**3GPP TSG RAN WG2 Meeting #130 R2-250xxxx**

Bengaluru, India, Aug 25th – 29th, 2025

Agenda Item: 8.1.x

Source: Xiaomi

Title: Report of [POST130][038][AI PHY] UE capabilities (Xiaomi)

Document for: Discussion and Decision

# Introduction

* [POST130][038][AI PHY] UE capabilities (Xiaomi)

 Intended outcome: Discuss RAN2 specific AI/ML capabilities and submit agreable proposals and RAN2 UE capability CRs

 Deadline:  Long

Rapporteurs will provide proposals for RAN2#131 and a UE capability running CR based on the outcome of this post email discussion after the deadline.

Companies providing input to this email discussion are requested to leave contact information below.

|  |  |  |
| --- | --- | --- |
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# Discussion

It is observed by rapporteur that BM/CSI prediction inference-related capabilities and UE-side data collection related capabilities are being discussed in RAN1. In this email discussion, for RAN2 specific capabilities, we will mainly focus on RAN2 specific features, including NW-side data collection, LCM, and candidate UE-side data collection.

***UE logging AS layer memory size***

It was agreed in RAN2 #126 meeting with following agreement,

1. For gNB centric and OAM centric (for RRC signaling between UE and gNB), reporting multiple instances of logged L1 measurement result from UE to gNB via a RRC message as configured by gNB is an optional feature. FFS how to handle case when single RRC message is not sufficient. FFS if there will be any further enhancement needed pending RAN1 agreement.

Following agreements were made during RAN2 #127 meeting, a minimum AS layer memory size is needed if UE supports UE logging and reporting for NW-side data collection. However, the memory size of AS layer memory is not decided.

1. UE stores the logged training data at AS layer with a minimum AS layer memory size supported by the UE. FFS on the memory size. This is across all use cases
2. When UE reaches its buffer limitation the UE stops measurement for data collection purposes and logging.

In logged MDT feature, a minimum AS layer memory size of 64kB is introduced. Furthermore, QoE also has additional 64kB for QoE pause and another 64kB for QoE measurement report in RRC\_IDLE/INACTIVE state.

Similar as logged MDT and QoE, UE logging for AI/ML air NW-side data collection can also introduce additional 64kB as baseline minimum AS layer memory.

##### Q1. Do you agree additional minimum AS layer memory size is 64kB (compared to logged MDT and QoE), which is shared by all AI/ML use cases?

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comment** |
| Samsung | Yes | In our understanding, 64KB may not be enough. - Regarding beam management use-case, as RAN1 has indicated in LS (i.e., R1-2310681), a single data sample for L1-RSRP of 128 resources accounts for about 500 bits. However, L1-RSRP combinations for 128 resources a UE can observe could be almost infinite due to multi-path fading and UE’s location/pose and surroundings/environment. So, numerous data samples would be needed to train practical AI/ML model with a quality of prediction performance. Besides, the more data generally is beneficial to model performance.- Moreover, we assume the shared memory among use-cases (i.e., not only beam management but also CSI prediction). It means larger memory capability would be needed. For example, the RAN1 LS indicated 1.5Mbits per data sample as an example for CSI prediction.Thus, while we are okay to adopt 64KB as the baseline capability, UE should also be able to indicate the larger sizes (e.g., hundreds of KB or tens of MB) if supported. Otherwise, NW cannot distinguish the UE with large memory. For example, even if NW needs large size of data (e.g., to train model for CSI prediction) per UE, there is no way for NW to choose UEs with larger memory. So, we suggest to define the UE capabilities as follows: (which is similar to QoE measurement in RRC\_IDLE and RRC\_INACTIVE): 1) UE mandatorily supports the fixed size (i.e., 64KB) of minimum AS layer memory without UE capability signalling, if UE supports NW-side data collection2) UE optionally reports a larger minimum AS layer memory size (e.g., 128KB, 256KB, 512KB, …) |
|  |  |  |
| Qualcomm | Yes | UE AS memory is expensive, therefore, we think that the minimum memory size should be the same as MDT, as 64KB.  |
| CATT | Yes | The minimum memory size could be the same as MDT, i.e. 64KB. It is not needed to define memory size per e.g. AI/ML use case. For different use cases, the associated ID together with the training data report could be used for usage indication. |
| Nokia | Yes | In general, minimum AS memory size of 64KB could be sufficient for Release 19 use cases. We suggest the following proposal.Proposal: UE minimum AS layer memory size is 64KB as a baseline. |
| Huawei, HiSilicon | Yes |  |
| Apple | Yes | In AI/ML based BM, we only agreed to log L1 RSRP and beam index. FFS details of timing information of logging. We have calculated based on number from RAN1 reply LS (R1-2310681):*“Note 1: There is no agreement on the data size of L1-RSRPs for Set A or Set B, but the following typical data size is provided as guidance for RAN2 discussion. Based on existing L1-RSRP reporting methodology, i.e., 7 bits for the strongest beam and 4 bits for the remaining beams, for Set B = 16 as an example, the typical data size would be 67 (hence up to ~100 bits), and for Set A = 128 as an example, the typical data size would be 515 (hence up to ~500 bits) if all beams in Set A were to be collected. For BM Case 2, the data size L1-RSRPs for Set A and Set B represents the data size per predicted future time instance and per history measurement time instance, respectively. Payload size may not be fixed.**Note 5: For BM Case 2, the typical value of the number of history measurement time instance used in evaluations is up to 8 and typical value of the number of predicted future time instance is 1~4.”* According to the highlighted parts, we can estimate that the typical training data size stored in AS layer memory is 100 bits×8 instances (Set B) + 500 bits×4 instances (Set A) = 2800 bits=0.35KB.It has a large gap with 64KB (to include FFS timing info). Thus, we think 64KB is sufficient. |
| vivo | Yes |  |
| Sharp | Yes |  |
| Ericsson | Yes | We agree that the minimum AS layer memory size can be 64 kB, as in legacy cases. Additionally, as Samsung suggested, the UE could report the AS memory size, if a larger one is supported.  |

##### Summary

All companies agree 64kB is the minimum AS buffer size to be mandatorily supported by UE supporting AI/ML features, similar to MDT and QoE. Two companies think that UE can optionally report a larger AS memory size that supported by UE, which is further summarized in Q2.

Proposal 1: It is mandatory for UE to support the minimum AS layer memory size of 64kB for UE supporting AI/ML based beam management, which is shared across all use cases with NW-sided model.

##### Q2. Do you think UE can support other memory sizes and indicate to network via optional capability signaling?

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| --- | --- | --- |
| **Company**  | **Yes/No** | **Comment**  |
| Samsung | Yes | Please refer to our previous response in Q1. |
| Qualcomm | No | UE can allocate additional memory (based on its implementation). Note that in logged MDT, the UE can allocate additional memory for logged measurements; but the UE does not need to indicate this to the network.Furthermore, on UE assistance for data availability, we agreed to use absolute value as threshold to avoid the scenario where different UEs may have different additional memory allocated.Thus, we do not see a need for indicating additional memory to the network.  |
| CATT | No | It’s sufficient to specify that 64KB is the minimum memory size, and it’s up to UE implementation to support larger size. We notice that for logged MDT the UE could store a large amount of data (more than 5M) if supported without additional indication to network. |
| Nokia | Yes | Additional memory gives network flexibility in retrieving the data from the buffer and can be used to support more configurations. |
| Huawei, HiSilicon | Yes | We think it is helpful for the network to know that the UE supports larger size, and it allows the network to set higher threshold value. |
| Apple | No | Same view as Qualcomm. According to our calculation in Q1, it has a large gap with 64KB (up to 0.35KB). Thus, at least in Rel-19, we do not see a need for indicating additional memory to the network. |
| vivo | No | We think the 64kB AS memory size is enough. After this memory full and UE indication of full memory, the network can retrieve the data and UE continue logging new data.There is no need for UE E to support other memory sizes and indicate to network. |
| Sharp | Yes | As companies mentioned above, it is helpful as it provides additional flexibility. |
| Ericsson | Yes | As Samsung and Nokia commented, it is beneficial for the NW to know if the memory size is larger, since this allows it to estimate better when to retrieve the logged data so that the buffer does not become full. |

##### Summary

5/9 companies think UE can optionally indicate other AS layer memory sizes to network due to the following reasons:

* network flexibility for higher buffer threshold configuration
* common AS layer buffer might need larger memory size to support other use cases as well

4/9 companies don’t agree to indicate other memory size to network due to the following reasons:

* for Rel-19 data collection, no need for additional memory
* more memory size is up to UE implementation
* network can retrieve data based on UE buffer full indication

There’s no consensus on whether to have additional AS layer memory optional UE capability signaling.

Proposal 2: FFS on whether UE can support other memory sizes and indicate to network via optional capability signaling.

***UE periodic and event-based logging***

In addition, RAN2 also introduced periodic and event-based data collection/logging with following agreements, where radio-condition based event data logging is supported, including L3 measurement triggered, beam-based event triggered and L1 beam measurement triggered.

|  |
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| * Periodic logging is supported for training data collection procedure in R19
* Event-triggered data logging will be supported. At least radio condition based event triggered logging will be supported. FFS the details of radio condition based event. FFS if other events are supported.
* Support the use of L3 measurement event triggered (i.e. L3 serving cell measurements becoming worse/better than a threshold for TTT) to determine whether the UE performs logging or not. L1 measurement event triggered will not be supported. FFS what to log
 |

##### Q3. Which option do you prefer as optional UE capability for UE logging?

Option 1) Single optional UE capability with signaling for both periodic logging and L3 measurement event triggered logging (all events).

Option 2) One optional UE capability with signaling for periodic logging, another optional UE capability with signaling for L3 measurement event triggered logging.

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| --- | --- | --- |
| **Company**  | **Option 1/2** | **Comment**  |
| Samsung | Option 2 | BTW, we would like to ask there is a separate capability for generic NW-side data collection (i.e., 1 bit capability whether UE supports NW-side data collection) and this Option 1 or 2 is a capability in addition to the generic capability. |
| Qualcomm | Option 2 | To support periodic and event-trigger logging different level of UE complexities can occur at the UE, therefore, two separate UE capabilities are needed. We also agree with Samsung that there should be a blanket capability indicating “whether UE support data collection for NW-side training”. Periodic and event-trigger UE capability can be conditional, i.e., UE indicate whether it support periodic and/or event triggered data collection logging if it supports data collection for NW-side training. |
| CATT | Option 1 | One optional UE capability is enough for AI/ML data logging capability for NW-side training, and when a UE indicates the support of this feature, it supports both periodic logging and event triggered logging. |
| Nokia | Option 1 | The following excerpt from 37.320 shows that in logged MDT, periodic and event-triggered are supported as part of the baseline feature. We see no reason to break the precedent.*For NR:**- The UE indicates one capability bit for support for Logged MDT in RRC idle and inactive mode, to indicate that the UE supports logging of downlink pilot strength measurements, periodical logging and event-triggered logging.* |
| Huawei, HiSilicon | Option 2 with comments | We think that at least "Support the use of L3 measurement event triggered" can be a separate capability.For periodic logging, we think it is necessary for network-side data collection and should be e pre-requisite for event-based logging. Also periodic-logging capability should be broader and cover not only logging as such, but also the reporting procedure and assistance information from the UE, as discussed below. |
| Apple  | Option 2 | Same view as QC, Samsung and CATT, the separate capabilities of periodical and event triggered logging are necessary.We also agree with QC and Samsung that there should be another capability indicating “whether UE support data collection for NW-side training”. If it can be agreed, either of the following two ways is acceptable to us:* Alt-1: It is pre-requisite of the capability of Periodic logging and capability of event-trigger logging.
* Alt-2: Periodic logging is part of the capability indicating “whether UE support data collection for NW-side training”. And it is pre-requisite of capability of event-trigger logging.
 |
| vivo | Option 2 | This would allow more flexibility on functionality implementation and reporting. For example, at early stage of product deployment, chip/UE vendors can, based on operator requirement, either first implement periodic or L3 easement event.This will allow rapid implementation of AI/ML NW side data collection. |
| Sharp | Option 2 |  Provides flexible and modular approach as it allows the network to configure or query each (periodic and event-triggered logging) independently. |
| Ericsson | Option 1, see also comments | We think a single capability for logging would be sufficient, as also commented by Nokia.We also agree with the point raised by several other companies, that an overall/generic NW-side data collection capability is needed. The generic capability should imply the UE supports periodic and L3 event-based logging, as well as the minimum AS memory size of 64 kB discussed in Q1. Alternatively, at least periodic logging and the minimum AS memory size should be mandatorily covered by the generic NW-side data collection capability, while L3 event-based logging can be optional. |

##### Summary

Option 1: 3/9 companies

Option 2: 6/9 companies

Furthermore, as raised by companies in this question and in Q11, an optional capability needs to be introduced to indicate UE supporting NW-side data collection, which rapporteur agrees. Based on the comment, following two options were raised:

* one capability for NW-side data collection, one capability for both periodic and event-based logging.
* one capability for NW-side data collection and periodic logging, another capability for event-based logging.
* Additionally, one company also raised to introduce a separate capability for specific measurement quantities.

Based on above, please see rapporteur’s proposal after Q4.

***Availability Indication Reporting***

As agreed in RAN2 #129bis meeting, UE can send a UAI to provide assistance information for NW-side data collection.

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| **Agreements on availability indication*** Availability indication can be triggered due to:
	+ Full buffer being reached (if configured)
	+ Buffer threshold being reached (if configured).
	+ Low power (if configured)
* The UE send a UAI that indicates:
	+ Data is available
	+ Reason for trigger (full buffer, threshold)
	+ Low power indication
* The encoding of the data is available/UAI and the cause value is FFS

NOTE: it is up to UE Implementation how buffer threshold reached and low power is determined |

Similar as other assistance information (e.g., *overheatingInd, referenceTimeProvision-r16, releasePreference-r16, flightPathAvailabilityIndicationUAI-r18, ul-TrafficInfo-r18*) reported via UAI, an optional UE capability with signaling can be introduced for NW-side data collection assistance information.

##### Q4. Do you agree to introduce an optional UE capability with signaling to indicate UE can provide assistance information (e.g., data is available, reason for trigger, low power indication) for NW-side data collection?

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| --- | --- | --- |
| **Company**  | **Yes/No** | **Comment**  |
| Samsung | Yes | We agree (i.e., as in legacy UAI), and we assume one common capability is defined for all assistance information (i.e., data availability, reason for trigger, low power indication) of NW-side data collectionBTW, we have a similar question with Q3 i.e., we wonder if this UAI capability is additional to the generic capability for NW-side data collection.[Rapp] to clarify that this capability is a separate capability from capability proposed in P3.  |
| Qualcomm | Yes | We prefer to have two separate UE capabilities * One for power issue indication at the UE, and
* Another for data availability indication.

UE may have different complexities needed to implement power indication and buffer status indication. |
| CATT | Yes | We agree to introduce an optional UE capability with signalling as for legacy UAI information, and one bit is enough for supporting all the NW-side data collection assistance information. |
| Nokia | No | It was decided that a UE Information procedure would be used to retrieve data from the buffer. Without a mechanism for the UE to report the availability indicator, the network only has the option to blindly request from UE buffers. Buffer status reporting and all its possible indications should be included in the baseline feature if NW side data collection is supported.  |
| Huawei, HiSilicon | No | There is no need to separately define it, i.e. it can be merged to the general capability for NW side data collection of any use cases covering also periodic logging, reporting procedure. |
| Apple | Yes | If RAN2 will introduce a top level capability of “whether UE support data collection for NW-side training”, then we can also accept to include UAI as part of it.  |
| vivo | Yes | Agree with QC |
| Sharp  | Yes |  |
| Ericsson | No | We agree with Nokia and Huawei that reporting assistance information for logging (especially data availability) should be part of a top-level capability for NW-side data collection, so that the NW is aware of when it can start retrieving data. |

##### Summary

Yes: 6/9 companies

 one company prefers to have separate capabilities for power indication and data availability

No: 3/9 companies

 the opponent companies think that this feature should be as part of capability of data collection for NW-side model (See proposal 3). 1 company supporting have this capability is also ok with this option.

Proposal 3: Introduce an optional UE capability to indicate supporting of data collection for NW-side model, which includes the minimum AS layer memory size. FFS whether the following components are part of this capability or separate capabilities, and how:

* periodic event logging
* event-based logging
* measurement quantities and resources (Set A/B, maximum resources of Set A/B, etc)
* provide assistance information (e.g., data is available, reason for trigger, low power indication) for NW-side data collection

***Applicability Reporting***

RAN2 agreed to report applicability reporting via *RRCReconfigurationComplete* message as initial reporting, while reporting the update of applicability reporting via UAI if there’s a change. Similar as NW-side data collection assistance information reporting via UAI, UE can also indicate the support of reporting update of applicability reporting via UAI as optional capability.

##### Q5. Do you agree to introduce an optional UE capability with signaling to indicate UE can provide update of applicability reporting via UAI?

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| **Company**  | **Yes/No** | **Comment**  |
| Samsung | No | There is no big motivation to have additional capability and also it might be more essential to have UAI considering UE is supposed to indicate UAI when functionality status has changed from applicable to non-applicable.  |
| Qualcomm  | No | UE need to support update of applicable configuration for feature to work properly. Therefore, it should be supported mandatorily.  |
| CATT | No | If UE can provide the initial applicability reporting, it can also use UAI for the update purpose, so it can be the same UE capability. |
| Nokia | No | Agree with Samsung, Qualcomm, CATT. During RAN2#130, the following agreement was reached: “The UE shall report when *CSI-ReportConfig* becomes not applicable.” To realize the agreement, the UAI reporting of applicability cannot be optional.Additionally, applicability update reporting is a necessary part of baseline capability. Without the capability to provide updates, the UE would be forced to operate an inapplicable, poorly performing model until its next RRC Reconfiguration when it could provide the update.The capability should be conditionally mandatory if at least one RRC-based use case is supported, i.e., Beam Management, CSI Prediction, and CSI Compression. |
| Huawei, HiSilicon | No | Relevant to Q6.UAI is always needed regardless of Option A or B for indicating applicability status change, so there is no need to separately define it. Applicability is something that may change dynamically over time (this is why it is different from capability reporting) and it is unacceptable to have applicability update reporting as an optional feature |
| Apple  | No | Same view as QC and Samsung. Applicability reporting should be mandatory if the UE supports any use case of Rel-19 AI/ML. |
| vivo | No | We think that if the UE supports the initial reporting, the UE should also support the update reporting. They should be bound, otherwise the initial reporting does not make much sense. Moreover, the support of update reporting does not require additional hardware capability, but just relates to some signalling implementation. |
| Sharp | No | Same UE capability/applicability reporting procedure can be used in a mandatory way. |
| Ericsson | No | Reporting of applicability via UAI should be part of the baseline capability, as also commented by the other companies above. |

##### Summary:

No companies agree to introduce an optional UE capability for applicability reporting via UAI. Based on this, rapporteur understands that this feature will be added on top of RAN1 defined FGs (i.e., FG 58-0-1 and/or FG 58-1-2/3/4/5). The details can be implemented after RAN1 feature groups are implemented in RAN2 UE capability mega CR.

Proposal 4: Include RAN2 feature ‘UE can provide update of applicability reporting via UAI’ as part of RAN1 FGs (e.g., 58-0-1 and/or FG 58-1-2/3/4/5, the details of those feature group depend on RAN1 progress) once implemented.

For companies’ information, following RAN1 inference FGs of AI/ML-based BM are copied below (note that similar inference capabilities are also introduced by RAN1 for AI/ML-based CSI prediction):





Furthermore, as agreed in RAN2 #130 meeting, both Option A and Option B are supported for applicability reporting. It was also proposed in R2-2503714 to introduce a separate UE capability is introduced for option B to allow more flexibility.

1. (RRC8) RAN2 confirm that option A and option B can be configured in the same RRCReconfiguration message with the unified applicability report procedure.

##### Q6. What is your view on UE capability for Option A and Option B applicability reporting procedure?

Option 1) Implicitly indicated UE supports both options if UE supports one or more of RAN1 defined inference related capabilities (e.g., FG58-0-1 and/or FG58-1-2/3/4/5, the details of those feature group depend on RAN1 progress). RAN2 will add applicability reporting procedure related UE capability description in RAN1 introduced related capabilities. (details will be implemented after RAN1 feature groups are implemented in RAN2 UE capability mega CR)

Option 2) Two conditional mandatory capabilities (with signaling) for Option A and Option B, respectively, if UE supports FG58-0-1 and/or FG58-1-2/3/4/5 (the details of those feature group depend on RAN1 progress).

Option 3) Mandatory of supporting one option and define the other option as optional capability.

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| --- | --- | --- |
| **Company**  | **Option 1 or Option 2** | **Comment**  |
| Samsung | Option 3 or Option 2 | Given that two options provide a same functionality, there is no big motivation to support both of them. If RAN2 can decide which option can be mandatory as explained in Option 3, we prefer option 3. Otherwise, option 2 is acceptable. |
| Qualcomm | Option 2 | While we agree that one should be mandatorily supported, we think it may be very hard for RAN2 to agree that which option should be mandatorily supported. Therefore, we prefer to have two conditional mandatory capability (with signaling) for Option A and Option B. |
| CATT | Option 2 | It may be controversial to define which one should be mandatory supported, so two conditional mandatory capabilities could be accepted easier. |
| Nokia | See comments | In RAN2#129 it was agreed that “upon receiving a full inference configuration, the UE sends the initial applicability report in *RRCReconfigurationComplete*. UAI can be sent to update applicability.”Therefore, Option A is mandatorily supported for AI/ML applicability reporting. Option B can be optional. |
| Huawei, HiSilicon | See comments | Q6 is related to Q5.We think there are following options for Option A and B:**Opt1: both option A and B are mandatory.****Opt2: the UE needs to support at least one (i.e. either option A or B, or both A and B)****Opt3: one option is mandatory while the other is optional.**Opt1 may be better for the NW, as the NW may choose which to support. Opt1 may put a high requirement to UE side as the UE needs to support both.Opt2 is better for the UE as it provides some flexibility, but the NW needs to support both.Opt3 seems to be in the middle.**We slightly prefer Opt2 or Opt3.****In addition, no matter which of options are to be selected, we think the UE supporting Option A/B should support RAN1 defined inference related capabilities (as Rapp mentioned).** |
| Apple | Option 3 or Option 2 | Same view as Samsung. If RAN2 go option 3, we think Option A is mandatory while Option B is optional. Please note that AI positioning and AI/ML CSI prediction only support option A (we don’t expect any surprise will happen in last RAN2 meeting August). Thus, it is not reasonable to define it in another way around.  |
| vivo | Option 2 | Explicit capabilities are clearer from our view. |
| Sharp | Option 2 |  |
| Ericsson | See comments | Agree with Nokia that option A should be mandatorily supported, because the UE always needs to do the applicability check after receiving the inference configuration, both in step 3 and in step 5, i.e. even if option B is used, the UE always needs to perform option A eventually. Option B can be optional.This (option A mandatory and option B optional) corresponds to Option 3 added by Samsung above. |

##### Summary

Option 1: None

Option 2: (7/9) SS, QC, CATT, HW, Apple, vivo, Sharp

Option 3 (Option A is mandatory, Option B is optional): (4/9) SS, Nokia, HW, Apple, Ericsson

Proposal 5: Introduce two conditional mandatory capabilities (with signaling) for AI/ML based BM Option A and Option B, respectively, if UE supports FG58-0-1 and/or FG58-1-2/3/4/5 (the details of those feature group depend on RAN1 progress).

***UE preferred data collection configuration***

During Rel-19, RAN2 has agreed UE can indicate preferred configurations for UE-side data collection, and following agreements were made:

Agreements on data collection configuration

* The UE can request measurement configuration for data collection of AI/ML based beam management. The request can contain one or more of the following:

• An indication on start/stop of data collection

• Preferred configuration from a list of candidate configurations provided by NW. Details of signaling are FFS. It is up to network what it configures at the end.

* Introduce UAI message for UE request of data collection measurement configuration. And it is up to UE implementation when to send the request.

##### Q7. Do you agree to introduce an optional UE capability signaling for UE preferred configuration for UE-side data collection? If yes, do you think 1) it can be added as part of RAN1 FG58-1-7 or 2) a separate capability is introduced?

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| --- | --- | --- | --- |
| **Company**  | **Yes/No** | **If yes, Option 1/2** | **Comment**  |
| Samsung | Yes | Option 1 | We believe this would be the conditional mandatory capability if UE supports UE-side data collection. i.e., No separate capability signalling is needed. |
| Qualcomm | Yes | We are not sure what is option 1 / option 2 here  | We agree with Samsung.  |
| CATT | Yes | Option1 | Agree with Samsung. |
| Nokia | Yes | Option 2 | UE preferred configuration definitely should be separate capability. |
| Huawei, HiSilicon | No for separate UE capability | Option 2 | 58-1-7 (for BM) and 58-3-4 (for CSI prediction) have multiple components already, so it is simpler to add the request part as another component. If we are to introduce a separate bit on top of existing L1 UE features, it may also work, but it adds unnecessary signalling as these two will have to be anyway always indicated together.**Our suggestion:****The UE supporting 58-1-7/58-3-4 (pending for UE data collection request for CSI prediction) should also support the request and indication of preferred configuration of UE-sided BM/CSI prediction. In this case, the description of 58-1-7/58-3-4 can be updated and no new UE capabilities are needed.** [Rapp] rapporteur understands this is Option 1.LPP UE capability on case 1 may have similar issues, but it can be separately discussed. |
| Apple | Yes | Option 1 (part of RAN1 FG58-1-7) | Same view as Samsung, QC and CATT.  |
| vivo | Yes | Option 2 | The RAN1 FG58-1-7 focuses on UE capability from a PHY perspective, e.g., RS type, measurement metric, and resource number. RAN2 has agreed that the network can provide the data collection configuration (at any point in time), with or without UE request. When the request is from the server to the network directly, the UAI from the UE is not needed, while the UE still needs to be capable of FG58-1-7. Therefore, introducing a separate UE capability for UAI is preferred. |
| Sharp | Yes | Option 1 | Same view as companies above (Samsung,QC etc.) |
| Ericsson | Yes  | Option 1 | We agree with Samsung, Qualcomm, CATT, Apple. |

##### Summary

All companies agree to introduce an optional UE capability signaling for UE preferred configuration for UE-side data collection.

Option 1: (7/9) SS, QC, CATT, HW, Apple, Sharp, Ericsson

Option 2: (2/9) Nokia, Vivo

Proposal 6: Include RAN2 feature ‘providing UE preferred configuration for UE-side data collection’ as part of RAN1 FG58-1-7/FG58-3-4 (once implemented).

***Use cases***

##### Q8. Do you think the above capabilities need be defined 1) for all use cases (e.g., BM Case 1, BM Case 2, CSI-prediction) or 2) per use case, except minimum AS layer memory size?

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| --- | --- | --- |
| **Company**  | **Option 1/Option 2** | **Comment**  |
| Samsung |  | Q1/Q2 (i.e., UE memory size): We think a common memory size could be shared for the use-cases for efficient usage of memory.Q3 (i.e., periodic and event-based logging): RAN2 only discussed this for BM use-case. So, it should be per use case (or only for BM). And we do not see the needs for separate capability per sub-use cases (i.e., BM Case 1 and BM Case 2) Q4 (i.e.,UAI for NW-side data collection): It is not use-case specific capability. i.e., common capability for use-cases.Q5 (i.e., UAI for updated applicability): As answered in Q5, we do not think separate UE capability is needed.Q6 (i.e., Option A and Option B): RAN2 only discussed this for BM use-case. So, it should be per use case (or only for BM). And we do not see the needs for separate capability per sub-use cases (i.e., BM Case 1 and BM Case 2)Q7 (i.e., UE preferred configuration): It could be included as part of 58-1-7, 58-3-4 (i.e., per use-case) |
| Qualcomm |  | Q1/Q2: for all use caseQ3: Agree with Samsung.Q4: for all use caseQ5: No UE capability needed. Mandatory support at the UEQ6: Per use case. No RAN1 discussion on option B for CSI prediction.Q7: per use case. |
| CATT |  | Q1/Q2/Q4: Memory and UAI support for all use casesQ3: For BM use case onlyQ5: No additional UE capability neededQ6: Per use case, for BM and PoS use cases if any.[Rapp] positioning capability is a separate discussion in TS 37.355 running CR.Q7: Per use case. |
| Nokia | See comments | Q1/Q2 [minimum AS layer memory]: Option 1Q3 [UE capability for UE logging type periodic, event triggered]: Option 1. See our comments in Q3.Q4 [Assistance information for logging]: See our comments in Q4. We think this is part of baseline for NW side data collection and no additional UE capability is needed. Q5 [Update of applicability reporting via UAI]: See our comments in Q5. Q6 [Implicit vs conditional mandatory for Option A and B]: Option 1. This should be a common capability of a UE for all use cases.Q7 [UE preferred configuration]: Option 1. This should be a common capability of a UE for all use cases. |
| Huawei, HiSilicon | See comments | **Q1, Q2, Q4:** for all use cases**Q3:** Only for BM. There is no difference between BM Case-1 and BM Case-2, i.e. the same data is supposed to be collected, hence there is no need for separate capabilities.**Q5:** no need to have separate UE capability**Q6:** for applicability reporting, if the UE supports inference, then some applicability reporting must be supported (as we commented above). On one hand, there is also no need to have capability reporting per use case, i.e. when the UE supports inference, it needs to also support applicability reporting (details depend on conclusion of Q6). One the other hand, Q6 is about capability indication details, and perhaps different use cases require different options, and then per use case may be more appropriate.**Q7:** per use case. No need to have separate UE capbility |
| Apple |  | Q1/Q2: for all use caseQ3: Agree with Samsung. For BM only. Q4: for all use case Q5: for all use case. No additional UE capability needed (mandatory if the UE supports any use case of Rel-19 AI/ML).Q6: Per use case. For BM only.Q7: per use case. Included as part of 58-1-7, 58-3-4 |
| vivo |  | We think that the capabilities may be different for different use cases. It should be discussed case by case. Though some capabilities can common for all cases. For example, Q1/Q2 should be common for all cases. Basically:Q1/Q2/Q4/Q5: for all use caseQ3/Q6: BM only. Q7: per use case.  |
| Sharp |  | Agree with Vivio: Capabilities may vary depending on the specific use case, and should therefore be evaluated on a case-by-case basis. However, certain capabilities may be common across multiple scenarios and can be defined as shared or baseline capabilities. |
| Ericsson |  | Q1, Q2: for all use casesQ3, Q4: for all use cases that are relevant to NW-side data collectionQ5: for all use casesQ6: per use case, as integrated with the RAN1 capabilities for inferenceQ7: per use case, as integrated with the RAN1 capabilities for UE data collection |

##### Summary

Q1/2: It is straightforward that memory size is shared by all use cases based on RAN2 agreement.

Q3/4: Currently in Rel-19, NW-side data collection is only used for AI/ML based beam management, therefore, at least for Rel-19, there’s no need to further discuss whether these capabilities for NW-side data collection is per use case or for all use case. Therefore, rapporteur proposes to further discuss in future releases when there’s a need.

Q5/7: Based on the above discussion and proposals, if RAN2 agrees P4 and P6, it is straightforward that update of applicability reporting and providing UE preferred configuration for UE-side data collection will be defined per use case, since they are part of RAN1 FGs.

Q6:

Only for BM (no further split into BM case 1 and case 2): SS, QC, CATT, Nokia, Apple, Vivo, Ericsson

According to the comments above, rapporteur understands there’s common understanding that we will not introduce Option A and Option B in CSI prediction. Therefore, it is straightforward that capabilities related to Option A and Option B is for BM only.

The above summary has been reflected to each proposal above with further clarification.

***AI/ML co-exist with other features***

It is observed that there are many features not supported by (e)RedCap UE, IAB-MT, and NCR-MT, for example, CA, MR-DC, DAPS, etc. It is mainly to reduce complexity for such UEs, especially for (e)RedCap UE(s), where they are expected to be reduced capability.

##### Q9. Do you think all AI/ML features can be supported by (e)RedCap UE, IAB-MT, NCR-MT?

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Reason/Any other features** |
| Samsung | No | We do not think the scenario where such UEs are used for data collection or performing inference. |
| Qualcomm | Yes |  |
| CATT | No | Other features should be discussed separately, and we do not think these scenarios are needed. |
| Nokia | No | NW side data collection can be supported but if we agree with minimum 64KB in general, then the question Q10 becomes irrelevant. It is better to keep Release 19 feature as simple as possible and not to extend for reduced capability of (e)RedCap UE, IAB-MT, and NCR-MT. |
| Huawei, HiSilicon | Yes with comments | For AIforPHY features, we think they can be supported by (e)RedCap UE and others, and the standard should be able to allow such "combinations" unless some issues are found. In other words, no special handling is needed for now and it can be up to UE implementation, e.g. if (e)RedCap UE wants to support AIML based BM, it can simply include such capability as it is optional anyway. If some modifications are needed, they can be discussed on a case-by-case basis. |
| Apple | Deprioritize this discussion | As Rel-19 AI PHY still has a lot of open issues, we think any discussion on feature combination need to be deprioritized (after all esstentialopen issues are closed). If no discussion finally, we don’t capture anything in spec.  |
| vivo |  | For (e)RedCap UE, IAB-MT and NCR-MT deployment scenarios are quite limited.Any consideration of supporting AI/ML feature should take into account the deployment complexity. |
| Sharp | No/Deprioritize |  |
| Ericsson | See comments | We agree with Apple. There is no need to discuss specific standardized solutions to support these cases in Rel-19. |

If AI/ML is supported by (e)RedCap, similar as logged MDT, minimum AS layer memory size can be 16kB.

##### Q10. If AI/ML is supported by (e)RedCap, do you agree the minimum AS layer memory size of UE logging measurement results for NW-data collection is 16kB?

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Nokia | See comment from Q9 |  |
| Huawei, HiSilicon | Yes |  |
| Apple | Deprioritize this discussion |  |
| vivo | Yes | If AI/ML is supported by (e)RedCap, 16kB as minimum AS layer memory size of UE logging measurement results for NW-data collection is enough. |
| Sharp | See comment from Q9 |  |
| Ericsson | See our comment for Q9 |  |

##### Summary

6 companies comment that there’s no/limited scenario in Rel-19 to combine (e)RedCap, IAB, NCR with AI/ML or prefer to deprioritize the discussion. One company proposes there’s no changes at least for now. One company is ok to consider a reduced memory size for (e)RedCap.

Based on above, rapporteur suggests that companies can bring contributions if there’s a need to support any change of capability to (e)RedCap, IAB, NCR.

##### Q11. If there’s other UE capability for AI/ML based beam management and/or CSI prediction that is not covered by above questions, please list in below table.

|  |  |
| --- | --- |
| **Company**  | **Comment** |
| Nokia | Similar to RAN1 introducing features (such as, FG 58-1-7 for Data collection for UE-side beam prediction, FG58-3-4 for UE side data collection for CSI prediction), RAN2 should introduce generic NW side data collection as an FG 58-x-x. This may allow UE to indicate one bit capability to support for NW side data collection and to indicate UE supports additional procedures, such as providing additional assistance information for logging, periodic and event-triggered logging etc. |
| Huawei, HiSilicon | We have one more comment as below:For NW-sided data collection for BM, we think the following aspect may need some discussions:How many simultaneous resource configurations for data collection the UE supports (per use case?) |
| Apple | We agree with Nokia (and also QC, Samsung in previous Question) to have a separate capability on generic logging-based NW side data collection. We have detailed proposal in our RAN2 contribution (R2-2503716)Proposal 15: Define the following UE capability of NW side model data collection, which is independent of UE capability of immediate MDT:* **Introduce a general NW-side data collection capability with forward compatibility (e.g. *loggedMeasurements-dataCollection-r19*) under *UE-BasedPerfMeas-Parameters*. For example:**

| ***loggedMeasurements-dataCollection-r19*** Indicates whether the UE supports logged measurements for NW-side data collection in RRC\_Connected state. A UE that supports logged measurements shall support both periodical logging and event-triggered logging. The minimum memory size of logged measurements for NW-side data collection is 64KB. | UE | No | No | Yes |
| --- | --- | --- | --- | --- |

* **The specific measurement quantities to log are separate UE capability (e.g., L1 RSRP for Set A/B are defined for Rel-19 AI based beam management).**

  |
| Ericsson | As we commented for Q3 and as also pointed out by other companies, a generic NW-side data collection capability should be introduced. The generic capability should imply that the UE supports e.g. periodic/L3 event-based logging, a minimum AS memory size of 64 kB, etc. |
|  |  |
|  |  |
|  |  |
|  |  |

##### Summary

The related summary has been captured in Proposal 3.

# Conclusion

Proposal 1: It is mandatory for UE to support the minimum AS layer memory size of 64kB for UE supporting AI/ML based beam management, which is shared across all use cases with NW-sided model.

Proposal 2: FFS on whether UE can support other memory sizes and indicate to network via optional capability signaling.

Proposal 3: Introduce an optional UE capability to indicate supporting logged measurements of data collection for NW-side model, which includes the minimum AS layer memory size. FFS whether the following components are part of this capability or separate capabilities, and how:

* periodic logging
* event-based logging
* measurement quantities and resources (Set A/B, maximum resources of Set A/B, etc)
* provide assistance information (e.g., data is available, reason for trigger, low power indication) for NW-side data collection

Proposal 4: Include RAN2 feature ‘UE can provide update of applicability reporting via UAI’ as part of RAN1 FGs (e.g., 58-0-1 and/or FG 58-1-2/3/4/5, the details of those feature group depend on RAN1 progress) once implemented.

Proposal 5: Introduce two conditional mandatory capabilities (with signaling) for AI/ML based BM Option A and Option B, if UE supports FG58-0-1 and/or FG58-1-2/3/4/5 (the details of those feature group depend on RAN1 progress).

Proposal 6: Include RAN2 feature ‘providing UE preferred configuration for UE-side data collection’ as part of RAN1 FG58-1-7/FG58-3-4 (once implemented).

# Open issue list

***Open issue UECap-1: whether UE can support other memory sizes and indicate to network via optional capability signaling***

*Issue Description:*

This was discussed during the email discussion, and there are 5 companies think that UE can optionally indicate other AS layer memory sizes to network due to the following reasons:

- network flexibility for higher buffer threshold configuration

- common AS layer buffer might need larger memory size to support other use cases as well

4/9 companies don’t agree to indicate other memory size to network due to the following reasons:

- for Rel-19 data collection, no need for additional memory

- more memory size is up to UE implementation

- network can retrieve data based on UE buffer full indication

*Status in running CR:*

Not captured

*Proposed resolution:*

companies to provide contributions to the following meeting.

***Open issue UECap-2: How to define UE logged measurement of data collection for NW-side model***

*Issue Description:*

This was discussed during the email discussion that how to capture UE logged measurement of data collection for NW-side model, including what components should be included, what other separate capabilities are needed. Following FFS is proposed by rapporteur:

Introduce an optional UE capability to indicate supporting logged measurements of data collection for NW-side model, which includes the minimum AS layer memory size. FFS whether the following components are part of this capability or separate capabilities, and how:

- periodic logging

- event-based logging

- measurement quantities and resources (Set A/B, maximum resources of Set A/B, etc)

- provide assistance information (e.g., data is available, reason for trigger, low power indication) for NW-side data collection

*Status in running CR:*

Not captured

*Proposed resolution:*

companies to provide contributions to the following meeting.

***Open issue UECap-3: RAN1 feature group dependency***

During the discussion, there are three RAN2 features having dependency with RAN1 feature group:

* 1) include RAN2 feature ‘UE can provide update of applicability reporting via UAI’ as part of RAN1 FGs (e.g., 58-0-1 and/or FG 58-1-2/3/4/5)
* 2) include RAN2 feature ‘providing UE preferred configuration for UE-side data collection’ as part of RAN1 FG58-1-7/FG58-3-4
* 3) introduce two conditional mandatory capabilities (with signaling) for AI/ML based BM Option A and Option B, if UE supports FG58-0-1 and/or FG58-1-2/3/4/5

*Status in running CR*

UECap-3-1 and UECap-3-2 are not captured, UECap-3-3 with editor notes in 38.306

*Proposed resolution:*

Wait for further updates of RAN1 feature list and implementation of those features in RAN2 UE capability mega CR.