

Top 3 things that happened on 6G waveform, channel coding and modulation at RAN1 #126-bis

THE VERDICT

1. For the low-PAPR uplink enhancement, RAN1 will not define transmit filter coefficients and leaves it to RAN4 how to specify filter characterizations. Low-PAPR enhancement for 16QAM is not pursued. (R1-2607287, chair notes, paragraph 63. R1-2607287, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607287.zip; R1-2607287, chair notes, paragraph 56. R1-2607287, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607287.zip)
2. For the Polar study of DCI above 140 bits, RAN1 will down-select between a 512 and a 1024 maximum mother-code length at RAN1 #127. Other agenda items must still confirm that such DCI sizes are needed. (R1-2607312, chair notes, paragraph 57. R1-2607312, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip)
3. NR downlink 1024QAM MCS entries are used as a reference for designing the uplink 1024QAM table, at least for CP-OFDM. RAN1 will also study an MCS table for 1024QAM with uplink DFTS-OFDM. (R1-2607313, chair notes, paragraph 38. R1-2607313, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607313.zip; R1-2607313, chair notes, paragraph 79. R1-2607313, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607313.zip)

WHAT WAS AGREED

No transmit filter coefficients in RAN1. For the low-PAPR uplink enhancement, RAN1 will not define filter coefficients, and RAN4 decides how to specify filter characterizations. The same filter applies to DMRS and data, and RAN1 understands that receiver use of it is an implementation choice and that network and UE alignment is possible, e.g. via UE capability and RRC.

CONCLUSION [...] RAN1 will not define transmit filter coefficients in RAN1.

R1-2607287, chair notes, paragraph 63. R1-2607287, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607287.zip

No low-PAPR 16QAM enhancement. Uplink low-PAPR enhancement for 16QAM is not pursued.

CONCLUSION R1-2607287, chair notes, paragraph 56. R1-2607287, 3GPP TSG RAN WG1 #126-bis.

https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607287.zip

Polar segmentation for larger UCI. For UCI above 1706 bits, the Polar-code study allows at most S segments, with S still FFS and set with the maximum UCI payload in mind. Other agenda items must still confirm that UCI beyond the NR range is needed.

AGREEMENT For the study of Polar code design for UCI with payload size larger than NR range (i.e., larger than 1706 bits), the maximum number of [...]

R1-2607312, chair notes, paragraph 50. R1-2607312, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip

DCI Polar mother-code options. For DCI above 140 bits, the study will choose between a 512 and a 1024 maximum mother-code length at RAN1 #127. As for UCI, the need for DCI beyond the NR range is still to be confirmed elsewhere.

AGREEMENT R1-2607312, chair notes, paragraph 57. R1-2607312, 3GPP TSG RAN WG1 #126-bis.

https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip

Small-UCI coding study deadline. The study of 3 to 11 UCI bits is planned to conclude at RAN1 #127. It is to clarify whether the NR Reed-Muller code has justifiable drawbacks and, if so, which candidate could be recommended.

CONCLUSION R1-2607312, chair notes, paragraph 99. R1-2607312, 3GPP TSG RAN WG1 #126-bis.

https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip

Uplink 1024QAM reference. NR downlink 1024QAM MCS entries in TS 38.214 Table 5.1.3.1-4 are used as a reference for designing the uplink table, at least for CP-OFDM.

AGREEMENT Use NR DL 1K QAM MCS entries (in TS 38.214 Table 5.1.3.1-4) as a reference for design of the UL 1K QAM MCS table, at [...]

R1-2607313, chair notes, paragraph 38. R1-2607313, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607313.zip

Uplink DFTS-OFDM 1024QAM study. RAN1 agreed to study an MCS table supporting 1024QAM with uplink DFTS-OFDM.

AGREEMENT R1-2607313, chair notes, paragraph 79. R1-2607313, 3GPP TSG RAN WG1 #126-bis.

https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607313.zip

Multiple-pair evaluation. The study of supporting one spectral-efficiency point with several modulation-order and code-rate pairs needs both fixed-SE and link-adaptation simulations. It defines an evaluation, not support for multiple pairs.

AGREEMENT R1-2607313, chair notes, paragraph 41. R1-2607313, 3GPP TSG RAN WG1 #126-bis.

https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607313.zip

Which $\pi/2$ -BPSK uplink waveform options did companies propose?

Proposals differ on frequency-domain truncation, transparent filtering and spectrum extension. No waveform option was selected.

Qualcomm Qualcomm recommends introducing DFT-S-OFDM with $\pi/2$ -BPSK and frequency-domain truncation.

For low-PAPR waveform design for 6G uplink, recommend introducing DFT-S-OFDM waveforms with $\pi/2$ -BPSK and frequency-domain truncation.

R1-2608743, Proposal 2.2, paragraph 81. R1-2608743, Qualcomm, 3GPP TSG RAN WG1 #126-bis. © Qualcomm.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2608743.zip; register: not treated

Sharp Sharp supports transparent-filter FDSS with and without spectrum extension.

For 6GR waveform, support the following options: Option 1: FDSS with no spectrum extension Transparent filter Modulation: $\pi/2$ BPSK
Option 2: FDSS with spectrum extension [...]

R1-2608314, Proposal 1, paragraph 59. R1-2608314, Sharp, 3GPP TSG RAN WG1 #126-bis. © Sharp.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2608314.zip; register: not treated

Pengcheng Laboratory (with BUPT) Pengcheng Laboratory and BUPT suggest studying configurable truncation ratios and dynamic selection.

It is proposed that an adaptive waveform enhancement for DFT-s-OFDM with $\pi/2$ BPSK be studied for 6GR, based on configurable spectrum truncation ratios and a [...]

R1-2607503, Proposal 2, paragraph 58. R1-2607503, Pengcheng Laboratory, 3GPP TSG RAN WG1 #126-bis. © Pengcheng Laboratory.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607503.zip; register: not treated

How should Polar coding handle DCI above 140 bits?

Both China Mobile and Qualcomm would consider DCI segmentation. China Mobile suggests a 1024 maximum and an extended distributed CRC interleaver pattern, while Qualcomm suggests keeping 512 and disabling the interleaver for one code block at E=432 or below.

China Mobile China Mobile suggests a 1024 maximum, DCI segmentation and an extended distributed CRC interleaver pattern.

For the DCI with payload sizes beyond NR range, the following enhancements of polar codes can be considered in 6GR study:
Extend the maximum mother [...]

R1-2607152, Proposal 1, paragraph 22. R1-2607152, China Mobile, 3GPP TSG RAN WG1 #126-bis. © China Mobile.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607152.zip; register: not treated

Qualcomm Qualcomm suggests considering the NR maximum of 512, one code block at E=432 or below without the distributed CRC interleaver, and two-block segmentation for E of 864 or more if supported.

[...] The maximum mother code length of DL polar is 512 (same as NR) Single CB carrying larger UCI sizes can be considered for E=432 (i.e. [...])

R1-2608414, Proposal 8, paragraph 213. R1-2608414, Qualcomm, 3GPP TSG RAN WG1 #126-bis. © Qualcomm.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2608414.zip; register: not treated

How should 6G MCS design pair modulation order and code rate?

Tejas Networks would keep one dynamic MCS index fixing modulation order and code rate. Nokia proposes studying decoupled quantities under joint signaling, which Tejas also keeps. NEC's several pairs per spectral-efficiency point fall within the agreed evaluation, which does not select NEC's mechanisms.

Tejas Networks Tejas Networks proposes retaining a table-based MCS where one dynamic index jointly identifies at least modulation order and target code rate.

For 6GR data channels, retain a table-based MCS indication in which one dynamic MCS index jointly identifies at least modulation order Q_m and target code [...]

R1-2607714, Proposal 1, paragraph 20. R1-2607714, Tejas Networks, 3GPP TSG RAN WG1 #126-bis. © Tejas Networks.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607714.zip; register: not treated

Nokia Nokia proposes studying decoupled modulation order and code rate under joint signaling.

Study decoupling but joint signaling of modulation order and code rate.

R1-2607059, Proposal 4, paragraph 45. R1-2607059, Nokia, 3GPP TSG RAN WG1 #126-bis. © Nokia.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607059.zip; register: not treated

NEC NEC suggests studying several pairs per spectral-efficiency point via table switching or a superset. RAN1 agreed evaluation assumptions for this study.

For MCS table design for 6GR, RAN1 to study supporting a spectral efficiency point by more than one combination of modulation order and coding rate [...]

[R1-2607919](#), Proposal 3, paragraph 35. R1-2607919, NEC, 3GPP TSG RAN WG1 #126-bis. © NEC.
https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607919.zip; register: not treated

STILL OPEN

- The maximum segment count S for Polar coding of UCI above 1706 bits is FFS. ([R1-2607312](#), chair notes, paragraph 50. R1-2607312, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip)
- The 512 or 1024 DCI mother-code choice waits for RAN1 #127, and the need for DCI above 140 bits is unconfirmed. ([R1-2607312](#), chair notes, paragraph 57. R1-2607312, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip)
- Whether the NR Reed-Muller code has justifiable drawbacks for 3 to 11 UCI bits is open until RAN1 #127. ([R1-2607312](#), chair notes, paragraph 99. R1-2607312, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip)

WHAT TO WATCH NEXT MEETING

- Watch the 512 or 1024 DCI Polar mother-code down-selection at RAN1 #127. ([R1-2607312](#), chair notes, paragraph 57. R1-2607312, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip)
- Watch whether RAN1 #127 keeps the NR Reed-Muller code for 3 to 11 UCI bits. ([R1-2607312](#), chair notes, paragraph 99. R1-2607312, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607312.zip)
- Watch the uplink DFTS-OFDM 1024QAM MCS table study. ([R1-2607313](#), chair notes, paragraph 79. R1-2607313, 3GPP TSG RAN WG1 #126-bis. https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_126b/Docs/R1-2607313.zip)

SOURCES

- [R1-2607287](#) Session Notes of AI 10.2.1. Session record; register lists NTT DOCOMO as editor. Chair notes. Register status: available at R1-126-bis. No decision recorded in the register.
- [R1-2607312](#) Session Notes of AI 10.3.1 (Channel Coding). Session record; register lists Ericsson as editor. Chair notes. Register status: available at R1-126-bis. No decision recorded in the register.
- [R1-2607313](#) Session Notes of AI 10.3.2 (Modulation). Session record; register lists Ericsson as editor. Chair notes. Register status: available at R1-126-bis. No decision recorded in the register.
- [R1-2608743](#) Waveforms for 6GR. Qualcomm. Contribution. Register status: not treated at R1-126-bis. No decision recorded in the register.
- [R1-2608314](#) Waveform for 6GR. Sharp. Contribution. Register status: not treated at R1-126-bis. No decision recorded in the register.
- [R1-2607503](#) Discussion on waveform for 6GR air interface. Pengcheng Laboratory (with BUPT). Contribution. Register status: not treated at R1-126-bis. No decision recorded in the register.
- [R1-2607152](#) Discussion on channel coding for 6GR interface. China Mobile. Contribution. Register status: not treated at R1-126-bis. No decision recorded in the register.
- [R1-2608414](#) Channel coding for 6GR. Qualcomm. Contribution. Register status: not treated at R1-126-bis. No decision recorded in the register.
- [R1-2607714](#) Consideration on a forward compatible MCS design for 6GR. Tejas Networks. Contribution. Register status: not treated at R1-126-bis. No decision recorded in the register.
- [R1-2607059](#) On remaining aspects of modulation in 6GR. Nokia. Contribution. Register status: not treated at R1-126-bis. No decision recorded in the register.
- [R1-2607919](#) Discussion on Modulation Aspects for 6G. NEC. Contribution. Register status: not treated at R1-126-bis. No decision recorded in the register.

Coverage: RAN1 #126-bis (South Korea, 2026-10-12 to 2026-10-16), agenda items 10.2.1, 10.3.1, 10.3.2. Scout read 14 recorded decisions and 112 company positions or contribution passages on these agenda items (catalog synced 2026-10-16) and cites 8 decisions and 8 positions from 11 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.

- All outcomes are study-phase agreements and conclusions for the 6GR study, not specification text, and can be revisited.
- All cited company submissions are pre-meeting positions, and all are marked not treated in the register.
- The decision record does not select a low-PAPR waveform or an MCS signaling mechanism.
- Built on the closing day from the chair notes marked final. Chair notes may still be revised after the meeting.
- Plenary outcomes were not checked.

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