins, on the same C-RNTI. `LCID` 52 again, six bytes of CCCH again — a fresh `RRCSetupRequest` from a new UE context, 3196.459 ms after the last frame of the old one.

This session contains both connections because `mac-ue` sessions are keyed on C-RNTI alone and the cell handed `0x8000` straight back out. The MAC-NR context field is what

📱 UE	📡 gNB

♻️ HARQ	0
📦 Subheader	LCID:52 6 bytes
📦 Subheader	Padding 24 bytes

tells them apart: UEId 1 for frames 2 to 129, UEId 2 from here on.

[131.2] 📤 UL LCID 63 (Padding)

[132.1] 🤝 Contention Resolution

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	0

[Frame 132.1] Contention resolution again — and the identity is different. The echoed UE Contention Resolution Identity is `0838468acf04`, not the `1b34056b1846` of frame 3.

That difference is the proof this is a genuinely new random access rather than a continuation. The identity is whatever Msg3 the UE actually sent this time, and a new random value produces a new echo. Everything frames 2 and 3 taught applies unchanged, one connection later.

[132.2] 📥 DL LCID 62 (UE Contention Resolution Identity)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	0
📦 Subheader	Contention Resolution
📦 Subheader	LCID:0 214 bytes

[Frame 132.2] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[132.3] 📥 DL LCID 0 (CCCH)

📏 SDU len	214
📦 Subheader	Padding 0 bytes

[Frame 132.3] A 214-byte CCCH SDU — the same size as frame 3's, because it is the same `RRCSetup` carrying the same `mac-CellGroupConfig`: `periodicBSR-Timer sf1`, `retxBSR-Timer sf80`, `phr-PeriodicTimer sf10`, `phr-ProhibitTimer sf0`, `phr-Tx-PowerFactorChange dB1`, `timeAlignmentTimer infinity`, and no `drx-Config`. The second connection therefore behaves exactly like the first, and for a readable reason rather than a guessed one.

[132.4] 📥 DL LCID 63 (Padding)

[Frame 132.4] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[133.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	0
📏 BS idx	0

[Frame 133.1] The new connection's first uplink, and the four-subheader shape of frame 4 returns intact: a 54-byte LCID 1 SDU, a Short BSR reading zero, a Single-Entry PHR reading the same index 57 and index 52 as all 36 before it, and 562 bytes of padding.

[133.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	0
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 133.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[133.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	0
📦 Subheader	LCID:1 54 bytes
📏 SDU len	54
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 133.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[133.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 133.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[133.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 562 bytes

[Frame 133.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[133.6] 📤 UL LCID 63 (Padding)

[Frame 133.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

[134.1] 📤 DL LCID 1 (1) (gNB → UE)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	0
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 134.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[134.2] 📤 DL LCID 63 (Padding) (gNB → UE)

[135.1] 📤 DL LCID 61 (Timing Advance Command) (gNB → UE)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	1
📦 Subheader	TAG=0 TA=31
📦 Subheader	Padding 0 bytes

[Frame 135.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[135.2] 📤 DL LCID 63 (Padding) (gNB → UE)

[136.1] 📤 DL LCID 1 (1) (gNB → UE)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	2
📦 Subheader	LCID:1 11 bytes
📏 SDU len	11
📦 Subheader	Padding 0 bytes

[Frame 136.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[136.2] 📤 DL LCID 63 (Padding) (gNB → UE)

[137.1] 📊 Short BSR (UE → gNB)

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	1
📏 BS idx	0

[Frame 137.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[137.2] 📶 Single-Entry PHR (UE → gNB)

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	1
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 137.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[137.3] 📤 UL LCID 1 (1) (UE → gNB)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	1
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	LCID:1 10 bytes

[Frame 137.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[137.4] 📤 UL LCID 1 (1) (UE → gNB)

📏 SDU len	10
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 137.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[137.5] 📤 UL LCID 61 (Short BSR) (UE → gNB)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 137.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

[137.6] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 601 bytes

[Frame 137.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[137.7] 📤 UL LCID 63 (Padding)

[Frame 137.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[138.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	3
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 138.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[138.2] 📥 DL LCID 63 (Padding)

[139.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	4
📦 Subheader	LCID:1 53 bytes
📏 SDU len	53
📦 Subheader	Padding 0 bytes

[Frame 139.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[139.2] 📥 DL LCID 63 (Padding)

[140.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	2
📏 BS idx	0

[Frame 140.1] 💡 Short Buffer Status Report — UE reports queued UL data for one Logical Channel Group

[140.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	2
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 140.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[140.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	2
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	LCID:1 10 bytes

[Frame 140.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[140.4] 📤 UL LCID 1 (1)

📏 SDU len	10
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 140.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[140.5] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 140.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[140.6] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 601 bytes

[Frame 140.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[140.7] 📤 UL LCID 63 (Padding)

[Frame 140.7] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority

📱 UE | 📡 gNB

template)

[141.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	5
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Padding 0 bytes

[Frame 141.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[141.2] 📥 DL LCID 63 (Padding)

[142.1] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	6
📦 Subheader	LCID:1 29 bytes
📏 SDU len	29
📦 Subheader	Padding 0 bytes

[Frame 142.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

[142.2] 📥 DL LCID 63 (Padding)

[143.1] 📊 Short BSR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	3
📏 BS idx	0

[Frame 143.1] The last uplink transmission of the session: a three-byte RLC status report, a Short BSR reading zero, a PHR, and 613 bytes of padding. The sixty-sixth Short BSR and the thirty-seventh PHR.

[143.2] 📶 Single-Entry PHR

🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	3
📡 Type2 other-cell	False
🔋 Pcmax	22 dBm <= Pcmax,f,c < 23 dBm [idx 52]

[Frame 143.2] 💡 Power Headroom Report — UE reports transmit power margin remaining below Pcmax

[143.3] 📤 UL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	3
📦 Subheader	LCID:1 3 bytes
📏 SDU len	3
📦 Subheader	Short BSR LCG ID=0 BS=0

[Frame 143.3] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[143.4] 📤 UL LCID 61 (Short BSR)

📊 BSR LCG0 idx	0
📦 Subheader	PHR PH=57 PCMAX_f_c=52

[Frame 143.4] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[143.5] 📤 UL LCID 57 (Single Entry PHR)

📦 Subheader	Padding 613 bytes

[Frame 143.5] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[143.6] 📤 UL LCID 63 (Padding)

[Frame 143.6] 💡 UL-SCH MAC PDU — UE->gNB on PUSCH (generic fallback for LCIDs not matched by a higher-priority template)

[144.1] 📥 DL LCID 61 (Timing Advance Command)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	7
📦 Subheader	TAG=0 TA=31

[Frame 144.1] 💡 DL-SCH MAC PDU — gNB->UE on PDSCH (generic fallback for LCIDs not matched by a higher-priority template)

📱 UE	📡 gNB

📦 Subheader	Padding 0 bytes

[144.2] 📥 DL LCID 63 (Padding)

[145] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	0
📦 Subheader	LCID:1 10 bytes
📏 SDU len	10

[Frame 145] A 10-byte `LCID` 1 SDU, downlink, alone in its transport block — the second connection's RRC Release, exactly as frame 128 was the first's.

[146] 📥 DL LCID 1 (1)

📐 Radio	FDD
🆔 RNTI	0x8000
🏷️ Type	C-RNTI
📱 UE ID	2
♻️ HARQ	1
📦 Subheader	LCID:1 10 bytes
📏 SDU len	10

[Frame 146] The session ends mid-retransmission. The same 10 bytes again, 44.915 ms after the previous frame — RLC's poll timer firing for the second time in the session, on a connection one frame old.

The session closes here not because anything ended, but because the next frame in the capture is 32.45 s away, past the 30 s idle timeout that defines this session's boundary. MAC itself carries on: frames 147 to 151 are a third connection's random access, setup and Setup Complete, in a session of their own. What MAC leaves behind is a tidy ledger: 144 frames, 370 subheaders, 66 Buffer Status Reports of which 55 asked for nothing, 37 identical Power Headroom Reports, 23 Timing Advance Commands that adjusted nothing, and 30955 bytes of uplink padding against zero bytes downlink.

Session Result: timeout — idle 30.000s after last activity (active span: 16.744s)