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5G-Advanced, Sorted: A Planner's Field Guide to Rel-18 and Rel-19

Rel-18 froze in four steps, Rel-19 in two — and none of those dates put a feature in your network. A working map of what each release actually contains, which headlines are studies wearing feature costumes, and what is verifiably running in mid-2026.

AUTHOR

5G/6G Academy Research

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Abstract—“5G-Advanced” is not a logo; it is two finished releases, a third closing, and a calendar most planners misread. Rel-18 froze in stages through June 2024; Rel-19 was finalised in September 2025 with RAN4 performance work landing March 2026; Rel-20 — the last release focused on 5G-Advanced — runs to a mid-2027 freeze while carrying the first 6G studies. This guide walks both catalogs feature by feature with a planner's question attached (who needs it, and what does it run on), then sorts the headlines onto a maturity ladder that vendor decks tend to flatten: SBFD jumped from study to normative spec; Ambient IoT jumped from two studies to a shippable ~1 μ W device class; ISAC remains requirements plus a channel-model clause — nothing to deploy; and Rel-19's AI/ML framework standardizes only one-sided models, deferring two-sided CSI compression to Rel-20. The shipping reality, mid-2026: Rel-18-class modem platforms announced at MWC 2025, eleven networks branded 5G-Advanced per GSA-reported data, no commercial eRedCap silicon we could find, and the flagship Rel-18 mobility feature at its first field demo. Budget against the deployed set, not the frozen one.

1. “Frozen” Is a Spectrum, Not a Date

Ask when 5G-Advanced arrived and you can defend at least six answers. The brand itself dates to an April 2021 decision that the 5G-Advanced logo applies from Release 18 onwards [4]. Rel-18 then froze in stages, as releases do: RAN1 functional freeze in September 2023 (declared on time), RAN2/3/4 in December 2023, first ASN.1 review in March 2024, and the ASN.1 freeze — the moment messages stop changing shape — in June 2024, on the published plan [3]. Rel-19 finished in two steps: Stage 3 and RAN work in September 2025, RAN4 performance specifications in March 2026 [1]. Rel-20 is mid-flight: Stage 1 frozen June 2025, Stage 2 targeted for September 2026 (about 80% complete this month), Stage 3 March 2027, final ASN.1/OpenAPI freeze June 2027 — 126 work items and 74 studies for 5G-Advanced were underway as of March 2026, alongside the first 6G studies, because Rel-20 is also the on-ramp: 3GPP has settled on Rel-20 for 6G studies and Rel-21 for 6G normative work, against ITU IMT-2030 dates of technology proposals in early 2029 and final submission mid-2030 [5].

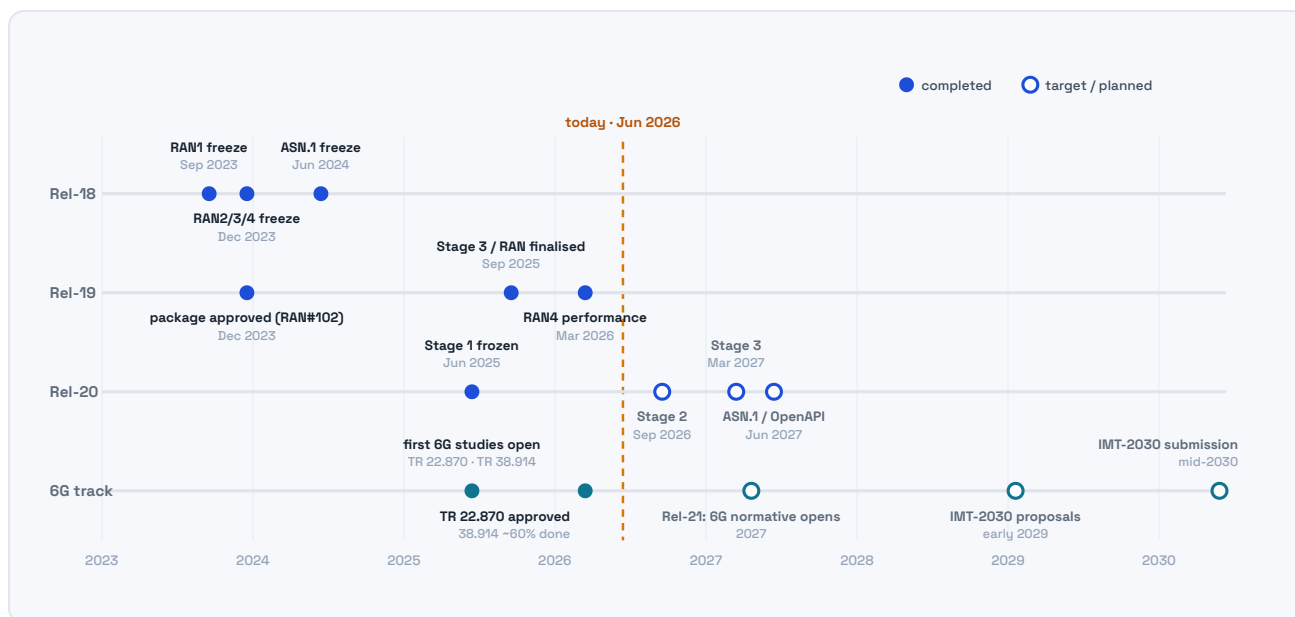


Fig. 1. Two tracks, one calendar: 5G-Advanced release milestones (Rel-18/19/20) and the 6G track they hand over to. Filled dots are completed; hollow are published targets. Rel-18 dates are the TSG RAN chair's plan, met as scheduled [1], [3]–[5].

Why belabor dates? Because the most expensive planning mistake in this subject is reading "frozen" as "available." Broadly Rel-18-capable phone silicon was announced at MWC in March 2025 — nine months *after* the ASN.1 freeze — and reached devices later still [13], [14]. As a rule of thumb that has now held for several releases: freeze plus roughly two years equals features you can actually buy. Everything that follows should be read against that offset.

2. The Rel-18 Catalog: The Deployable Baseline

Rel-18 is the floor 5G-Advanced stands on, and its character is clear once you list it: most of the value lands on *things that are not smartphones*. **MIMO evolution** brought a unified TCI framework to multi-TRP, coherent joint transmission codebooks, doubled orthogonal DMRS ports — and its marquee item, **8Tx uplink with up to eight layers**, aimed explicitly at CPE, FWA, vehicle and industrial devices [2]. One precision worth carrying into meetings: there is no RAN1 downlink-8Rx feature in Rel-18 — the eight-antenna story is an uplink story — though a Rel-18 RAN4 item did specify FR1 8Rx DL *RF requirements* for that same high-end device class [2]. **L1/L2-Triggered Mobility (LTM)** rebuilt the handover: cell switch on L1 measurements, triggered by a MAC CE instead of an RRC reconfiguration, with candidate cells staying configured after the switch for the next one — built for FR2 and high-mobility cells where interruption hurts [2], [16]. Rel-18 LTM stays within one CU; the fact that Rel-19 had to "enable inter-CU" mobility tells you where the boundary was [1].

Down-market, **eRedCap** creates a tier below RedCap: peak rate restricted to 10 Mbps in DL and UL "regardless of what other features the UE may support," positioning it — 3GPP's own words — between LPWA (NB-IoT/LTE-MTC) and Rel-17 RedCap, i.e. LTE Cat-1 territory [2]. **Positioning** gained sidelink ranging (SL-PRS, the new SLPP protocol in TS 38.355) and **carrier-phase positioning** reaching toward centimetre-class accuracy with double-differential operation [2]. **Sidelink** moved onto unlicensed FR1 (SL-U in n46/n96/n102) and added carrier aggregation in the ITS band [2]. The verticals kept arriving: a first NR **air-to-ground** specification, **UAV** support for aerial UEs, slicing Phase 3, multicast reception in RRC_INACTIVE for mission-critical scale, network-controlled

repeaters, mobile IAB, and NTN Phase 2's smartphone-grade uplink work — this series covered the energy toolkit in N°07 and the NTN story in N°08 [2]. And two famous Rel-18 names were deliberately *not* features: AI/ML for the air interface (study, TR 38.843) and duplex evolution (study, TR 38.858) [11], [12]. Both graduate next.

3. The Rel-19 Catalog: Where the Lines Were Drawn

Rel-19 reads like a release that knows exactly how much it trusts itself. **AI/ML for the NR air interface went normative** — a framework for one-sided models at gNB or UE covering beam management, positioning and CSI prediction, plus generic lifecycle management. The sentence that matters is the exclusion: "two-sided CSI compression and UE training-data collection is deferred to Rel-20" [1]. Two-sided models — encoder in the phone, decoder in the network — promise the largest gains and pose the hardest multi-vendor interoperability problem, and the standard just told you precisely where the industry's interop confidence ends. **MIMO Phase 5** extends CSI and coherent joint transmission to **128 ports**, adds 3Tx uplink and UE-initiated beam management [1]. **Mobility Phase 4** takes LTM across CU boundaries and adds UE-triggered conditional LTM [1].

Two graduations deserve their own sentences. **SBFD is now a work item, not a study**: non-overlapping sub-band full duplex in TDD NR — simultaneous uplink and downlink on separate sub-bands within the band, with new sub-band configurations, RACH support, and cross-link-interference measurement and coordination machinery [1]. And **Ambient IoT** became a shippable device class: "device 1" draws roughly **1 μ W peak**, talks by backscattering an external carrier wave, receives with an RF envelope detector, runs OOK with Manchester coding, and carries no RRC, no PDCP, no HARQ, no AS security — a radically simplified stack with a new core function (AIOTF) behind it. Scope is deliberately narrow: indoor inventory and indoor command, FR1 licensed FDD, base-station-as-reader topology only; devices 2a/2b and the UE-as-reader topology are targeted (not committed) for Rel-20 [1], [6]. The rest of the catalog: NTN Phase 3 (regenerative payloads, store-and-forward, RedCap over NTN — the orbit half of this story is N°08), low-power wake-up signals and receivers (LP-WUS), XR Phase 3 capacity work, mobile-gNB wireless access backhaul, NR femto, multi-cell scheduling from a single DCI, and the 256-bit algorithm suite (SNOW 5G, AES-256, ZUC-256) entering the train — with profile integration, as N°06 examined, still the part to watch [1].

4. Study vs Spec: A Planner's Decoder

The most useful skill in reading 5G-Advanced marketing is telling deliverable types apart. A *study item* produces a technical report — evaluations, channel models, feasibility. A *stage-1 specification* produces requirements language. A *work item* produces normative protocol you can eventually buy. The three most-hyped topics of the moment sit on three different rungs, and Fig. 2 sorts them.

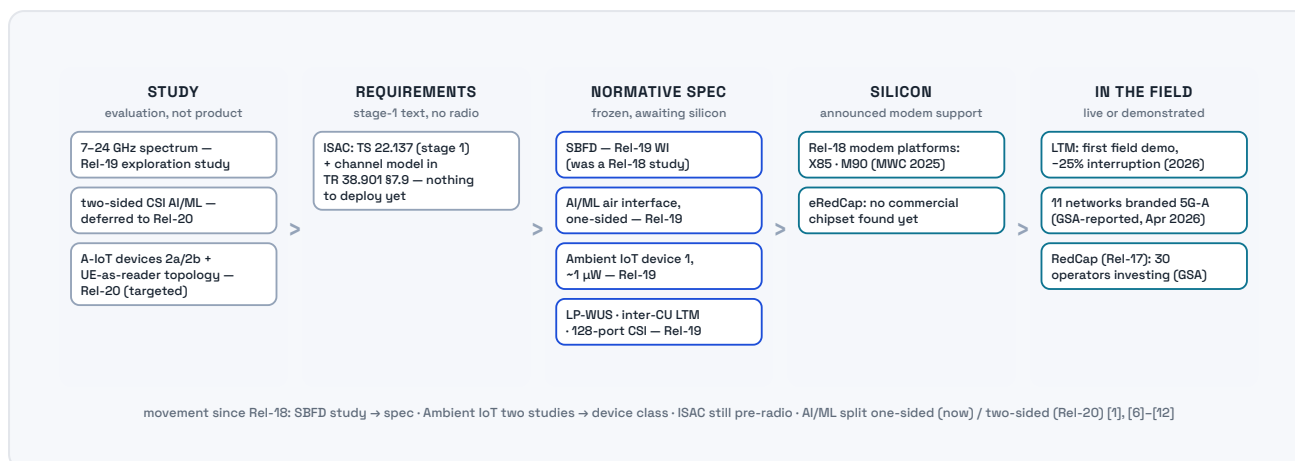


Fig. 2. The maturity ladder, mid-2026: where the headline topics actually sit, from evaluation framework to field evidence. Sources: 3GPP Rel-19 Summary, release pages, spec archive, vendor/GSA-reported items [1]–[18].

ISAC — integrated sensing and communication — currently consists of a use-case study (TR 22.837), stage-1 service requirements (TS 22.137), and a channel model that lives as **clause 7.9 inside TR 38.901**; there is no separate channel-model TR and no RAN sensing feature anywhere in the Rel-19 feature list [1], [7]–[9]. Anyone selling "ISAC-ready" hardware in 2026 is selling ahead of the paperwork. The **7–24 GHz** upper midband is likewise an exploration study. **SBFD** shows the opposite motion — study (TR 38.858) to normative spec in one release [1], [12]. **Ambient IoT** went further still: two studies (TR 38.848, TR 38.769) to a standardized device class [6], [10]. The decoder question to ask of any roadmap slide is simply: *which document type does this map to — TR, stage-1 TS, or frozen protocol?* The answer usually reprises the slide.

5. What Is Actually Shipping, Mid-2026

Now the gap between catalog and field. **Silicon:** Qualcomm's X85 modem platform, announced March 2025, lists "3GPP Release 18 support" (12.5 Gbps peak DL, 3.7 Gbps UL, a dedicated AI processor) [13]; MediaTek's M90 is reported at 12 Gbps with Rel-17-plus-forthcoming-Rel-18 alignment [14]. Treat the "Release-18-ready" badge with care — the previous generation wore similar marketing a year earlier; what you want from a datasheet is feature-by-feature support, not the badge. **Networks:** GSA-reported data from April 2026 counts **11 launched 5G-Advanced networks and 35 operators investing** — up from seven the previous November — with commercial services concentrated in Asia [17]. China Mobile alone is reported (by a single analyst source) above 10 million 5G-A package customers across 300-plus cities [19]. A caution attaches to all of it: a "5G-Advanced launch" is a brand event, not a feature manifest — none of these figures tells you which Rel-18 features are switched on.

TABLE 1 • The catalog at a glance — what each release gives you, and what it runs on [1], [2]

Domain	Rel-18 gave you (frozen Jun 2024)	Rel-19 added (finalised Sep 2025 / Mar 2026)	It runs on
MIMO	8Tx uplink, up to 8 layers (CPE/FWA class); RAN4 8Rx DL requirements	Phase 5: CSI/CJT to 128 ports, 3Tx UL, UE-initiated beam management	new devices + RAN software
Mobility	LTM: L1-measured, MAC-CE-triggered cell switch; candidates retained	inter-CU LTM; UE-triggered conditional LTM	software both ends; Rel-18 UEs
XR	PDU-Set awareness, delay-status reporting, power/capacity tools	Phase 3 capacity/QoS; encrypted-flow handling (XRM Ph2)	software + devices
Low-tier devices	eRedCap: peak rate capped at 10 Mbps, LTE Cat-1 territory	RedCap over NTN	new silicon — none commercial yet
Ambient IoT	study (TR 38.848)	device 1: ~1 µW backscatter, indoor, FR1 licensed FDD, BS-reader	a whole new device class + readers
Duplex	study (TR 38.858)	SBFD: sub-band full duplex in TDD, CLI measurement/coordination	new radios + spectrum re-plan
AI/ML air interface	study (TR 38.843)	one-sided models normative (beams, positioning, CSI prediction); two-sided → Rel-20	software + devices
Energy	cell DTX/DRX, CSI sub-configurations (→ N°07)	on-demand SSB/SIB1; LP-WUS wake-up receivers	network software; WUS needs new receivers
NTN	Phase 2: smartphone-grade UL, Ka-band VSAT (→ N°08)	Phase 3: regenerative payloads, store-and-forward, RedCap-NTN	new payloads + devices
Sidelink	SL-U in n46/n96/n102; carrier aggregation in n47	multi-hop relay (up to two extra hops)	spectrum posture + devices
Positioning	carrier-phase cm-class; SL-PRS + SLPP (TS 38.355)	refinements ride other items	software + devices
Security	—	256-bit algorithm suite: SNOW 5G, AES-256, ZUC-256 (→ N°06)	profile integration still to come

Per-feature evidence is thinner and more honest. **RedCap** — the Rel-17 baseline eRedCap builds on — had 30 operators in 21 countries investing as of April 2025, with launches including the Chinese big three and T-Mobile US (GSA-reported) [18]. **eRedCap**: we found no commercial Rel-18 eRedCap chipset announcement at all during this research — if your IoT roadmap assumes one, it assumes a future. **LTM**, the flagship Rel-18 RAN feature, reached its first in-field demonstration in 2026 — Ericsson, KDDI and MediaTek, reporting roughly 25% reduction in data interruption at cell change [15]. A field demo two years after freeze is not a criticism; it is the calibration. That is what the freeze-to-field pipeline looks like when it is working.

6. Planning Guidance: Sort by What It Costs You

Sort the catalog not by release number but by what each feature demands of you, and the 2026–2028 budget mostly writes itself. **Spectrum-posture features** — SBFD and SL-U — touch your TDD frame plan, your interference environment, your regulatory file. They are the slowest and most consequential; nothing about them is a software toggle. **Software-led features** — network energy savings, slicing Phase 3, MBS, intra-CU LTM on the network side — can ride upgrade cycles, with the honest caveat that almost all need device-side support before the benefit shows up (LTM's field demo needed a cooperating modem vendor for a reason) [15]. **New-device features** — 8Tx-UL CPE, eRedCap, Ambient IoT tags and readers, LP-WUS receivers — are hostage to silicon cycles you do not control; the eRedCap lesson above generalizes. And **watch-list items** belong in strategy documents, not purchase orders: two-sided CSI AI/ML, Ambient IoT topology 2 and devices 2a/2b, normative ISAC — all Rel-20-or-later, all currently paperware [1], [5], [6].

The numbers to keep on one slide: Rel-19 finished March 2026; first Rel-19-class silicon, by the established offset, lands around 2027–2028; Rel-20 freezes June 2027 and is the last 5G-Advanced-focused release; 6G normative work opens with Rel-21 toward an IMT-2030 submission in mid-2030 [1], [5]. Two years after Rel-18 froze, eleven networks wear the 5G-Advanced badge and one Rel-18 RAN feature has a public field demo [15], [17]. That is not a failure of the standard — it is the actual clock speed of this industry, and the planners who internalize it stop buying menus. The catalog is a menu. Budget for what the kitchen has demonstrably cooked.

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