

Top 3 things that happened on NTN and satellite direct-to-device at RAN1 #126, RAN2 #135 and RAN4 #120

THE VERDICT

1. Under the NR-NTN GNSS-resilience work (agenda item 9.4.1), RAN1 agreed which inputs a UE uses to pre-compensate uplink timing and frequency on the service link for initial access: a reference location plus satellite ephemeris in (quasi) Earth-fixed cells, and common TA and Doppler information in Earth-moving cells, cell-specific with one SSB beam per cell and SSB-beam-specific with several. (R1-2606759, chair notes, paragraph 57. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip; R1-2606759, chair notes, paragraph 65. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip)
2. RAN1 agreed what to consider, not values, for Msg2/RAR in initial access: frequency adjustment command range, granularity and sign, and an extended timing advance command range. Separately, RAN2 agreed to define a new downlink MAC CE for the frequency adjustment command, with an expiry timer; the timer design and whether the MAC CE also carries timing advance are FFS. (R1-2606759, chair notes, paragraph 73. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip; R1-2606759, chair notes, paragraph 82. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip; R2-2605832, meeting or session report, paragraph 798. R2-2605832, 3GPP TSG RAN WG2 #135. https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2605832.zip)
3. RAN4 endorsed draft CRs and CRs to TS 38.101-5 (Rel-20) for NTN bands: the 3 MHz channel for PC3 in n250, n251 and n253 (Viasat), PC1 and PC2 at 3 MHz in those bands (Viasat with Qualcomm), the 3 MHz channel and PC2 in n252 (Apple with Terrestar and Skyworks), and PC2 in n254 (Apple with Amazon, Globalstar and Skyworks, in the endorsed CR R4-2612715). Endorsement is an intermediate step: none is yet an agreed CR. (R4-2610031 (Draft CR. Register status: endorsed at R4-120.). R4-2610031, Viasat, 3GPP TSG RAN WG4 #120. © Viasat. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2610031.zip; R4-2612717 (Draft CR. Register status: endorsed at R4-120.). R4-2612717, Viasat, 3GPP TSG RAN WG4 #120. © Viasat. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2612717.zip; R4-2612716 (CR. Register status: endorsed at R4-120.). R4-2612716, Apple, 3GPP TSG RAN WG4 #120. © Apple. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2612716.zip)

WHAT WAS AGREED

Uplink pre-compensation for initial access (NR-NTN GNSS resilience). Reference location with ephemeris for (quasi) Earth-fixed cells; common TA and Doppler for Earth-moving cells. Service link only; whether a cell-specific value can be used with multiple SSB beams, multiple values per beam, and signalling are still open.

AGREEMENT For open-loop UL time/frequency pre-compensation on the service link in (quasi) Earth-fixed cells, for initial access support a reference-location-based approach together with satellite ephemeris where [...]

R1-2606759, chair notes, paragraph 57. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip

AGREEMENT R1-2606759, chair notes, paragraph 65. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip

Timing and frequency commands (RAN1 for Msg2/RAR, RAN2 for a new MAC CE). RAN1 agreed what to consider for Msg2/RAR: a frequency adjustment command range, granularity and sign, and an extended timing advance command range with today's granularity as baseline. RAN2's agreement is a new downlink MAC CE for the frequency command; whether it also carries timing advance is FFS.

AGREEMENT R1-2606759, chair notes, paragraph 73. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip

AGREEMENT R1-2606759, chair notes, paragraph 82. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip

AGREEMENT RAN2 to define a new DL MAC CE for FAC command, and a timer will be used to control its expiry. [...]

R2-2605832, meeting or session report, paragraph 798. R2-2605832, 3GPP TSG RAN WG2 #135. https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2605832.zip

RAN4: 3 MHz channel and higher power classes (endorsed, not yet agreed). Endorsed documents add the 3 MHz channel for PC3 UEs in n250, n251 and n253 (Viasat), PC1 and PC2 at 3 MHz in the same bands (Viasat with Qualcomm), and the 3 MHz channel and PC2 in n252 (Apple with Terrestar and Skyworks).

DRAFT CR ENDORSED (NOT YET AN AGREED CR); 38.101-5, REL-20 Introduction of the 3 MHz channel bandwidth for n250, n251, n253 PC3 UE. R4-2610031 (Draft CR. Register status: endorsed at R4-120.). R4-2610031, Viasat, 3GPP TSG RAN WG4 #120. © Viasat. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2610031.zip

DRAFT CR ENDORSED (NOT YET AN AGREED CR); 38.101-5, REL-20 Introduction of PC2 and PC1 for n250, n251, n253 for channel BW of 3 MHz. R4-2612717 (Draft CR. Register status: endorsed at R4-120.). R4-2612717, Viasat, 3GPP TSG RAN WG4 #120. © Viasat. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2612717.zip

CR ENDORSED (NOT YET AGREED); 38.101-5, REL-20 Introduction of the 3MHz channel and the PC2 power class for the NTN band n252. R4-2612716 (CR. Register status: endorsed at R4-120.). R4-2612716, Apple, 3GPP TSG RAN WG4 #120. © Apple. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2612716.zip

RAN4: PC2 for band n254 (endorsed, not yet agreed). A CR adding the PC2 power class for n254 was endorsed (Apple with Amazon, Globalstar and Skyworks).

CR ENDORSED (NOT YET AGREED); 38.101-5, REL-20 Introduction of the PC2 power class for the NTN band n254. R4-2612715 (CR. Register status: endorsed at R4-120.). R4-2612715, Apple, 3GPP TSG RAN WG4 #120. © Apple. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2612715.zip

6G NTN link-budget scope (study). RAN1 agreed at least a set of evaluation scenarios by band and orbit. A note attached to the link-budget working assumptions says studying a scenario does not commit RAN1 to closing any coverage gap it finds.

AGREEMENT For the link budget template of 6G NTN, at least the following scenarios are evaluated NOTE: APC = "Adverse propagation conditions" [...]

R1-2606765, chair notes, paragraph 97. R1-2606765, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606765.zip

WORKING ASSUMPTION R1-2606765, chair notes, paragraph 103. R1-2606765, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606765.zip

6G NTN satellite parameters (working assumptions). Working assumptions set MEO-7000 S-band parameters, including a maximum bandwidth per beam of 5 MHz and a 160 km reference beam, and LEO-1200 Ku-band G/T and EIRP density.

WORKING ASSUMPTION R1-2606765, chair notes, paragraph 128. R1-2606765, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606765.zip

WORKING ASSUMPTION R1-2606765, chair notes, paragraph 133. R1-2606765, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606765.zip

6G NTN study boundaries. Co-channel inter-satellite interference is studied at least for same-orbit LEO, assuming one satellite connection at a time. The GNSS-less, GNSS-free and degraded PRACH study runs in the common 6GR agenda item, with NTN-specific adjustments not precluded if the common design misses NTN requirements.

AGREEMENT R1-2606765, chair notes, paragraph 166. R1-2606765, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606765.zip

CONCLUSION R1-2606765, chair notes, paragraph 69. R1-2606765, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606765.zip

WHO PUSHED WHAT

Should Rel-20 GNSS-resilience work serve as a baseline for 6G NTN?

MediaTek proposes Rel-20 as the baseline; LG Electronics calls it a useful baseline for uplink synchronization but flags wider 6G conditions; ST Engineering iDirect argues for GNSS-free initial access unconstrained by the Rel-20 study's design constraints. All were submitted to RAN1 and not treated.

MediaTek MediaTek proposes Rel-20 enhancements as the baseline for 6G GNSS-degraded and GNSS-less operation.

Proposal 8: Adopt Rel-20 NR NTN GNSS resilience enhancements as baseline for 6G NTN GNSS-degraded and GNSS-less/GNSS-free resilient operation.

R1-2606137, Proposal 8, paragraph 185. R1-2606137, MediaTek, 3GPP TSG RAN WG1 #126. © MediaTek. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606137.zip; register: not treated

LG Electronics LG sees a useful baseline for uplink synchronization, but flags UEs without GNSS and with degraded or outdated location.

Rel-20 GNSS-resilient NR-NTN provides a useful baseline for 6G NTN uplink synchronization, but 6G NTN may need to support broader conditions, including UEs without GNSS [...]

R1-2606591, Observation 10, paragraph 220. R1-2606591, LG Electronics, 3GPP TSG RAN WG1 #126. © LG Electronics. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606591.zip; register: not treated

ST Engineering iDirect ST Engineering iDirect proposes designing 6GR GNSS-free initial access without the Rel-20 study's design constraints.

Proposal 1 Design procedures and signals for GNSS-free initial access in 6GR NTN without the design constraints that were present during the Rel-20 study for [...]

R1-2605279, Proposal 1, paragraph 19. R1-2605279, ST Engineering iDirect, 3GPP TSG RAN WG1 #126. © ST Engineering iDirect.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2605279.zip; register: not treated

How should measurements and mobility work without reliable UE location?

MediaTek points to a valid last-known location, while Sharp proposes studying time-based and beam-RSRP measurement conditions. ETRI identifies a need for non-location alternatives in inter-orbit mobility. These are company positions, not mobility agreements.

MediaTek MediaTek observes that a valid last-known GNSS location can sustain location-based mobility.

Location-based mobility like that in NR-NTN can work in GNSS-free/degraded scenario at least when valid last-known GNSS-based location is available.

R2-2604817, Observation 2, paragraph 30. R2-2604817, MediaTek, 3GPP TSG RAN WG2 #135. © MediaTek.
https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2604817.zip; register: noted

Sharp Sharp proposes studying time and beam-RSRP conditions for measurement initiation and relaxation.

For GNSS-free operation, RAN2 should study time-based and beam-level RSRP-based conditions together with S-measure for NTN-specific measurement initiation and relaxation in connected and idle/inactive states.

R2-2604790, Proposal 2, paragraph 21. R2-2604790, Sharp, 3GPP TSG RAN WG2 #135. © Sharp.
https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2604790.zip; register: available

ETRI ETRI observes that alternatives not based on UE location are needed for basic inter-orbit mobility.

Observation 3: In multi-orbit NTN, UE GNSS location is used for at least three mobility-related functions: SMTC offset calculation, location-based measurement triggering, and inter-orbit coverage [...]

R2-2604887, Observation 3, paragraph 40. R2-2604887, ETRI, 3GPP TSG RAN WG2 #135. © ETRI.
https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2604887.zip; register: available

How should NTN-to-terrestrial downlink coexistence be modelled?

vivo addresses the simulation platform and multi-satellite aggregation, not the victim model. AST SpaceMobile, and Verizon with AST as co-submitter (AST is on both documents), argue that the existing interference-limited victim model hides adjacent-channel interference; Verizon adds a rural rationale. All were noted; no coexistence decision is in the evidence.

vivo vivo proposes TR 38.863 Scenario 3 unchanged as the baseline, scaling the single-satellite adjacent-channel interference term for aggregation.

To adopt TR 38.863 clause 6.4.3 (Scenario 3) as the baseline simulation platform for the NTN-TN DL coexistence study, without structural changes, and to model [...]

R4-2611099, Proposal 1, paragraph 24. R4-2611099, vivo, 3GPP TSG RAN WG4 #120. © vivo.
https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2611099.zip; register: noted

AST SpaceMobile AST SpaceMobile argues for a noise-limited terrestrial victim model.

The Release-17 interference-limited model returns a 12 dB requirement and near-zero loss at every constellation size and therefore does not capture this interference path; [...]

R4-2610548, Observation 6, paragraph 60. R4-2610548, AST SpaceMobile, 3GPP TSG RAN WG4 #120. © AST SpaceMobile.
https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2610548.zip; register: noted

Verizon (with AST) Verizon, with AST, says the TR 38.863 co-channel-limited victim model hides satellite adjacent-channel interference, giving too low an ACLR requirement for NTN.

Victim TN model in TR 38.863 is Co-channel Interference Limited, which does not represent the reality in sparsely populated Rural America. [...]

R4-2611983, Observation 8, paragraph 38. R4-2611983, Verizon, 3GPP TSG RAN WG4 #120. © Verizon.
https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2611983.zip; register: noted

STILL OPEN

- For both pre-compensation approaches, cell-specific values with multiple SSB beams and multiple values per beam are FFS, and signalling will come in a separate proposal. (R1-2606759, chair notes, paragraph 57. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip; R1-2606759, chair notes, paragraph 65. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip)
- RAN1 left the random access occasion arrangement for two PRACH sequences FFS; RAN2's separate-resource working assumption does not resolve that question, and RAN2 still has to consider the listed MAC impacts. (R1-2606759, chair notes, paragraph 93. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip; R2-2605832, meeting or session report, paragraph 744. R2-2605832, 3GPP TSG RAN WG2 #135. https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2605832.zip; R2-2605832, meeting or session report, paragraph 760. R2-2605832, 3GPP TSG RAN WG2 #135. https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2605832.zip)
- For S-band UEs in adverse propagation conditions, other losses has a bracketed 6 to 15 dB value for downlink broadcast evaluation, to be decided at the next meeting. (R1-2606765, chair notes, paragraph 141. R1-2606765, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606765.zip)
- A noted offline discussion report, not a confirmed agreement, says time-based measurement and mobility can be supported at least in quasi-Earth-fixed 6G NTN regardless of GNSS status; applicability to all UEs or only Idle/Inactive UEs remains FFS. (R2-2605881, meeting or session report, paragraph 74. R2-2605881, 3GPP TSG RAN WG2 #135. https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2605881.zip)

WHAT TO WATCH NEXT MEETING

- Frequency adjustment command granularity: RAN1 plans to down-select between two ways forward at the next meeting, with combining them not precluded. (R1-2606759, chair notes, paragraph 95. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip)
- RAN2 has a working assumption that separate random access resources can be configured for two PRACH sequences, while RAN1 keeps FFS whether they use the same occasion or separate occasions in time; watch whether the two groups converge. (R1-2606759, chair notes, paragraph 93. R1-2606759, 3GPP TSG RAN WG1 #126. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126/Docs/R1-2606759.zip; R2-2605832, meeting or session report, paragraph 744. R2-2605832, 3GPP TSG RAN WG2 #135. https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_135/Docs/R2-2605832.zip)
- Whether the endorsed RAN4 draft CRs and CRs for n250 to n254 become agreed CRs, possibly merged into a larger CR, before TSG RAN approval. (R4-2610031 (Draft CR. Register status: endorsed at R4-120.). R4-2610031, Viasat, 3GPP TSG RAN WG4 #120. © Viasat. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2610031.zip; R4-2612716 (CR. Register status: endorsed at R4-120.). R4-2612716, Apple, 3GPP TSG RAN WG4 #120. © Apple. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2612716.zip; R4-2612715 (CR. Register status: endorsed at R4-120.). R4-2612715, Apple, 3GPP TSG RAN WG4 #120. © Apple. https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_120/Docs/R4-2612715.zip)

SOURCES

- [R1-2606759](#) Session Notes of AI 9.4. Session record; register lists Ericsson as editor. Chair notes. Register status: endorsed at R1-126.
- [R2-2605832](#) Report from session on MIMO, AIPHY, CovEnh, NTN and other topics. Session record; register lists CATT as editor. Meeting report. Register status: approved at R2-135.
- [R4-2610031](#) Introduction of the 3 MHz channel bandwidth for n250, n251, n253 PC3 UE. Viasat. Draft CR. Register status: endorsed at R4-120.
- [R4-2612717](#) Introduction of PC2 and PC1 for n250, n251, n253 for channel BW of 3 MHz. Viasat (with Qualcomm). Draft CR. Register status: endorsed at R4-120.
- [R4-2612716](#) Introduction of the 3MHz channel and the PC2 power class for the NTN band n252. Apple (with Terrestar, Skyworks Solutions). CR. Register status: endorsed at R4-120.
- [R4-2612715](#) Introduction of the PC2 power class for the NTN band n254. Apple (with Amazon, Globalstar, Skyworks Solutions). CR. Register status: endorsed at R4-120.
- [R1-2606765](#) Session Notes of AI 10.7 (NTN specific requirements and design). Session record; register lists Ericsson as editor. Chair notes. Register status: endorsed at R1-126.
- [R1-2606137](#) Discussion on 6G NTN specific requirements and design. MediaTek. Contribution. Register status: not treated at R1-126. No decision recorded in the register.
- [R1-2606591](#) Discussion on NTN specific requirements and design. LG Electronics. Contribution. Register status: not treated at R1-126. No decision recorded in the register.
- [R1-2605279](#) Proposals for GNSS-free 6GR NTN operation. ST Engineering iDirect. Contribution. Register status: not treated at R1-126. No decision recorded in the register.
- [R2-2604817](#) Discussion on 6G NTN. MediaTek. Contribution. Register status: noted at R2-135.
- [R2-2604790](#) GNSS-free mobility and NTN-specific measurement handling for 6GR NTN. Sharp. Contribution. Register status: available at R2-135. No decision recorded in the register.
- [R2-2604887](#) Multi-Orbit Mobility in NTN. ETRI. Contribution. Register status: available at R2-135. No decision recorded in the register.
- [R4-2611099](#) Discussion on NTN-TN co-existence aspects. vivo. Contribution. Register status: noted at R4-120.
- [R4-2610548](#) Initial results on aggregate NTN-NTN and NTN-TN DL-DL adjacent-channel coexistence. AST SpaceMobile. Contribution. Register status: noted at R4-120.
- [R4-2611983](#) On Victim TN Model for NTN-TN Coexistence in Adjacent DL Channels. Verizon (with AST). Contribution. Register status: noted at R4-120.
- [R2-2605881](#) Report of NTN GNSS free/resilience offline discussion. 3GPP RAN2. Meeting report. Register status: noted at R2-135.

Coverage: RAN1 #126 (Maastricht, 2026-08-24 to 2026-08-28), agenda items 10.7.1, 9.4.1; RAN2 #135 (Maastricht, 2026-08-24 to 2026-08-28), agenda items 9.6, 8.11; RAN4 #120 (Maastricht, 2026-08-24 to 2026-08-28), agenda items 5.5.2, 5.5.3, 5.5.4, 5.5.5, 8.4.3.2, 8.4.4. Scout read 48 recorded decisions and 561 company positions or contribution passages on these agenda items (catalog synced 2026-09-23) and cites 21 decisions and 9 positions from 17 TDocs. Every quoted passage was matched verbatim against the TDoc text; the summaries around the quotes are Scout's reading. Register statuses are copied from the 3GPP TDoc register: not treated means a document was not handled on its own, though its content may have fed feature-lead summaries or merged revisions. Not covered: other agenda items and meetings, plenary TDocs and plenary decisions after the meeting, email discussions after the meeting, and anything not yet in the chair notes or register.

- Chair notes and session reports record group outcomes, not the views of their editors or moderators.
- The frequency-command granularity formula in the chair notes did not survive text extraction, so the k values are not explained here.

- The coexistence contributions shown were noted; no coexistence decision is in the evidence. Plenary outcomes after these meetings were not checked.
- RAN4 register titles do not give numerical power limits or frequency ranges for the bands.

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