[RAN94e-R18Prep-15] UAV (Uncrewed Aerial Vehicles) - Version 0.0.5
RAN

3GPP TSG RAN Meeting #94e RP-212675

Electronic Meeting, Dec. 6 - 17, 2021

Title: Moderator's summary for [RAN94e-R18Prep-15] UAV (Uncrewed Aerial Vehicles)

Source: Moderator (ZTE, RAN2 VC)

Agenda Item: 8A.1

Document for: Discussion and decision

1 Scope of the discussion on UAV

This email discussion on Rel-18 support for UAV starts from the conclusions of the previous round, summarized in RP-211665 and copied below.

——————————— *From RP-211665 (start)* ———————————

The following areas/objectives can be considered as a starting point for further discussions on UAV:

- *Measurement reports (RAN2)*
  - *UE-triggered measurement report based on configured height thresholds*
  - *Reporting of height, location and speed in measurement report*
  - *Flight path reporting*
  - *Measurement reporting based on a configured number of cells (i.e. larger than one) fulfilling the triggering criteria simultaneously*
- *Signaling to support subscription-based aerial-UE identification (RAN2/RAN3/SA2 interaction)*

  Note: Work done in LTE is a starting point for the above objectives intended to cover LTE UAV functionality including any NR-specific enhancements as necessary
- *Support for broadcast/groupcast of drone identification over PC5 dependent on SA2 outcome (RAN2)*

  [Applicable to both LTE and NR]
- *Study and specify if needed*

  [Additional RRM enhancements to control volume of reports (RAN2)]

  [Mobility enhancements, e.g., for CHO]

  [Beam management enhancements]

——————————- *From RP-211665 (end)* ———————————-

2 Initial round

2.1 Measurement reports

Regarding measurement reports, the (RAN2-led) objective for a possible WID seems already quite clear (with the understanding that work done in LTE should be a starting point):

Potential WID objective #1:

- Measurement reports (RAN2):
  - UE-triggered measurement report based on configured height thresholds
  - Reporting of height, location and speed in measurement report
  - Flight path reporting
  - Measurement reporting based on a configured number of cells (i.e. larger than one) fulfilling the triggering criteria simultaneously

Companies are invited to provide comments on the potential WID objective #1 above

Feedback Form 1:

1 – Nokia Corporation Taking on board what LTE has done should be the natural starting point
2 – SoftBank Corp. Same opinion as Nokia.
3 – TELECOM ITALIA S.p.A. ok, but please keep the work focused on what done for LTE
4 – OPPO Share the similar view with Nokia
5 – Ericsson LM This objective looks good.
6 – China Mobile Group Device Co. Agree with the objectives provided above.
7 – Xiaomi Communications 1 For the third bullet, flight path reporting may need to be discussed with SA2 first, as those information would require the UE to subscribe to certain service entity(ies) in the CN. 2 For the forth bullet, the triggering criteria seems too vague. We should have clearer objective.

8 – Samsung Electronics Co.

We agree that importing LTE work to NR is a good baseline. We are fine with objective #1.

9 – ZTE Corporation

We are supportive of this objective and take the LTE solution as a baseline.

10 – NEC Corporation

We are supportive of this objective. And the previous works done in Rel-15 for LTE is good reference for NR related work.

11 – Lenovo Mobile Com. Technology

Support to use LTE work as a starting point

12 – vivo Mobile Communication Co.

We are OK with the objective, and LTE solution should be reused as the baseline.

13 – NTT DOCOMO INC.

The objective looks good

14 – Apple AB

Looks good to us. Our view is that we should focus on how existing LTE functionality can be mapped to NR/5G.

15 – Sony Europe B.V.

The objectives looks good

16 – LG Electronics France

We prefer that the work scope of this objective is restricted to functionalities already done for LTE, whenever applicable.

17 – VODAFONE Group Plc

We support work to copy LTE functionality across to NR.

18 – InterDigital

We agree with the objective and agree with others that LTE solutions should be used as baseline.

19 – Qualcomm Incorporated

RP-211665 summary includes this **"***Note: Work done in LTE is a starting point for the above objectives intended to cover LTE UAV functionality including any NR-specific enhancements as necessary"*.

We support the intent of that NOTE, i.e., LTE is a starting point ***including any NR-specific enhancements as necessary***. We think, particularly the objective "measurement reporting based on a configured number of cells" may need some NR-specific enhancements (see comment in 2.4 below).

20 – HUAWEI TECHNOLOGIES Co. Ltd. Huawei, HiSilicon We are fine with this objective.
21 – AT&T GNS Belgium SPRL Agree with the objectives
22 – Intel We should introduce all 4 items above in NR following LTE procedure.
23 – LG Uplus We can agree with this objectives as a starting point.
24 – Futurewei Technologies We are fine with these objectives to port LTE schemes to NR.

Moderator's conclusion:

This potential WID objective #1 seems quite stable. Based on some valid feedback, even if the work done in LTE is a starting point for this, it seems ok to indicate that NR-specific enhancements can be considered, if needed.

The following **WID objective #1** is then suggested:

1. Specify the following enhancements on measurement reports (RAN2):
    - UE-triggered measurement report based on configured height thresholds
    - Reporting of height, location and speed in measurement report
    - Flight path reporting
    - Measurement reporting based on a configured number of cells (i.e. larger than one) fulfilling the triggering criteria simultaneously

undefined Note: Work done in LTE is a starting point for this objective. NR-specific enhancements can be considered if needed.

2.2 Signaling to support subscription-based aerial-UE identification

In previous discussion, signaling to support subscription-based aerial-UE identification was indicated as another potential objective for a WID (again with the understanding that work done in LTE should be a starting point):

Potential WID objective #2:

- Signaling to support subscription-based aerial-UE identification (RAN2/RAN3/SA2 interaction)

Companies are invited to provide comments on the potential WID objective #2 above

Feedback Form 2:

1 – TELECOM ITALIA S.p.A. agree
2 – Ericsson LM This objective looks good
3 – OPPO Agree that work done in LTE should be a starting point.
4 – China Mobile Group Device Co. Support the objective listed above.
5 – Xiaomi Communications We think it is too early to determine the objective, and we may need to get clear support or requirement from SA2 first.
6 – Samsung Electronics Co. We agree that importing LTE work to NR is a good baseline. We are fine with objective #2.
7 – ZTE Corporation This objective looks good
8 – NEC Corporation We are supportive of this objective.
9 – Lenovo Mobile Com. Technology Support to use LTE work as a starting point
10 – NTT DOCOMO INC. The objective looks good
11 – vivo Mobile Communication Co. We are OK with the objective.
12 – Apple AB Looks good to us. Our view is that we should focus on how existing LTE functionality can be mapped to NR/5G.
13 – Sony Europe B.V. The objectives looks good

14 – LG Electronics France We prefer that the work scope of this objective is restricted to functionalities already done for LTE, whenever applicable.
15 – VODAFONE Group Plc We support that the LTE functionality is copied into NR.
16 – InterDigital We support this objective.
17 – Verizon UK Ltd The objective is fine.
18 – Qualcomm Incorporated Agree
19 – HUAWEI TECHNOLOGIES Co. Ltd. Huawei, HiSilicon We are fine with this objective.
20 – AT&T GNS Belgium SPRL Agree with the objective
21 – Intel We should introduce support of subscription-based aerial-UE identification following LTE procedure.
22 – LG Uplus Support
23 – Futurewei Technologies We are supportive of this objective.
24 – vivo Mobile Communication Co. Agree with the objective.

Moderator's conclusion:

This potential WID objective #2 seems fully stable.

The following **WID objective #2** is then suggested:

2. Specify the signaling to support subscription-based aerial-UE identification (RAN2/RAN3/SA2 interaction)

Note: Work done in LTE is a starting point for this objective

2.3 Support for broadcast/groupcast of drone identification over PC5

Also the support for broadcast/groupcast of drone identification over PC5 was indicated as a potential (RAN2-led) objective for a WID in previous discussions.

For this, the relationship between with the RAN2 and SA2 work needs to be clarified.

Companies are invited to provide comments on the expected relationship with SA2 work (e.g. what is needed in RAN2 depending on the outcome of the SA2 discussion).

Feedback Form 3:

1 – Nokia Corporation We are supportive of this objective. We should cover here LTE also, otherwise it becomes unclear what happens when moving to LTE only coverage area for example. (should then PC5 transmission stop etc.)
2 – SoftBank Corp. We think the most important aspect is to import LTE functionality to NR. If sufficient time unit is available for this WI, we are OK to include this in the scope.
3 – TELECOM ITALIA S.p.A. it should be clarified over which band PC5 transmission is supposed to be done. This objective is likely a low priority one, and interference to non PC5 transmission in the same band should be evaluated. Therefore RAN1 and RAN4 involvement is expected
4 – OPPO Importing LTE functionality to NR should be the first priority, for this objective, what is needed in RAN2 depending on the outcome of the SA2 discussion.
5 – China Mobile Group Device Co. **F**or NR UAV, the features of UAV discussed in LTE R15 could be discussed as the starting point. Then, we are also interested in this topic and accept to cover it in the WID scope if time allows.
6 – Xiaomi Communications We agree with TELECOM ITALIA. This objective can be deprioritized.
7 – Samsung Electronics Co. We share same view with others i.e. importing LTE work to NR should be the top priority. Hence, we can discuss this objective later on what should be done in RAN based on the outcome of SA2 discussion.
8 – ZTE Corporation We are supportive of this objective, but limited work with a clear scope should be defined. The essential part is to design the solution for remote ID indication and it should be highlighted that no additional optimization on the legacy PC5 mechanism is expected.

9 – NEC Corporation

The first priority must be to introduce the essential functions as for LTE in Rel-18. After this is completed, another aspect, e.g. PC5 may be considered, which is anyway pending SA2 work.

10 – Lenovo Mobile Com. Technology

In general support the objective. But first need to support the feature in NR.

11 – Apple AB

We think this topic can be deprioritized.

12 – Sony Europe B.V.

Agree with most companies above the first step is to introduce the LTE functionality.

13 – LG Electronics France

The intended functionalities of this objective are still unclear.

14 – VODAFONE Group Plc

(agreeing with Nokia:) We are supportive of this objective. It should also cover LTE, otherwise it becomes unclear what happens when moving to LTE only coverage area (e.g. parts of Africa)

15 – InterDigital

We agree with most companies that the first step is to introduce LTE functionality; this objective can be handled later.

16 – Qualcomm Incorporated

We do not see any direct relation of SA2 outcome to RAN2 work. So, we suggest to remove "dependent on SA2 outcome".

For remote identification, one of the FAA requirements is to achieve a range as large as possible.

Current sidelink was not designed with very long range communications as a focus. For example, typical V2X range: 150m for Urban and 320m for freeway (as given in Annex A.1 of TR 38.885). If the UAV flies high in the air, the remote ID range requirement can easily be above 1km range for UAVs with free-space LoS), as shown by simulation results in RP-211945. However, such range has not been studied so far in V2X scenarios. So RAN1 should study and specify PC5 enhancements to achieve longer range communications for UAVs flying in the air. In particular, we think that a small change to DMRS PSCCH is needed, since the presence of cyclic shifts limits the range of this channel (the other physical channels / signals are OK).

Additionally, besides remote ID, we should not preclude applying sidelink to other scenarios using PC5 for UAV (e.g. detect and avoid). PC5 based Detect And Avoid (DAA) for V2X would be useful for the aerial vehicles and better for 3GPP ecosystem, instead of relying on proprietary collision avoidance mechanisms based on other technologies.

Therefore, we suggest updating this objective to the following:

Support for broadcast/groupcast of drone identification and detect and avoid over PC5 (RAN2, RAN1)

- Adapt to UAV scenarios, such as 3D zone, UAV specific assistance info, support of longer-range communications (specifically, enhancements to NR PSCCH DMRS)
- Applicable to both LTE and NR.

17 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon we think as with many others that this objective is secondary compared to the previous two objectives, which are fundamental in order to migrate the LTE feature of UAV support to NR. Also we think we need to give time to SA2 to study and specify the framework for support of this requirements first. We would like clarification on the wording ”groupcast” in addition to ”broadcast”, which is the term mentioned in the FAA requirements. Finally, we are not sure why we need to depend on PC5 technology and spectrum in order to fulfill this requirements. This could be detrimental in terms of speed of adoption of solutions in practical deployments. Even more so if the legacy PC5 for some reason needs to be enhanced.

18 – AT&T GNS Belgium SPRL

This is an important objective for both LTE and NR to fulfill the FAA’s requirement for uncrewed aerial vehicles to broadcast identification information.

19 – Intel

RAN2 should wait for SA2 discussion.

20 – LG Uplus

We have similar view with many companies that Uu should be prioritized.

21 – Futurewei Technologies

This needs some study first, and can be secondary to the first two objectives.

Furthermore, in previous discussions, it was mentioned that this requirement should be applicable to both LTE and NR.

Companies are invited to provide comments on whether the support for broadcast/ groupcast of drone identification over PC5 should be applicable to LTE as well (or just to NR)

Feedback Form 4:

1 – Nokia Corporation

As stated response to the earlier question, this should be done for LTE as well

2 – Ericsson LM

Federal Aviation Administration (FAA) has issued a requirement that broadcast ID is now mandatory for all unmanned aircraft except for a few exceptions. In order to support the drone identification for NR, system information support for broadcast and groupcast would be needed. Further, as an NR sidelink device can be configured by LTE BS, the system information support is needed on LTE side as well. When LTE system

information is in place, LTE device can also be configured by both LTE and NR BS.

Further, the LS in S2-2009228 lists as one system enabler a support for UAV to ground identification (e.g. to authorized third parties such as police devices).

Both LTE and NR should fulfil FAA requirements, hence this objective should be for both LTE and NR.

3 – China Mobile Group Device Co.

If this topic is to be discussed, then both LTE and NR should be included.

4 – Samsung Electronics Co.

If discussed/specified, we agree that it should be applicable to both LTE and NR.

5 – ZTE Corporation

We are open to specifying the feature for both LTE and NR. But we can start with NR firstly.

6 – NEC Corporation

This is also depending on SA2 discussion.

7 – Lenovo Mobile Com. Technology

Yes the broadcast/groupcast of drone identification over PC5 should also be supported in LTE, otherwise UAV cannot be identified when flying into LTE area

8 – NTT DOCOMO INC.

Agree to study the feature for both LTE and NR.

9 – vivo Mobile Communication Co.

We should first focus to import LTE functions to NR. This should be deprioritized.

10 – Apple AB

If agreed to be pursued, then solutions for both LTE and NR need to be explored.

11 – Sony Europe B.V.

Maybe a joint NR LTE topic for next Release.

12 – InterDigital

If this topic is discussed, the feature should be studied for both LTE and NR.

13 – Qualcomm Incorporated

We are open to studying for LTE as well.

14 – HUAWEI TECHNOLOGIES Co. Ltd. We are not against having a solution for LTE but see our comments in feedback form 4.
15 – AT&T GNS Belgium SPRL Agree with Ericsson. This should be supported for both LTE and NR.
16 – Intel This should be applied to NR only. It can further discuss if this add to LTE in next LTE release.
17 – LG Uplus If proceeded, NR only is preferred.
18 – Futurewei Technologies We are fine to study this feature for both LTE and NR.

Moderator's conclusion:

Several comments were made in response to Q3 and Q4. The key aspects seem to be the following:

- Although several companies think that an objective for multicast/broadcast of drone identification over PC5 can be considered, most of them think this is in any case a second priority issue

- One company claims that L1 enhancements to PC5 are needed for drone identification, while the preference of many others is to keep PC5 (at least L1) possibly untouched

- A few companies wonder if we really have to rely on PC5 for this (and in case on which spectrum). [moderator's comment: based on the just approved SA2 SID in S2-2108154 it seems that also SA2 hasn't fully concluded on this]

- Most of the companies commented that if we do something, we should do it for both NR and LTE

So the moderator thinks that any objective for this should be listed as second priority, be based on SA2 progress, aim at reusing the existing sidelink design and be applicable for both LTE and NR, as below.

The following **WID objective #3** is then suggested:

3. [second priority] Based on SA2 progress, specify needed enhancements for PC5, e.g. for broadcast/groupcast of drone identification (RAN2, RAN1, SA2 interaction)

  - Applicable to both LTE and NR.

Note: The legacy sidelink design is a starting point for this objective

2.4 Other

In previous discussions it was also suggested to study and specify other possible enhancements, e.g.:

- Additional RRM enhancements to control volume of reports
- Mobility enhancements, e.g., for CHO
- Beam management enhancements

Companies are invited to provide justification for the suggested enhancements above (and other possible ones, if any), comment whether - in case - a study phase is needed and which WGs are expected to be involved/lead the work.

Feedback Form 5:

1 – Nokia Corporation

1. We should take advantage of the beam forming capabilities we have in 5G, and address beam management enhancements. An UAV with HD video transmission creates a lot of interference to many sites and network being able to control the directivity of the UAV (which has relatively large surface area thus space for antennas also) would allow to reduce the interference in a significant way. This would need RAN1 work with RAN2 involvement from the signaling point of view.
2. For mobility we don' see a major need for UAV specific work, but we remain open for that depending on the possible justification coming up in the discussion. This would be RAN2 work naturally
3. We understand earlier items already covering this controlling the volume of measurements (see question 1 on measurement reporting).

2 – TELECOM ITALIA S.p.A.

Beam management, as described by Nokia above is very important and it is a very good use case for UL enhancements (see discussion RAN94e-R18Prep-01 MIMO Evolution for Downlink and Uplink)

3 – Ericsson LM

Additional RRM enhancement to control volume or reports - We think that the current RRM measurement framework works well for non-flying UEs. However, as discussed already back in the LTE SI, a UE which is flying may trigger excessive and unnecessary RRM measurement reports since new cells for which the entry-condition becomes fulfilled would be very frequent. Even if all those reports would be of interest. We think RAN2 should look in to this. No SI would be needed for this in our view.

Mobility enhancments, e.g. for CHO - CHO is a key feature for ensuring that RLF during mobility can be avoided. It was not designed with UAVs in mind though. We think that for example new trigger conditions for CHO should be considered. No SI would be needed for this in our view.

Beam management - This objective seem to have less consensus (compared to the other objectives in this WI). The impact would likely also be significantly larger. In the spirit of getting a reasonable scope in Rel-18, we suggest that this objective can be postponed to a later release.

4 – China Mobile Group Device Co.

We Support. Cause the movement of UAVs cannot be ignored and especially mobility enhancements are essential.

5 – Xiaomi Communications

Additional RRM enhancements to control volume of reports: It is not clear to us why this enhancement is needed. More evaluation or probably an SI is needed to find out whether there is a real issue, and in which case the issue of unnecessary measurement report is severe, and why this cannot be handled by proper network configuration.

Mobility enhancements, e.g., for CHO: We think that the Rel-16 CHO can be considered as the baseline. Some evaluation is needed to see whether the RLF is frequent when the CHO or DAPS handover is used.

Beam management enhancements: Both RAN1 and RAN2 need to be involved to evaluate the performance of the beam management in the UAV scenarios.

6 – Samsung Electronics Co.

We do not think separate SI is needed for above enhancements. If time allows, we can study and specify them.

7 – ZTE Corporation

- **Additional RRM enhancements to control volume of reports:** We share the views as Nokia that in objective-1, some approaches have already been proposed to control the volume of reports. It's not clear on the details of "additional RRM enhancements".
- **Mobility enhancement, e.g. for CHO:** By taking the legacy as the baseline, we are open to checking whether some new criteria are needed for the UAV case.
- **Beam management enhancements**: The well-defined BM mechanism is beneficial to ensure the reliability and service continuity of UAVs with movement□e.g., in the horizontal or vertical domains. The corresponding study and specification work is needed in Rel-18 and can also be one key solution to address the issue of frequent handover.

8 – Lenovo Mobile Com. Technology

1. **for mobility**, we think CHO is a very suitable tool for UAV, which can be seen as a fast moving vehicle in the air. CHO enables UAV to have fast HO and less delay, which is very important for UAV remote control. On the other hand, CHO is a mature tool and has been discussed for two release, most functions can be reused and expected specification work is low

2. **For beam management**, we think we should support it for UAV. Beam management is a special feature in NR system, we can take advantage of it to better serve UAV e.g. for interference control which is one of most important issue caused by UAV that identified in LTE. Since UAV has LOS to neighbor gNBs and using beam to serve UAV is a very suitable tool. Additionally, one other enhancement that may need to be addressed is enhancements on beam switching due to high mobility of the UAV.

9 – NTT DOCOMO INC.

1. share view with Ericsson that measurement reporting is easier to be triggered for airbone UE in NR scenario, RAN2 needs to further study how to control the excessive measurement reporting in beam based cellular environment.
2. we may take rel-16 CHO as baseline, and agree to study how CHO can apply to flying UE.
3. Open to study whether any enhancemnet for beam management is needed to apply for flying UE.

10 – vivo Mobile Communication Co.

Regarding CHO, we think it is suitable for UAC use case. We think Rel-18 CHO mechanism should be taken as the baseline. We only need to discuss new trigger conditions for UAC use cases.

11 – Apple AB

We think none of these objectives are super-critical. Objective 1 (measurements) can address RRM enhancements to control reporting volume and we don't see a strong justification for mobility enhancements. Beam managements enhancements could be useful given the form-factor and footprint of UAVs.

12 – Sony Europe B.V.

What may differ from LTE would be beam management aspects, which then would be good study.

13 – VODAFONE Group Plc

Functionality to use NR's beam management would be interesting - if time permits.

Measurement trigger improvements are also interesting, and, should be for both NR and LTE.

14 – InterDigital

We believe that CHO for UAV is beneficial as it enables fast HO with less delay. We should use solutions developed for NTN as baseline. No SI is needed for this in our view. This would be RAN2 led.

15 – Qualcomm Incorporated

As commented in 2.1, we think study is needed and NR-specific enhancements may be required for "additional RRM enhancements to control volume of reports". We need to discuss whether the number of cells/beams should be involved, for example. We are fine to include this in 2.1, or list here separately.

LTE study concluded that one of the major issues when supporting UAVs is the amount of

interference they introduce to the system. Due to the beam-based nature of 5G, we think this could be a clearly differentiating factor with respect to LTE in the support of UAVs. Other issue is non-traditional coverage in the air (UEs being served by sidelobes of far-away base stations due to direct LoS, for example.) It has been discussed during LTE study that uptilting of antennas at the BS may be beneficial. NR can support SSB with flexible beamforming. The SSB(s) with uptilted beams can be used to connect aerial UEs, instead of using sidelobe of downtilted beams. In addition, directional antennas at aerial UEs can significantly improve the system capacity and reliability due to reduced interferences, as shown by simulation results in RP-211945. Therefore, for NR, we think RAN1 should study and specify Uu directional beamforming enhancements in FR1 for UAVs, e.g., gNB uptilt beamforming, aerial UE beamforming by directional antennas, etc.

Other low hanging fruits such as aligning LTE specs to enable UAV support by ng-eNB could be considered

without much additional workload in RAN2. Current LTE specification does not support Rel 15 UAV features when connected to 5GC.

Further, we encourage companies to seriously look into the band that is being defined in the US by FCC for UAV communications. We strongly believe it would be good for 3GPP to define mechanisms to operate in such band. If we envision UAVs being widely deployed in the next few years, we should also consider

techniques to increase capacity and reduce operator's burden. Therefore, we propose to proactively study and introduce necessary changes to support bands with a primary allocation to UAV communications (as being currently discussed by the FCC) which will alleviate the interference issues of sharing the spectrum with terrestrial UEs.

16 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon

- **Additional RRM enhancements to control volume of reports**:

More clarification is needed on this bullet. Our feeling is that it is overlapped with the last bullet of objective#1. Maybe what we have there is enough to start with.

- **Mobility enhancement, e.g., for CHO**:

In NTN, the time/location based CHO enhancement has been specified. Any additional UAV specific mobility enhancement needs justification.

- **Beam management enhancements**:

The target scenario and the corresponding performance evaluation is needed to figure out whether there is valid requirement on beam management enhancements for UAV, i.e. the UAV specific requirements should be identified. It is not a good choice to leave this evaluation and identification to the SI/WI, since we should keep the overall Rel-18 load/scope reasonable and with this additional part the UAV item seems too large.

17 – AT&T GNS Belgium SPRL

Additional RRM enhancements to control volume of reports:
We agree with Ericsson. Compared to what was done in LTE, there may be some further scope for improvement. We don't expect this to be relative small in scope.

Mobility enhancement, e.g., for CHO:
CHO can be an important mobility feature for UAVs. We should leverage existing specifications and assess if any UAV-specific enhancements are needed. Again, we expect small enhancements, if at all, over existing CHO functionalities available in NR specifications.

Beam management enhancements:
We agree with Nokia. Beam management functionality of NR should be leveraged to reduce potential interference caused by UAVs.

18 – Intel

We don't see the need to introduce other improvement in the first release of UAV in NR. CHO is already supported and it is not preclude in use in UAV case.

19 – LG Uplus

We need some time to reveal the further issues in SI level.

20 – Futurewei Technologies

These issues need more study, and we are not sure that they are critical to the first release of NR UAV.

Moderator's conclusion:

Regarding "Additional RRM enhancements to control volume of reports", also based on companies feedback,

the moderator thinks that discussion on this could happen as part of the expected RAN2 work on objective #1, with no need to clarify anything else.

Regarding ”Mobility enhancements, e.g., for CHO”, also based on companies feedback, the moderator thinks that’s it would makes sense to check if the existing CHO triggers would apply for UAV or if anything else needs to be specified.

Considering the comments that this should be a second priority item, the moderator would like to suggest the following second priority **WID objective #4:**

4. [second priority] Study and, if needed, specify additional trigger condition for CHO [RAN2].

”Beam management enhancements” also received some good support but, in general, with the understanding that this should also be considered as a second priority item.

Based on further details raised in the discussion, the moderator would then like to suggest the following second priority **WID objective #5:**

5. [second priority] Study and specify the enhancements on beam management, with the following assumptions [RAN1, RAN2]:

- FR1 with directional antenna at UE side
- gNB uptilt beamforming

3 Intermediate round

Companies are invited to provide further comments, if any, on the possible WID objectives #1 to #5, listed in the **moderator’s conclusions** in Section 2.

Feedback Form 6: Comments on moderator’s suggested WID objective #1 in Section 2

1 – Ericsson LM Fine
2 – Nokia Corporation The proposal by the moderator seems good from our point of view.
3 – ZTE Corporation We are fine with this proposal
4 – Deutsche Telekom AG We agree with the objectives but would like to remind that consistency with the LTE solution is needed in order to have a common LTE & NR framework for UAV operation. It is clear that there will be LTE and NR networks covering a PLMN with the likelihood that a UAV flight path changes between those. LTE solution should be the baseline and only if a different solution is justified

for NR it should be adopted.

5 – Intel

We don't see the need for "additional RRM enhancements to control volume of reports" for this release. We think we should introduce the same LTE feature first and can consider "additional" if time permit or in future release. But since we didn't change wording in objective 1, so we are ok with the current version.

6 – VODAFONE Group Plc

Consistent functionality in NR-5GC and LTE-EPC is important as UAV might operate anywhere on/above the planet.

7 – InterDigital

We are fine with this objective.

8 – Apple AB

Looks fine to us.

9 – China Mobile Group Device Co.

Fine with this.

10 – Qualcomm Incorporated

We would like to propose a small change in the note as follows (remove "if needed", since typically this kind of text results in controversies during the normative work):

Note: Work done in LTE is a starting point for this objective. NR-specific enhancements can be considered ~~if needed.~~

11 – Samsung Electronics Co.

We are fine with it.

12 – AT&T GNS Belgium SPRL

Agree

13 – Lenovo Mobile Com. Technology

Support the objective

14 – Sony Europe B.V.

Looks fine

15 – BT plc

We support the proposed way forward.

16 – NEC Corporation Agree with the objective provided above.
17 – HUAWEI TECHNOLOGIES Co. Ltd. Huawei, HiSilicon We are fine with objective #1 as worded by the moderator.
18 – LG Electronics France We are fine with the current version in general. But, for additional RRM enhancements to control volume of reports, we think we can add, 'if needed' for this objective as well.
19 – LG Uplus We are fine with this.
20 – vivo Mobile Communication Co. Agree

Moderator's conclusions: the suggested objective #1 seems largely agreeable. The suggestion to remove "if needed" seems also reasonable and in any case any specific proposal in the WGs will have to be justified (as usual). So objective #1 is suggested to be included (removing "if needed") in the WID description (see Section 4.1).

Feedback Form 7: Comments on moderator's suggested WID objective #2 in Section 2

1 – Ericsson LM Fine, but RAN3 can be the first company listed in the bullet as this mainly impacts RAN3: 2. Specify the signaling to support subscription-based aerial-UE identification (RAN3/SA2 interaction/RAN2)
2 – Nokia Corporation The proposal from the moderator seems fine from our point of view
3 – ZTE Corporation Fine with the proposal and agree to take RAN3 as the leading WG for this topic
4 – Deutsche Telekom AG We agree with Ericsson's comment.
5 – Intel Support

6 – InterDigital We are fine with this proposed objective.
7 – Apple AB Looks fine to us.
8 – China Mobile Group Device Co. Support
9 – Qualcomm Incorporated Support
10 – Samsung Electronics Co. We are fine with it and agree with Ericsson's suggestion.
11 – AT&T GNS Belgium SPRL OK and agree with Ericsson
12 – Lenovo Mobile Com. Technology Support the objective
13 – Sony Europe B.V. Looks fine
14 – BT plc We support the proposed way forward.
15 – NEC Corporation Agree with the objective provided above.
16 – HUAWEI TECHNOLOGIES Co. Ltd. Huawei, HiSilicon We are fine with objective #2 as worded by the moderator.
17 – LG Uplus Agree with this.
18 – vivo Mobile Communication Co. Agree.

Moderator's conclusions: the suggested objective #2 seems largely agreeable. The suggestion to make it a RAN3-led objective is also reasonable. So objective #2 (RAN3-led) is suggested to be included in the WID description (see Section 4.1).

Feedback Form 8: Comments on moderator's suggested WID objective #3 in Section 2

1 – Ericsson LM

We are OK to consider SA2 progress, however we don't think this is second priority. It is instead a very important aspect to support UAVs in 3GPP systems.

So, given that it says that RAN should consider SA2 progress for this objective, we think that we should remove "[second priority]".

To address companies' concern about workload, to limit the scope/workload due to this objective, we think we should not target any PC5 L1 enhancement for UAV. L1 enhancements may be discussed and addressed other WIDs, where UAV can be used as a motivating use case. We therefore propose to remove RAN1 from the list of WG and to clarify it in the note: Note: The legacy sidelink design is a starting point for this objective. No L1 enhancement is expected. We hope that with this scope reduction companies can accept this (important) objective.

2 – Nokia Corporation

The proposal from moderator seems fine form our point of view

3 – TELECOM ITALIA S.p.A.

We still believe this to be a second priority objective. And a study phase is likely to be required. Coexistence with Uu communication in the same band also need to be studied and assessed. Relevant WGs: RAN1 and RAN4

4 – ZTE Corporation

We share the views to take legacy sidelink design as a baseline and prefer to avoid additional enhancement. Meanwhile, regarding the priority issue, keeping this bullet as the 2nd priority seems to be reasonable since discussion in SA2 is still pending. Once the Rel-18 is initialized, the remaining can be done firstly.

5 – Intel

Support

6 – Deutsche Telekom AG

We agree with the concerns raised by TIM in the initial round. It should be clarified first, which frequency band would be used for PC5/SL communication between UAVs! Depending on the outcome, the solution will look quite different. In addition, we also believe that a study phase for this objective of second priority might be required, while coexistence with Uu communication on the same band should be evaluated.

7 – InterDigital

We are fine with this proposed objective.

8 – Apple AB

OK to consider as second priority.

9 – China Mobile Group Device Co.

Taking this objective as second priority is ok to us.

10 – Qualcomm Incorporated

In SA2 SID S2-2108154, following is included in the justification:

"It is necessary to study how the adoption of PC5 solutions for Broadcast Remote Identification and C2 communication would enable re-using 3GPP technologies for enabling this important building block in the deployment of UAVs and UAM for BVLOS and LOS".

Therefore, from SA2 point of view, it is clear that PC5-based solution should be the baseline to support BRID. Given this and considering the FAA requirement on the longer-range communication for UAV BRID communications, it is not convincing to see the comments suggesting that 3GPP WI on UAVs would be complete without working on this aspect.

Therefore, we strongly disagree to marking this objective at "[second priority]". The existing V2X scenarios only consider 2D case and limited communication range, which means PC5 enhancements are needed for UAV. Therefore, it should be prioritized for Rel-18 WI.

Also, since the objective already states "SA2 interaction", we think "Based on SA2 progress" is redundant.

In addition to BRID, S2-2108154 also emphasizes that

"to enable UAV-to-UAV communications to support DAA solutions to ensure safe co-existence of UAV and UAM in congested airspaces, … TS 22.125 supports these scenarios with requirements R-5.2.2-001, and R-5.2.2-004 to R-5.2.2-0011, which refer to UAV-to-UAV direct communication using 3GPP technologies (e.g. PC5)."

Accordingly, the DAA for UAV in PC5 should also be included in the Rel-18 WID.

Based on the above consideration, we suggest the objective#3 to be modified as follows:

3. Specify enhancements for PC5, e.g. for broadcast of UAV identification and for broadcast/groupcast of UAV detect and avoid (RAN2, RAN1, SA2 interaction)

− Adapt to UAV scenarios, such as 3D zone, UAV specific assistance info

− Support of longer-range communications for broadcast of drone identification (specifically, enhancements to NR PSCCH DMRS)

− Applicable to both LTE and NR.

Note: The legacy sidelink design is a starting point for this objective

11 – Samsung Electronics Co.

We are fine with it.

12 – AT&T GNS Belgium SPRL

This is an important objective that enables meeting a regulatory requirement. The [second priority] marking should be removed.

13 – Lenovo Mobile Com. Technology

Support the objective. And we are open for discussion of PC5 enhancement other than remote identification broadcast/groupcast

14 – Sony Europe B.V.

Fine with moderator proposal.

15 – NEC Corporation

NEC suggests focusing on importing LTE functionality to NR for the first release until clear needs are identified.

16 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon Our understanding is that if SA2 has conclusion on the support of PC5 for drone identification, than RAN can study whether there is any technical gap to support this. SA2 will only start with a study on this, therefore "second priority" should be kept. The second priority is also not about the support of the FAA requirements, but on the need of any RAN enhancements to do so. Also we have not seen any clarification on the wording "groupcast" in addition to "broadcast". If we do not see a clarification, we would ask for removal of "groupcast". We also support Telecom Italia and DT comments.

17 – LG Electronics France

We think this objective pursuing PC5 enhancement can be excluded. because the technical gap is not clear; we have the following observations that 1) repetitive transmission can somehow achieve coverage extension and 2) the support of 3D-zone based resource allocation is not really necessary given that the existing 2D-zone based resource allocation can work well if the horizontal surfaces (altitudes) of drones are not much different.

18 – LG Uplus

We are fine with this.

Moderator's conclusions : Based on the comments:

- There are split views on whether this should be a "normal" or a second priority item
- There are comments on the overall design principle (e.g. which band would be used for PC5 communication between UAVs) and that SA2 should progress the work first (by the way, it is understood that the SA2 SID mentions UAV identification over PC5 in the Justification part, however there seems to be no SA2 SID Objective clearly referring to this)
- Even if some company claims that L1 PC5 enhancements are certainly needed, most companies think they are not necessary

The moderator's view is that we could keep this objective as a "normal" priority item, but only start it (and

possibly revise it) after the situation will be clarified in SA2, and without adding further details for now on which (L1) impacts are expected.

The suggestion is then to consider the following revision (also taking into account the comment that in case we could also address the Detect and Avoid aspects mentioned in the SA2 SID, which apparently would also justify the reference to ”groupcast”):

3. ~~[second priority] Based on~~ After SA2 progress, specify needed enhancements for PC5, e.g. for broadcast~~/groupcast~~ of ~~drone~~UAV identification and for broadcast/groupcast of UAV Detect and Avoid (RAN2, RAN1, SA2 interaction)

− Applicable to both LTE and NR.

Note1: The legacy sidelink design is a starting point for this objective

Note2: This objective might be revised after SA2 has further progressed on this

Feedback Form 9: Comments on moderator’s suggested WID objective #4 in Section 2

1 – Ericsson LM Fine.
2 – Nokia Corporation The moderator proposal seems fine from our point of view
3 – ZTE Corporation Fine with this proposal
4 – Intel **We can check if existing CHO can be applied to UAV, but any enhancement to existing CHO for we don’t think we should add new trigger condition for CHO in this release due to limited time in this work item.**
5 – Deutsche Telekom AG We think that sufficiently good mobility support for UAV operation is a prerequisite for a successful operation. It should be evaluated whether the existing CHO triggers apply for UAV. This can have 2nd priority from our point of view.
6 – InterDigital We are fine with this proposed objective.
7 – Apple AB Ok to consider as second priority.

8 – China Mobile Group Device Co.

We are fine that the existing mechanism goes first, then, consider further enhancements if there is remaining time.

9 – Qualcomm Incorporated

Support it in general. Minor comment: "additional trigger condition" may be modified to "additional trigger condition(s)".

10 – Samsung Electronics Co.

We are fine with it.

11 – AT&T GNS Belgium SPRL

OK

12 – Lenovo Mobile Com. Technology

Support the objective

13 – Sony Europe B.V.

We are fine.

14 – NEC Corporation

We suggest that this objective can be postponed to a later release.

15 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon Based on other company feedbacks, we do not object objective #4. Firstly It should be evaluated whether the existing CHO triggers apply for UAV. Also this can have 2nd priority.

Moderator's conclusions: the suggested objective #4 seems largely agreeable and is then suggested to be included in the WID description (see Section 4.1).

Feedback Form 10: Comments on moderator's suggested WID objective #5 in Section 2

1 – Ericsson LM

We don't have a strong view on this topic, but we acknowledge that this may be a rather large objective. Anyway, we assume that this would be based on Rel-17 MIMO work.

2 – TELECOM ITALIA S.p.A.

We think this is an important objective. We would prefer to remove [second priority]

3 – Nokia Corporation

The moderator proposals is fine here, considering there was considerable interest to address the beamforming aspects, to allow control the interference caused by drones. We don't expect much, if any, standards

impact for the ”gNB uptilt beamforming” part.

4 – Nokia Corporation

but also wonder if there is need to have here as ”second priority” as commented by Telecom Italia

5 – ZTE Corporation

In general, we are supportive of this proposal and since the enhancement to BM is important to improve the UAV service, we prefer to remove the ”second priority”.

Meanwhile, regarding the scope and workload, it may not be the issue since we are only for the UAV-specific scenario with horizontal/vertical movement.

6 – Intel

- *For “FR1 with directional antenna at UE side”, we would like to request clarification on the considered antenna architectures and considered direction (DL/UL). Fully digital beamforming can be applied without any RAN1 impact with the best performance in DL/UL for a given number of antenna elements. Thus, justification is needed to consider antennas with hybrid/analog beamforming or antenna selection.* At least *RRM may be impacted and require RAN4 input to support hybrid/analog beamforming and antenna selection in FR1. Feasibility and performance study should be first provided by RAN1. From our perspective there is no critical need to consider this item in Rel-18, it can be postponed for future releases.*
- *For “gNB uptilt beamforming” in our view this feature is already supported by configuring multiple SSBs in FR1. So, there is no need to do additional study/work.*

7 – Deutsche Telekom AG

In case of uptake of UAV connectivity, dedicated / optimized network deployment is a likely scenario; hence, we see benefits of the proposed study in objective #5. This should not be dropped from the WI.

8 – VODAFONE Group Plc

We see this as a useful objective

9 – InterDigital

We are fine with this proposed objective.

10 – China Mobile Group Device Co.

Agree

11 – Qualcomm Incorporated

Support it

12 – Samsung Electronics Co. We don't think that further MIMO ehnancement is necessary for UAV on top of Rel-17 MIMO and we think that RAN1 study is required to justify such enhancements. On the other hand, considering that there are so many RAN1 candidate items for Rel-18 at this point and RAN1 is trying to make overall Rel-18 RAN1 scope manageable, we don't believe that RAN1 can afford such study in Rel-18. Having said that, [second priority] should be kept as suggested by moderator and whether objective #5 is included in the scope of Rel-18 UAV can be determined later depending on RAN1's capacity.
13 – AT&T GNS Belgium SPRL OK
14 – Lenovo Mobile Com. Technology Support the objective
15 – Sony Europe B.V. No strong view
16 – NEC Corporation We suggest that this objective can be postponed to a later release.
17 – HUAWEI TECHNOLOGIES Co. Ltd. Huawei, HiSilicon Based on other company feedbacks, we do not object objective #5, but we should keep the second priority. We need to check also the MIMO related possible overlapping.
18 – LG Uplus We are fine with this.

Moderator's conclusions: the suggested objective #5 seems agreeable, possibly with the clarification that enhancements will be specified only if needed, and involving RAN4 as well.

The following slightly revised objective is then suggested to be included in the WID description (see Section 4.1).

5. [second priority] Study and, if needed, specify the enhancements on beam management, with the following assumptions [RAN1, RAN4, RAN2]

4 Final round

4.1 Work Item objectives

The following objectives are suggested to be included in the (RAN2-led) WID:

1. Specify the following enhancements on measurement reports [RAN2]:
   - UE-triggered measurement report based on configured height thresholds

- Reporting of height, location and speed in measurement report

- Flight path reporting

- Measurement reporting based on a configured number of cells (i.e. larger than one) fulfilling the triggering criteria simultaneously

Note: Work done in LTE is a starting point for this objective. NR-specific enhancements can be considered.

2. Specify the signaling to support subscription-based aerial-UE identification [RAN3/SA2 interaction/RAN2]

   Note: Work done in LTE is a starting point for this objective.

3. After SA2 progress, specify needed enhancements for PC5, e.g. for broadcast of UAV identification and for broadcast/groupcast of UAV Detect and Avoid [RAN2, RAN1, SA2 interaction]

   - Applicable to both LTE and NR.

   Note1: The legacy sidelink design is a starting point for this objective

   Note2: This objective might be revised after SA2 has further progressed on this

4. [second priority] Study and, if needed, specify additional trigger condition(s) for CHO [RAN2].

5. [second priority] Study and, if needed, specify the enhancements on beam management, with the following assumptions [RAN1, RAN4, RAN2]:

   - FR1 with directional antenna at UE side

   - gNB uptilt beamforming

Companies are invited to provide further comments, if any, on the above list of objectives

Feedback Form 11: Remaining comments on the suggested list of objectives

1 – ZTE Corporation

We are in general fine with the proposal, but the following updates are preferred:

1. Regarding the enhancement on the measurement report, it's still preferred to keep the "if needed" in the note. Otherwise, without enough justification, the discussion for this part may be diverse.

- Note: Work done in LTE is a starting point for this objective. NR-specific enhancements can be considered **if needed**.

2. For the 3rd bullet, we share the views from moderator, and the following editorial updates is recommended:

- ~~**After SA2 progress,**~~ Specify needed enhancements for PC5, e.g. for broadcast of UAV identification and for broadcast/groupcast of UAV Detect and Avoid [RAN2, RAN1, SA2 interaction]
  - Applicable to both LTE and NR.
- Note1: The legacy sidelink design is a starting point for this objective
- Note2: **The RAN-level discussion will be initialized with potential updated objectives once** SA2 has further progressed on this topic.

2 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon

We don't think the current Objective #3 reflects the discussion on previous rounds. Companies showed concerns on the SA2 progress and potential RAN1 impact, based on which, we don't think there is strong support to keep this as normal priority.

There two "sub-objectives" now.

On the broadcast of UAV ID based on the FAA requirements, in SA2, nothing about PC5 was captured in the objective list, which means it is FFS whether to support PC5 from SA2 perspective. Maybe there are solutions with even no RAN impact. So instead of "After SA2 progress" we could say "Depending on SA2 progress". Groupcast word should be removed for now.

For the sub-objective on UAV Detect and Avoid, it is one of WT captured in SA2 SID, but, it should be noticed that neither PC5 nor broadcast/groupcast is mentioned there and we do not know the outcome of SA2 study yet. In RAN only one or two companies asked for this objective clearly, and we have not seen enough support for it (i.e. for example more than half of the companies), so it doesn't make sense to add this part just before the last final round of the last RAN email discussion. So this "sub-objective" should be removed.

Overall, we should give an indication on when the RAN objective n.3 should be revised. One option is when the SA2 WID on UAV will be approved. So:

- Note2: The RAN-level discussion will be initialized with potential updated objectives once SA2 has started the corresponding WI phase.

3 – Ericsson LM

We have a similar concern as Huawei regarding detect and avoid. More specifically, we are concerned with the adding of Detect and Avoid to objective 3, for the following reasons:

- In our view, also shared by other companies, besides the top priority of porting LTE functionalities for UAV to NR, only the broadcast of remote ID is urgently needed to comply with the FAA rule, which comes into effect in September 2023 Remote Identification for Drone Pilots (faa.gov). Other use cases mentioned in the SA SID **S2-2108154** such as Detect and Avoid or UAV swarm should be ~~considered low priority and~~ addressed in later releases. This is also to keep the scope of the WI reasonably within the targeted TUs.
- Detect and Avoid very likely requires bigger enhancements to PC5 than Remote ID broadcasting, since Detect and avoid involves communication between UAVs, which are more complex in nature than UAVs just broadcasting their ID to an officer which is mostly on the ground. In our view, such big changes should be handled in another WI.
- If Detect and Avoid would be added the TU allocation would need to be extended, and Rel-18 is already getting overallocated as we all can see.
- Finally, while we think Detect and Avoid does not even fit in or is required for either NR or LTE. Particularly for LTE: we are not even sure if LTE sidelink can be enhanced to fulfill requirements of detect and avoid as captured in the note.

Through the discussions so far for Rel-18 UAV there has been two extremes:

- some companies have wanting to reduce the scope to the bare minimum (i.e. only copy-paste from LTE) and

- some other companies wanting to extend the scope (e.g. by adding detect and avoid).

We think that the only reasonable scope is to have the above, but **without** detect and avoid. That would be the middle-ground and **is** the compromise between these two ”extremes”. To push now at this late stage to extend the scope with something as large as detect and avoid, is in our view not at all a middle-ground and is not something that plenary should attempt.

4 – Deutsche Telekom AG

It is unfortune that the comments/concerns raised by operators (TIM, DT, ...) on topic 3) have been ignored !

Without a clear indication/agreement which frequency band(s) the SL should work on, this objective is not agreeable.

We have no clue about which frequency band companies think off — we are not aware of any dedicated or usable by UAVs ?!

If we are takling about any licensed band, further study objectives are needed (i.e. interference related) and configuration of the frequency resources must be fully under (operators) network control.

For the time being we do not agree adding this objective.

5 – Intel

We are ok with the objectives proposed above

6 – Nokia Corporation

The proposal by the moderator forms a reasonable starting point for WID creation, however we suggest the following:

1. We recognize the need to define the frequency band used for PC5 broadcast, one possibility is to consider the 5 GHz unlicensed band (ref sidelink related discussion). Perhaps the draft WID could have ”[RAN#94 to clarify the frequency band]” to point out this needs to be solved before approval?

2. We agree that only the PC5 broadcast part is needed to meet the regulation needs. We could consider this Detect and Avoid once we learn more of the SA2 progress, and after seeing how well we have progressed with the work. (Huawei wording is also fine as ”Depending on SA2 progress”)

3. With the beamforming as second priority, which then for RAN1 does not mean much if that is anyway the only objective they can start with (as PC5 needs to wait for SA2 progress), thus could as well drop the [Second priority] there.

7 – Apple AB

We are generally OK with the proposal on the table. We would either prefer removing objective 3, or marking it as second priority.

8 – Samsung Electronics Co.

We are fine with the proposed objectives in general. But we have some concerns/suggestions on objective #3 as follows:

- We share the same view as others i.e. the wordings can be improved i.e. depending on SA2 progress rather than after SA2 progress, and removal of ‘detect and avoid’ for now.

- We think that RAN1 needs to be added as the second priority. Similarly to beam management in Objective #5, RAN1 study is required to justify and validate the necessity of enhancements and we are not sure whether RAN1 can afford this study in Rel-18 at this point because it will be dependent on overall Rel-18 scope in RAN1. So, this aspect needs to be captured somewhere in the proposal and one example would be to have the following additional note:

Note 3: RAN1 involvement needs to be discussed later depending on decision on the overall Rel-18 scope in RAN1

9 – Qualcomm Incorporated

In the objective#3, moderator suggested "only start it (and possibly revise it) after the situation will be clarified in SA2". But for 'After SA2 progress' in the main bullet, it is unclear what kind of SA2 progress RAN is waiting for. Companies may have different understanding on it. Since the added Note2 already addressed the concern, we think 'After SA2 progress' in the main bullet should be deleted.

Regarding 'groupcast' for DAA, we think it is the existing scheme supported in V2X scenarios. It can be extended for UAV as well.

10 – AT&T GNS Belgium SPRL

We agree with the moderator's proposed objectives.

11 – Lenovo Mobile Com. Technology

We are fine with the objectives

12 – China Mobile Group Device Co.

Agree the WID scope.

13 – TELECOM ITALIA S.p.A.

We object as per DT comment

In addition, if the objection is solved, objective 3:

- should as a minimum require a study phase
- should have RAN4 involved

14 – LG Electronics France

1) For the objective 1, we also would like to keep the "if needed" in the note. This would enforce justification of each potential enhancement more seriously and help relevant discussion converge.

2) For the objective 3, we observe that several companies are not convinced for now that PC5 enhancements are essential. Hence, we would like to a) remove this objective completely or b) take this as a second priority with the rewording as follow:

- "Depending on SA2 progress, specify enhancements, if needed, for e.g, …" i.e., we prefer to remove 'for PC5'.

15 – NEC Corporation We generally agree with the priority of the potential objectives and prefer not to have a too large scope. The first priority in Rel-18 must be to introduce the essential functions for NR, similar as previously for LTE (objective 1 and 2). At least, the objective 4 should be dropped considering work load in RAN2. If the objective 3 is going to be included in the WID, we should ensure that sufficient TUs can be allocated.
16 – VODAFONE Group Plc We support copying LTE UAV functionality across to NR, and that any enhancements should be consistent across NR and LTE.
17 – vivo Mobile Communication Co. We share the views that 3rd bullet should be kept as [second priority] or removed. We could revisit it after SA2 made further progress.
18 – Sony Europe B.V. We are basically fine with the objectives, but share the concern raised by some companies on the added objective 3 relate to detect and avoid.
19 – Verizon UK Ltd Generally fine with the objectives...objective 3 likely needs more work. We are also looking at it,
20 – SoftBank Corp. We would clarify that objective 3 can be included if sufficient number of TUs can be allocated for this WI. Copying LTE UAV functionality is the most important task.
21 – InterDigital We are fine with the objectives

Moderator's conclusions: Based on the received comments, the following changes are suggested to the proposed objectives:

- "if needed" is re-introduced in Objective #1:
- The description of Objective #3 is changed to clarify that for now this is just a placeholder for a RAN2-led objective that will be drafted in more detail when SA2 will have concluded their study on the architectural aspects (also removing references to Detect and Avoid for now). Although there is good support already for using/enhancing PC5, it's clear that some companies think this should be discussed in SA2 first. And in case we need to understand which band(s) would be used for a PC5 based solution, before clarifying the objective (e.g. to see whether RAN4 should also be involved):

  3. ~~After SA2 progress,~~[Specify needed enhancements ~~for PC5, e.g.~~ for broadcast of UAV identification ~~and for broadcast/groupcast of UAV Detect and Avoid~~ [RAN2, RAN1, SA2 interaction]]

  - Applicable to both LTE and NR.
    ~~Note1: The legacy sidelink design is a starting point for this objective~~
    Note~~2~~: This description is a placeholder for a more detailed objective to be drafted once SA2 will have concluded their study on the architectural aspects.

The final list of objectives is copied in the Conclusions in Section 5.

4.2 TU allocation

Based on the suggested objectives, the moderator's view is that the TU allocation for the WID could be as follows:

- 0.5 - 1 TU (per meeting) in RAN2
- 0.5 TU (per meeting) in RAN3 (and likely not for the whole release)
- 0.5 TU (per meeting) in RAN1 (from when the work will start there)

Companies are invited to provide their views on the possible TU allocation (taking into account the suggested list of objectives in Section 4.1

Feedback Form 12: Comments on the TU allocation

1 – ZTE Corporation We are in general fine with the proposed TU. Regarding the 0.5 TU in RAN1 per meeting, if the TDM-arrangement among the topics is considered, maybe 1 TU for each meeting is possible with sparser meeting.
2 – HUAWEI TECHNOLOGIES Co. Ltd. For the TUs in RAN2, given that most of the work should be copy and paste from LTE and zero or minimum work is expected on PC5, we do not think we need much time. The most important point is the timescale. It would make sense for the whole WI to be started in the second half of REl-18 timeframe, so that we have a stable situation in SA2 first. So for example 1 TU x 3 (or 4) meetings, at the end of the Release. Also we should leave the TU allocation in RAN1 as FFS for now.
3 – Ericsson LM Assuming Detect and Avoid is **not included**: The TU allocation seems reasonable. If Detect and Avoid is **included**: The RAN1 allocation would need to be larger (but as said, we assume that Detect and Avoid should not be included).
4 – Intel RAN2 should keep to 0.5TU. RAN4 may be needed if beam management is included.
5 – Nokia Corporation The TU allocation seems reasonable, RAN2 as the leading group should have 1 TU planned per meeting, in the F2F meeting one can't get too far with a 0.5 TU only. As the beamforming is not dependent on SA2, RAN1 could address that earlier thus the possible RAN4 work would not be end of Release only like with most WIs. TU allocation could be revisited once there are clear conclusions from SA2 side.

6 – Samsung Electronics Co. The suggested TU allocation is acceptable to us.
7 – Qualcomm Incorporated In general, the TU allocation looks reasonable to us.
8 – AT&T GNS Belgium SPRL TU allocation seems reasonable for the moderator's proposed objectives. We have concerns about adding Detect and Avoid at the expense of more TUs.
9 – Lenovo Mobile Com. Technology Since RAN2 as the leading group, we think 1 TU per meeting for RAN2 is better
10 – China Mobile Group Device Co. Support the TU allocation suggested by the moderator.
11 – TELECOM ITALIA S.p.A. It is very sad to see that RAN4 impact is ignored, even if RAN4 is listed among the involved WGs. RAN4 TUs HAVE TO BE IDENTIFIED Moreover, if objective 3 is agreed, it has clear impact in RAN4 (WHICH BANDS, COEXISTENCE WITH Uu, ...)
12 – LG Electronics France We are fine in general with the moderator's proposal. For RAN2, we prefer to have max 0.5 TU per meeting, given that PC5 enhancements are minimized/omitted.
13 – NEC Corporation At least 1 TU is needed in RAN2.
14 – vivo Mobile Communication Co. Considering most work is mainly copy from LTE, we think 0.5TU per-meeting in RAN2 would be enough. Or if 1TU per-meeting in RAN2 is allocated, there may be no need for all meetings in Rel-18.
15 – Sony Europe B.V. We are fine with the objectives
16 – InterDigital We are fine with the proposed TU allocation.

Moderator's conclusions: Based on the comments the following initial TU allocation is suggested for the affected WGs:

- 1 TU (per meeting) in RAN2

- 0.5 TU (per meeting) in RAN3 (not for the whole release)
- 0.5 TU (per meeting) in RAN1 and RAN4 (for Objective #5, from the start of the related work)

With the understanding that the TU allocation for RAN1 and/or RAN4 might need to be revised based on the final revision of Objective #3

5 Conclusions

The following objectives will be included in the Draft (RAN2-led) WID:

1. Specify the following enhancements on measurement reports [RAN2]:
   - UE-triggered measurement report based on configured height thresholds
   - Reporting of height, location and speed in measurement report
   - Flight path reporting
   - Measurement reporting based on a configured number of cells (i.e. larger than one) fulfilling the triggering criteria simultaneously
     Note: Work done in LTE is a starting point for this objective. NR-specific enhancements can be considered, if needed
2. Specify the signaling to support subscription-based aerial-UE identification [RAN3/SA2 interaction/RAN2]

   Note: Work done in LTE is a starting point for this objective.
3. [Specify needed enhancements for broadcast of UAV identification [RAN2, RAN1, SA2 interaction]]
   - Applicable to both LTE and NR
     Note: This description is a placeholder for a more detailed objective to be drafted once SA2 will have concluded their study on the architectural aspects.
4. [second priority] Study and, if needed, specify additional trigger condition(s) for CHO [RAN2].
5. [second priority] Study and, if needed, specify the enhancements on beam management, with the following assumptions [RAN1, RAN4, RAN2]:
   - FR1 with directional antenna at UE side
   - gNB uptilt beamforming

The following initial TU allocation will be suggested for the affected WGs:

- 1 TU (per meeting) in RAN2
- 0.5 TU (per meeting) in RAN3 (not for the whole release)
- 0.5 TU (per meeting) in RAN1 and RAN4 (for Objective #5, from the start of the related work)

With the understanding that the TU allocation for RAN1 and/or RAN4 might need to be revised based on the final revision of Objective #3.