**3GPP TSG RAN Meeting #90-e Draft RP-**

**Electronic Meeting, 7-11 December 2020**

**Source: Moderator (CMCC)**

**Title: summary of [90E][08][52.6-71GHz\_WI\_scoping] Intermediate round**

**Agenda item: 9.8.2**

**Document for: Discussion and Decision**

# Introduction

This is the kick-off of the email thread on scoping out RAN1 aspects and revise the corresponding WI for 51.6-71GHz.

Goal: Generate an agreeable revised WID.

Input contributions covered:  2502, 2532, 2561, 2584, 2756, 2304, 2587, 2713, 2411, 2215, 2269, 2350, 2526, 2547, 2643, ~~2661~~, 2668, 2762, 2355. (Note: 2661 mainly consider the test issues related 52.6-71GHz, which could be a separate discussion)

* Initial round: collecting views on the detailed proposals, deadline: Dec. 8, 2020 12:29h UTC.
  + Moderator to provide intermediate summary before Dec, 8, 2020 15:29h UTC
* Intermediate round:
  + Collecting views on intermediate summary, deadline: Dec. 9, 2020 11:29h UTC
  + Moderator to provide an updated intermediate summary before Dec. 9, 2021 12:30h, UTC
  + Collecting views on updated intermediate summary, deadline for technical comments: Dec. 10, 2020 12:29h UTC
  + Moderator to provide final proposals and potential revised WID before Dec, 10, 2020 15:29h UTC
* Final round: collecting final comments, deadline: Dec. 11, 2020 11:29h UTC
  + Moderator to provide final proposals compiled based on the final rounds of comments, before Dec. 11, 2020 12:30h UTC

# Collecting views on the key issues

Based on the input contributions, moderator would like to propose that we should not go right to WID update, instead, we should identify the agreeable proposals firstly. Targeting the agreeable proposals, moderator would like to encourage companies to fully consider how to facilitate the progress in WGs and to have a whole picture of the reasonable scope of this WI when you provide your proposals.

It is concluded in [20] “*Study of required changes to NR using existing DL/UL NR waveform to support operation between 52.6 GHz and 71 GHz was conducted. The study included study of applicable numerology including subcarrier spacing, channel BW (including maximum BW), and their impact to FR2 physical layer design to support system functionality considering practical RF impairments, and identification of potential critical problems to physical signal/channels, if any. Study of channel access mechanism, considering potential interference to/from other nodes, assuming beam-based operation, in order to comply with the regulatory requirements applicable to unlicensed spectrum for frequencies between 52.6 GHz and 71 GHz was also conducted.*

*As an outcome of the study, it is recommended to support 120 kHz subcarrier spacing with normal CP length, and at least one additional subcarrier spacings among 240 kHz, 480 kHz, and 960 kHz subcarrier spacing candidates. It is recommended to consider supporting at most up to three subcarrier spacings including 120 kHz. It is not recommended to consider support of only 240 kHz SCS for PDCCH/PDSCH/PUCCH/PUSCH in addition to 120 kHz. Subcarrier spacing outside 120 kHz to 960 kHz are not supported for any signals and channels. The applicability of the supported subcarrier spacing to particular signals and channels should be further discussed when specifications are developed. It is additionally recommended to limit the maximum FFT size required to 4096 and to limit the maximum of RBs per carrier to 275 RBs. The candidate supported maximum carrier bandwidth(s) for a cell should be between 400 MHz and 2160 MHz. Further investigation of the details of required changes to NR may be needed.*

*As an outcome of the channel access study, it is recommended to support both channel access with LBT mechanism(s) and a channel access mechanism without LBT for gNB and UE to initiate a channel occupancy. Further investigation of the details of the channel access mechanism may be needed*.”

In order to facilitate the following discussion, moderator has identified from the contributions some key issues echoing the conclusion that seem to be confirmed the sooner the better, and would like to check your initial views on these issues or something else important but missing from the list, including your views on the list itself and moderator’s observations of these issues.

2.1 Key issue 1: SCS selection for data&control, and Maximum bandwidth

Firstly, from the views input in this meeting on numerologies, since no contributions express strong preference of 240KHz SCS, it will not be listed as an option in the following discussion. Secondly, since RAN1 has provided the facts and status about numerologies, it seems we could only check which of the below options is unacceptable to each company.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Additional SCS on top 120KHz | | | | |
|  | 480KHz (NCP) only | 960KHz (NCP) only | 960KHz (NCP + ECP) only | 480KHz (NCP) + 960KHz (NCP) | 480KHz (NCP) + 960KHz (NCP+ECP) |
|  | Unacceptable/ acceptable | Unacceptable/ acceptable | Unacceptable/ acceptable | Unacceptable/ acceptable | Unacceptable/acceptable |
| FUTUREWEI | Acceptable | Unacceptable | Unacceptable | Unacceptable | Unacceptable |
| Charter Communications | Unacceptable | Acceptable | Acceptable | Acceptable | Unacceptable |
| OPPO | unacceptable | Acceptable | Unacceptable with ECP | acceptable | Unacceptable with ECP |
| InterDigital | Unacceptable | Acceptable | Acceptable | Acceptable | Unacceptable |
| CATT | Acceptable | Unacceptable | Unacceptable | Unacceptable | Unacceptable |
| Intel | unacceptable | Acceptable (1st preference) | Acceptable | Acceptable |  |
| Samsung | Unacceptable | Acceptable | Unacceptable | Unacceptable | Unacceptable |
| Lenovo, Motorola Mobility | Unacceptable | Acceptable | Acceptable | Acceptable | Acceptable |
| Qualcomm | Unacceptable | Acceptable | Unacceptable | Acceptable | Unacceptable |
| Ericsson | Acceptable | Unacceptable | Unacceptable | Acceptable | Unacceptable |
| vivo | Unacceptable | Acceptable (1st preference) | Unacceptable | Acceptable | Unacceptable |
| Huawei, HiSilicon | Acceptable (1st preference) | Acceptable | Unacceptable | Unacceptable | Unacceptable |
| ZTE | Acceptable (1st preference) | Acceptable | Unacceptable | Unacceptable | Unacceptable |
| Apple | Acceptable | Unacceptable | Unacceptable | Acceptable | Acceptable |
| LG Electronics | Acceptable | Unacceptable | Unacceptable | Unacceptable |  |
| MediaTek | Acceptable | Unacceptable | Unacceptable | Unacceptable | Unacceptable |
| NTT DOCOMO | Acceptable | Acceptable | Unacceptable | Acceptable (1st preference) | Unacceptable |
| NEC | Unacceptable | Acceptable | Unacceptable | Acceptable | Unacceptable |
| Xiaomi | Unacceptable | Acceptable | Unacceptable | Unacceptable | Unacceptable |
| Nokia | Not preferred | Acceptable | Acceptable | Acceptable | Acceptable |
| Sony | Unacceptable | Acceptable | Acceptable | Acceptable | Acceptable |

Based on your views on SCS selection, which maximum bandwidth is to be supported?

|  |  |
| --- | --- |
| Company | Detailed comments |
| FUTUREWEI | Up to 1.6 GHz |
| Charter Communications | 2.0 to 2.16 GHz should be the target for a single carrier |
| OPPO | With 960kHz, we support max BW 1.6GHz with 2K FFT size or 3.2GHz with 4K FFT size. |
| InterDigital | Up to 2.0 or 2.16 GHz should be supported for the coexistence with IEEE802.11ad/ay |
| CATT | Up to 1.6 GHz |
| Intel | Near 2 GHz to maximize peak data rates. While 1.584 GHz could be achieved with 480kHz and maximum PRB size of 275, if we consider guard bands for channel bandwidth of 1.6 GHz, the actual bandwidth is expected to be smaller. Support of 960 kHz would be critical to support 2 GHz channel bandwidth, which might be even possible to support with 2K FFT. |
| Samsung | Approximately 2 GHz. 3GPP shall provide one channelization to guarantee fair coexistence with Wi-Fi channelization. |
| Lenovo, Motorola Mobility | In our view, maximum support BW should include ~2GHz (similar to WiFi) |
| Qualcomm | 2.16GHz |
| Ericsson | Up to 1.6 GHz for 480 kHz SCS. If both 480 and 960 kHz are supported, then prefer maximum bandwidth for 960 kHz SCS to be an integer multiple of the minimum bandwidth (e.g., RAN4 is discussing 400 MHz as the minimum bandwidth). |
| vivo | 2GHz or 2.16GHz |
| Huawei, HiSilicon | Up to 1.6 GHz with 480 kHz SCS is sufficient as single carrier bandwidth. If 960 kHz SCS was selected, it is likely that implementation complexity would still limit the maximum carrier bandwidth to e.g. 2 GHz. In this case, to reach 8 GHz of aggregated bandwidth (to match WiGiG) then the difference between 480 vs. 960 is in aggregating 5 vs. 4 carriers, both of which are feasible. So in terms of bandwidth capability, 480 kHz meets the requirements to match WiGiG and may be in general easier to implement than 960 kHz SCS. |
| ZTE | Up to 1.6GHz for 480kHz, or 2GHz for 960kHz (as an integer multiple of the minimum bandwidth). |
| Apple | Up to 1.6 GHz for 480 kHz SCS (mapped to 2 GHz with CA). 2 GHz for 960 kHz if selected. We should have an channelization alignment with 802.11ad/ay. |
| LG Electronics | Up to 1.6 GHz |
| MediaTek | Up to 1.6 GHz for 480kHz. |
| NTT DOCOMO | Up to 1.6 GHz for 480 kHz SCS, and around 2 GHz for 960 kHz |
| NEC | Up to 2.16GHz. |
| Xiaomi | 2.16GHz |
| Nokia | Up to 2.16 GHz |
| Sony | Channelization of 2.16 GHz should be supported for the coexistence with IEEE802.11ad/ay. |

2.2 key issue 2: Applicability of the additional SCS

Several companies [7],[8], [10] propose to limit the SCS of initial access signals and channels to legacy SCS. One company proposes SSB for cases other than initial access could support additional SCS [5]. These proposals have different implication for scope of WID and it is better to be determined at the TSG #90e. Striving for minimizing the supported combinations of SCSs, there would like to initially check the views on the *applicability of the additional SCS.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Applicability of the additional SCS on initial BWP | | Applicability of the additional SCS SSB for cases other than initial access | |
|  | Yes/No | Detailed Comments | Yes/No | Detailed Comments |
| FUTUREWEI | No | No benefit was shown for applying additional SCS on initial access channels. This will only increase workload unnecessarily. | No | We do not see the benefit of doing this |
| Charter Communications | No | No performance gain seen in the SI | Neutral |  |
| OPPO | neutral | We are open for applying new SCS for initial BWP. Supporting new SCS on initial BWP at least benefits from coexisting of idle UE and connected UE in a given band. | No | If SSB is re-designed to support new SCS, we don’t prefer to only apply it on non-initial access case. It should be applied on initial access too. |
| InterDigital | No | No clear justification observed during the study phase | No | No clear benefit to support this |
| CATT | Yes | If the new SCS is supported for SSB and initial access BWP, the SSB location in Rel-15 frame structure for other SCS’s, such as 15 kHz, 30kHz, 60 kHz, and 120 kHz could be reused. When the SCS of initial access channels is same as data/control channels, the physical channel multiplexing is flexible with least restriction | Yes | The channel multiplexing would be flexible. The implementation would be less complicated. |
| Intel | Yes | We assume the question is asking whether additional SCS for data/control channel (other than 120kHz) should be supported for SSB.  Being able to implement the system with a single subcarrier spacing (for all data/control channels including SSB) is extremely valuable for implementation.  Specification re-use is nice on paper and could reduce some work in standardization, but does not necessarily reduce implementation complexity. Especially more so since some of the gNB and UE form factors and antenna configuration needed for 60 GHz use cases could be very different from existing FR1/FR2 implementation.  We don’t think there is a need to support all different combinations of SCS for SSB and control/data. Just a single SCS for all signals/channels should be sufficient, and if needed we could further consider different SCS for SSB. | No (?) | May not have fully understood the question. If the question is asking whether we should support two different SCS for SSB, whether one SCS for SSB would be used for initial access, and another SCS for SSB would be used for non-initial access purposes, then our answer would be No.  Its not clear what kind of impact this would have for the UE and gNB when gNB is multiplexing multiple SSB with different SCS together. It may be technically feasible, but we weren’t sure why such feature would be needed. |
| Samsung | Yes | The wording should be changed to “applicability of the additional SCS on singnals/channels in initial access” since “initial BWP” doesn’t include SSB.  We support the SA operation of using the new SCS to make its use cases broader. Actually the discussion of this topic has never happened in SI yet, and it doesn’t impact the working scope if the answer to the next question is Yes, so we can consider it in RAN1/4 in the WI stage. | Yes | The wording question is a little bit confusing. Better changed to “application of the additional SCS on all signals/channels”, or “application of the additional SCS on singals/channels on SCell”, and the discussion should not only on SSB.  Enabling same numerology operation is most essential issue, even more essential than the value of SCS itself. We strongly support applying the new SCS to all signals and channels in both DL and UL. We understand there is some specification impact, but the scope is quite clear and RAN1 has enough experience in the past on specifying the gap. Without supporting the new SCS for all signals/channels, network and UE have to implement mixed numerology when using the new SCS, which remarkably reduce the application of the new SCS in real development. Meanwhile, when implementing the mixed numerology, RAN1 has to deal with a new issue of control symbols blocked by SSB, which NEVER happened in Rel-15 and Rel-16, and the spec impact or implementation limitation toward this direction is not small as well. |
| Lenovo, Motorola Mobility | Yes | To strive for commonality between the SSB and data/control channels, we suggest supporting the same set of values for all channels | Yes | With our preference to support the additional SCS on initial BWP, the additional SCS can also be used for cases other than initial access |
| Qualcomm | Neutral | For initial access, we prefer to use 120KHz SCS for SSB, and it is easier to use the same numerology for initial BWP. However, at this phase, we don’t see a strong need to rule out using new SCS for other DL transmissions in the initial BWP, especially when pattern 1 multiplexing is used | Yes | SSB with new SCS can be used for RRM |
| Ericsson | No | For initial access, as in FR2, our first priority is to support both 120 and 240 kHz SCS for SS/PBCH block, and 120 kHz SCS for RMSI (SIB1) delivery and RACH-related messages in an initial BWP. | Yes | We could be OK with this option if that simplifies UE implementations. |
| vivo | Yes | Enabling the option of a single numerology is important for implementation. If reusing FR2 numerology for 52.6-71GHz, there are the following three problems: 1) More branches are needed to make frequency sync with smaller SSB SCS, which will heavily increase the complexity; 2) At least two different SSBs need to be transmitted (e.g. one for initial access, the other for non-initial access); 3) SSB symbols with smaller SCS will limit more simultaneous symbols to be DL only with larger SCS. | Yes | We prefer to apply additional SCS to both initial access and non-initial access case |
| Huawei, HiSilicon | No | 120 kHz is sufficient for supporting initial access, but 240 kHz can be considered additionally if a new SCS like 480 or 960 kHs SCS is adopted. | No | Similar to others, the aim of the question is unclear. Similar to Intel, we don’t see the need to use different SCS for SSB in initial access and after initial access. |
| AT&T | Yes | It is fundamentally crucial that B52 systems can operate with a single numerology. It is not realistic to assume mixed numerology (regardless of FDM or TDM) will be deployed. Defining a first numerology just for initial access and one or more additional numerologies for data/control, in reality, most likely means that all signals and channels will be implemented in said first numerology only. If additional numerologies not readily supported in R15 are deemed important, RAN1 should specify every signal and channel for those new numerologies incl. the initial access signals/channels and associated procedures. | Yes | The essential aspect is that B52 systems can operate with a single numerology. It is not realistic to assume mixed numerology (regardless of FDM or TDM) will be deployed and consequently, there is no need to treat initial access and non-initial access differently. All signals and channels shall always operate with the same numerology regardless of the procedure they are being used for. |
| ZTE | neutral | If 960kHz is selected for data/control channel, it is beneficial to apply the SCS to both SSB and data/control channel so that the multiplexing pattern can be reused; Otherwise if 480kHz is selected for data/control channel, reusing the 120/240kHz for SSB is sufficient. | neutral |  |
| Apple | No | No performance gain seen during study item phase. | Neutral |  |
| LG Electronics | No | Legacy SCS for SSB (i.e., 120 kHz or 240 kHz) is sufficient. However, we are open to discuss the necessity of using new SCS for signal/channel other than SSB, in the initial BWP. | No | Cannot understand what is intended for this question. If new SCS is introduced for SSB, it should be able to be applied for any purposes (e.g., initial access, RLM, RRM, and so on). In addition, if additional SCS SSB applied for cases other than initial access requires associated CORESET#0 design (e.g., for ANR purpose), it seems that corresponding specification impact will be similar to the specification impact for new SCS SSB for initial access. |
| MediaTek | No | We prefer to reuse current FR2 initial access design to minimize the implementation and spec efforts. Also, we don’t see the strong need to support new SCSs for other signals/channels in initial BWP, i.e., we support 120kHz for initial BWP. | Neutral |  |
| NTT DOCOMO | Neutral | We are open with the exact value(s) of SCS used for initial access.  Reusing 120 kHz (or 240 kHz for SSB) may be beneficial in terms of minimizing additional specification impact for initial access, while supporting same SCS as data for initial access may also be beneficial in terms of facilitating single numerology operation even for SA case.What we want to emphasize is that, it should be sufficient for UE to expect only 1 (or at most 2) SSB SCS during initial access. The expected SCS during initial access needs to be limited to avoid UE implementation complexity. | Yes | Same SCS as data could be used for RRM. |
| Xiaomi | neutral | We propose 240kHz SCS for SSB due to 120kHz SSB is difficult for candidate SSB positions design as in NR-U | No | We think it should be the same as cell defined SSB. |
| Nokia | Not preferred | We propose not supporting the new SCS(s) on the initial BWP in order to keep the same numerology as the SSB; see argumentation regarding SSB in the next column, from which it follows that we could also accept the new SCS(s) on the initial BWP if they are adopted for SSB. | Not preferred | We propose keeping only the Rel-15 SCSs on the SSB in order to minimize specification effort. But we also recognize that it would be feasible to support the new SCS(s) on the SSB, and we would not object to that approach. |
| Sony | Neutral | We can further discuss taking into account performance, implementation complexity, and specification impact. | Neutral | If SSB with new SCS is applied for initial access, it could be also applied for cases other than initial access. |

# Collecting views on updating of the scope of WID

## Potential updates on objectives of “Physical layer aspects”

#### 3.1.1 Question 1: Adding detailed objectives on initial access

4 companies [6][15][11][17][18] are proposing to add objective of specifying SSB pattern/DRS, while 1 company [7] proposes to deprioritize it.

4 companies [11][15][17][18] are proposing to add objective of specifying SSB/CORESET0 multiplexing

1 company [17] is proposing to add objective of specifying sync raster.

2 companies [7][14] are proposing to deprioritize coverage enhancement of SSB.

6 companies [5][11][13][15][17][18] are proposing to adding objectives of PRACH enhancement.

Companies are invited to provide their views on the additional objectives of initial access

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| --- | --- |
| Company | Comments |
| FUTUREWEI | Additional SCS should only apply for PUSCH/PUCCH/PDSCH/PDCCH and associated reference signals. In addition to necessary specification of applying the new SCS to these channels/RSs, only essential additional enhancements should be considered. So far, we did not identify any essential additional enhancement. |
| Charter Communications | SSB enhancements do not seem to be warranted. |
| OPPO | We are fine with adding objective of specifying SSB pattern/DRS  We are fine with adding objective of specifying SSB/CORESET0 multiplexing |
| InterDigital | Similar view with FutureWei that the new SCS should be used only for control and data channels with associated reference signals. |
| CATT | Additional SSB locations need to be supported in order to support up to 64-beam sweeping in 60 GHz unlicensed band operation |
| Intel | SSB/CORESET 0 multiplexing objective is needed since we agree to support data/control SCS of 120 kHz and another larger SCS. The existing SSB/CORESET 0 multiplexing patterns were designed with data/control SCS of 60 kHz and 120kHz in mind. It would not be possible to re-utilize the existing patterns.  In the same context, there should be possibility for RAN1 to discuss the SSB patterns, as they are integral part of the SSB/CORESET 0 multiplexing. |
| Samsung | Yes, all of the aspects are essentially needed, and the detailed scope will depend on the answer to questions in Section 2. |
| Lenovo, Motorola Mobility | We propose that at least the aspects related to SSB/CORESET0 multiplexing and PRACH enhancement should be added as an objective in the WID |
| Qualcomm | We do not see the need to introduce QCL’ed candidate SSB positions. However, for new SCS SSB, we do see the need to develop time domain SSB pattern and multiplexing with coreset 0. Even if the new SCS SSB is not used to support initial access, we still have the ANR issue that may require the SCell to send RMSI.  We agree to deprioritize SSB coverage enhancement, consider low SCS SSB can handle the coverage issue.  We agree to PRACH enhancements, including longer PRACH sequence (571 and 1151) and gaps between ROs to leave beam switching gaps at gNB receiver between ROs |
| Ericsson | SSB patterns/DRS: Depending on the outcome of Key Issue 2 such that if 480/960 kHz for SSB is supported for purposes other than initial access, we will need to specify an SSB pattern for those SCSs, so we are open to this What we think should be de-prioritized is the definition of a DRS window to allow sliding DRS   * SSB/CORSET0 multiplexing: Enhancements are not needed if only 120/240 are supported for initial access   Sync raster: This is part of band definition to be done RAN4 regardless.   * SSB cov. enh: We see no need for coverage enhancements, especially since our view is that 120/240 are used for initial access, for which coverage is sufficient. * PRACH enh.: With respect to PRACH enhancements, it should be clarified whether the enhancements are for initial access or not. In our view, for initial access, with120 kHz SCS, PRACH is supported as in Rel-15, and thus no enhancement is needed for this. If 480/960 PRACH is supported (for purposes other than initial access), then PRACH occasions will need to be defined, so we are open to that enhancement. |
| vivo | If applying new SCS to SSB for either initial access or non-initial access case, new SSB pattern and SSB/Coreset 0 multiplexing pattern are needed. In addition, we are open to improve coverage as well.  Sync raster is a RAN4 issue which definitely needs to be done (I think it is already included in current WID)  PRACH enhancement is needed to support new SCS, including supporting long PRACH sequence which is already agreed in SI phase, LBT gap between continuous ROs and RO configuration. |
| Huawei, HiSilicon | Specify multiplexing of SSB with CORESET#0 and uplink transmissions, depending on the choice of SCS for SSB.  Specify, if needed, a transmission window (such as DRS window) and SSB cycling transmission within a DRS transmission window.  Specify at least one subcarrier spacing value for PRACH (by RAN1#104-e), and specify longer PRACH sequence lengths, L=571 and L=1151.  Specify support for non-consecutive RACH occasions (RO) in RO configuration, considering LBT gap between ROs.  We also see no need for coverage enhancements for SSB. |
| AT&T | If new numerologies not readily supported by R15 are agreed to be introduced for beyond 52 GHz systems, objectives to specify all signals and channels for said new numerologies must be included to guarantee operation of the system with a single numerology. It is not realistic to assume mixed numerology (regardless of FDM or TDM) will be deployed. |
| ZTE | SSB/CORESET0 multiplexing needs to be considered, unless we enforce the SSB and data/control channel to be the same numerology.  SSB pattern needs to be specified if new SCS is supported.  We also agree to deprioritize the coverage enhancement of SSB |
| Apple | If the conclusion in question 2 is no additional SCS for the initial BWP, then there will be no need to specify new patterns for SSB and for CORESET 0 multiplexing. |
| LG Electronics | In our view, introducing additional SSB locations with up to 64 beams maintained is needed (but not limited to SCS larger than 240 kHz) for unlicensed band operation.  We agree to deprioritize coverage enhancement for SSB, as proposed in [14].  We support RACH enhancement such as application of longer PRACH sequence defined in Rel-16 NR-U and RO configuration for new SCS PRACH. |
| MediaTek | SSB pattern/DRS: we prefer to reuse existing SSB design but we are open to discuss SSB pattern if new SCS for SSB is introduced. However, the need of DRS depends on whether PBCH transmission can be treated as short signal without LBT and we should deprioritize DRS discussion for now.  SSB/CORESET0 multiplexing: the decision will depend on the outcome of Discussion item 2.2. From our view, we support reusing existing SCSs in initial access and no need for enhancement on SSB/CORESET0 multiplexing  Sync raster: This aspect should be discussed after minimum channel bandwidth and SSB SCS decision. Also, we are not sure we should discuss this aspect in RAN1.  coverage enhancement of SSB: we don’t see the need for such enhancement since SSB applies QPSK and shows adequate performance in simulation.  PRACH enhancement: We prefer to reuse FR2 existing PRACH SCSs when possible. If not possible, we are open to discuss new PRACH SCSs and sequence lengths |
| NTT DOCOMO | Coverage enhancement for SSB could be deprioritized. The others can be discussed. |
| Xiaomi | We are fine to add objective of specifying SSB/CORESET0 multiplexing |
| Nokia | It is not necessary to add any additional detailed objectives. |
| Sony | We are fine to add objective of specifying SSB pattern/DRS. New SSB pattern is needed not only for new SCS but also for legacy SCS.  If new SCS is applied for SSB, objective of SSB/CORESET0 multiplexing is needed. |

#### 3.1.2 Question 2: Interlace based resource mapping for uplink transmission

3 companies [7][8][17] are proposing not to support or deprioritize interlaced resource mapping for uplink channel because of larger subcarrier space and no strict OCB requirement from regulation.

Companies are invited to provide their views on the exclusion of interlace based resource mapping for uplink transmission.

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| --- | --- |
| Company | Comments |
| FUTUREWEI | This should be secondary priority. |
| Charter Communications | Secondary priority. Primary motivation for interlacing is overcoming PSD limitation, not OCB. |
| OPPO | We think that interlace can be beneficial for power boosting, which is important for uplink transmission in coverage limited scenario when PSD limitation is imposed by the regulation according to some regions. Thus, we support adding interlace based resource mapping for uplink in the WID for the above scenario. |
| InterDigital | No need to include in WID given that there is no strict OCB requirement. |
| CATT | Not needed. The implementation solution could allocate resources for existing PUSCH/PUCCH to meet OCB without the support of interlace. |
| Samsung | This can be a secondary object. |
| Lenovo, Motorola Mobility | We agree to not support interlaced resource mapping for uplink channels |
| Qualcomm | Not needed to introduce PRB level or sub-PRB level interlace for this band |
| Ericsson | No need to support interlacing.  It is important thing to keep in mind is that the primary purpose of interlacing is to overcome a potential PSD limitation, and the PSD is measured in dBm in a 1 MHz measurement bandwidth. Already for 120 kHz, one PRB is almost equal to the measurement bandwidth, so there is absolutely no motivation to introduce RB-level interlacing. |
| vivo | No need to support interlace |
| Huawei, HiSilicon | Although there could be benefits for interlaced uplink transmission but since it appears the scope of this WI may be large, the definition of interlaced uplink transmission can be deprioritized (i.e. not part of the scope). |
| ZTE | No need to support interlacing. |
| Apple | This is a secondary priority. |
| LG Electronics | This could be secondary priority. |
| MediaTek | We don’t see the need to introduce PRB/sub-PRB interlace. |
| NTT DOCOMO | Not necessary from our perspective. We share Ericsson’s point. |
| NEC | No need to support interlace. |
| Nokia | Interlacing is not needed and can be downscoped. |
| Sony | We have the same view with OPPO. We support adding interlace based resource mapping for uplink for 120 kHz SCS. |

#### 3.1.3 Question 3: Adding objectives on PUCCH

3 companies [2][7][15] are proposing to add objective(s) on PUCCH format enhancement in the WID, while 1 company [3] thinks it secondary priority.

Companies are invited to provide their views on adding objectives on PUCCH format enhancement.

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| --- | --- |
| Company | Comments |
| FUTUREWEI | Not needed. |
| Charter Communications | Acceptable for boosting PUCCH performance. |
| OPPO | Fine with adding objective(s) on PUCCH format enhancement in the WID |
| InterDigital | Not needed. If needed, it can be handled in CovEnh WI |
| CATT | Not needed |
| Intel | If the objectives are with respect to PUCCH format 0/1/4 enhancement to combat PDF limitation, given that this was recommended to complete during SI, we are ok. It would be good to see the actual text regarding PUCCH enhancement before agreeing of the support or not supporting it. |
| Samsung | This can be a secondary object. |
| Lenovo, Motorola Mobility | We don’t think that this is an essential feature and would be okay to de-prioritize any enhancements related to PUCCH format enhancement |
| Qualcomm | Agree to add the objective to support wider bandwidth PUCCH at least for format 0/1/4 for higher UL transmit power |
| Ericsson | For PUCCH enhancements, we would be fine if it is limited only to PUCCH format 0 and 1 since the transmit power can be quite limited due to regulatory constraints since these formats are limited to 1 PRB. |
| vivo | We are open to have this objective. However, we lack related study in SI phase for PUCCH. Therefore, we suggest to add “if needed” in this PUCCH objective. In RAN1, we need related studies to determine whether there is essential problem (i.e. coverage). |
| Huawei, HiSilicon | We support specifying enhancements for PUCCH format 0, 1, and 4 to enable higher transmission power when regulatory limits apply |
| ZTE | Fine to add the objective if the enhancement is only for higher transmit power. |
| Apple | This is a secondary priority. |
| LG Electronics | We support to add the objective to specify PUCCH enhancements for any formats to increase the number of RBs for the purpose of power boosting. |
| MediaTek | We think this aspect should be deprioritized and limited to PUCCH format 0 and 1. Also, UE might not need such enhancement for format 1 and 4 since UE can be configured with repetition transmission of PUCCH format 1 and 4 to address coverage issue. |
| NTT DOCOMO | We support to discuss PUCCH enhancement, at least PUCCH format 0/1/4 to deal with EIRP/PSD limitation under BRAN regulation. |
| Nokia | This can be a secondary objective, if time permits. If included, we agree that the scope should be PUCCH format 0/1/4 enhancement to combat PSD limitation. |
| Sony | We agree to add the objective on PUCCH format enhancement. |

### Question 4: Adding objectives on enhancement of PTRS/DMRS

3 companies [2][15][11] are proposing to add objective(s) on PTRS/DMRS enhancement, while 6 companies [3][7][8][13][17][10] think it 2nd/low priority.

Companies are invited to provide their views on adding objectives on PTRS/DMRS enhancement.

|  |  |
| --- | --- |
| Company | Comments |
| FUTUREWEI | Not needed |
| Charter Communications | Not needed. |
| OPPO | We are fine with adding DMRS enhancement in WID |
| InterDigital | We think that DMRS enhancement should be included in WID |
| CATT | Not needed |
| Intel | Companies have provided some results on PTRS and DMRS issues. However, no conclusions were explicitly drawn. We believe RAN1 should be given the time to conclude on this issue, since PTRS and DMRS both fundamental can change how the UE processes signals. Therefore, we suggest to include the issues in the WID. |
| Samsung | This should be included as objective. SI already showed many evaluation results on the BLER degradation due to phase noise for 120 kHz SCS, and enhancement to PTRS/DMRS is needed to compensate the loss. |
| Lenovo, Motorola Mobility | We think that at least DMRS enhancement is an essential requirement and should be included in the objectives for WID. PTRS related enhancements could be down prioritized |
| Qualcomm | We are fine with adding DMRS enhancments in WID |
| Ericsson | Our view is that DMRS and PTRS enhancements have low priority. |
| vivo | Low prioirty |
| Huawei, HiSilicon | RAN1 should make a firm conclusion on the need and benefits of specifying enhancements to DL and UL PT-RS to ensure that the system can provide a functional BLER for all MCS for all subcarrier spacing values of PDCCH/PDSCH/PUCCH/PUSCH, while providing the possibility for implementing a receiver with reasonable complexity. This is true for all candidate values of SCS, since we have observed an error floor for 960 kHz SCS and MCS28 without ICI compensation. |
| ZTE | Prefer to de-prioritize the PTRS and DMRS enhancement. For 120kHz which is more intended for coverage limited scenarios we can avoid using 64QAM. |
| Apple | DMRS enhancements may be needed depending on the SCS selected. |
| LG Electronics | PT-RS enhancements should be added to WID objective since phase noise compensation is one of key challenges to be overcome for this frequency range. DM-RS enhancement could be secondary priority. |
| MediaTek | We support to include enhancement of PTRS/DMRS at least for 120kHz in WID according to SI evaluation results. |
| NTT DOCOMO | We support to add DMRS enhancement in WID. PTRS could be deprioritized in our view since we can see some evaluation results that show sufficient performance of the existing PTRS in Rel-15. |
| NEC | We support to include DMRS/PTRS in the WID. |
| Mitsubishi | PT-RS enhancements should be added to WID objective since phase noise compensation was shown to provide important performance gain in target bands, especially for already agreed SCS values. DM-RS enhancement could also be investigated, (either as normal priority or as secondary priority, if supplementary gain is shown after PT-RS enhancement). |
| Nokia | PTRS enhancement could be included with second priority. DMRS enhancement does not need to be included. |
| Sony | We are fine with adding DMRS enhancement in WID. |

### Question 5: Adding objectives on multiple PDSCH/PUSCH scheduling

5 companies [2][7][15][17][11] are proposing to add objectives on multiple PDSCH/PUSCH scheduling in the scope, while 2 companies [3][14] think it 2nd/low priority.

Companies are invited to provide their views on adding objectives on multiple PDSCH/PUSCH scheduling.

|  |  |
| --- | --- |
| Company | Comments |
| FUTUREWEI | Not essential and hence not needed |
| Charter Communications | Support. |
| OPPO | Fine with adding objectives on multiple PDSCH/PUSCH scheduling |
| InterDigital | Ok with adding these objectives |
| CATT | Not needed |
| Intel | Some discussions may relate to UE capability which will need to be discussed eventually. We support addition of the objectives. |
| Samsung | This should be included as objective. When supporting a large SCS from 480 kHz and 960 kHz, the scheduling aspect should be further investigated, including the multiple PDSCH/PUSCH scheduling. This aspect is directly related to the new numerology, and should be included in the WID, and a restriction of its applicability to new numerology can be added to limit its scope. |
| Lenovo, Motorola Mobility | In our view, the enhancements related to multiple PDSCH/PUSCH scheduling with a single DCI is an essential requirement for high SCS and should be included in the WID with high priority. |
| Qualcomm | Support adding PUCCH monitoring enhancements including slot level BD/CCE capability and span based (every multiple slots) PDCCH monitoring capability |
| Ericsson | We are supportive of including this objective. |
| vivo | Support |
| Huawei, HiSilicon | We would support specifying PDCCH monitoring enhancements, multi-PDSCH scheduling and related HARQ enhancements. |
| ZTE | We support to include this objective |
| Apple | Support |
| LG Electronics | We support to add objectives on multiple PDSCH or multiple PUSCH scheduling by a single DCI. |
| MediaTek | For us the gain from multi-PDSCH is not clear and this enhancement should be deprioritized. |
| NTT DOCOMO | Together with the discussion on PDCCH monitoring which would be essential from our perspective, we agree to discuss multiple PDSCH/PUSCH scheduling aspect. |
| NEC | We support to include multiple PDSCH/PUSCH scheduling in the WID. |
| Xiaomi | Support |
| Nokia | This could be included. It should be focused on multi-PDSCH/PUSCH scheduling with the new SCS(s). |
| Sony | We are fine with adding objectives on multiple PDSCH/PUSCH scheduling in the WID. |

### Question 6: Adding objectives on PDCCH monitoring enhancement

5 companies [2][13][15][17][11] are proposing to add objectives on enhancement of PDCCH monitoring. 2 companies [3][10]think it 2nd/low priority. 2 companies [14][7] think enhancement of PDCCH monitoring is not necessary.

Companies are invited to provide their views on adding objectives on PDCCH monitoring enhancement.

|  |  |
| --- | --- |
| Company | Comments |
| FUTUREWEI | Not needed |
| Charter Communications | Not needed. |
| OPPO | Fine with adding objectives on enhancement of PDCCH monitoring |
| InterDigital | Not needed |
| CATT | Not needed |
| Intel | Not entirely sure about the enhancement aspect, but we should discuss and include aspects that could relate to UE capability. |
| Samsung | This should be included as objective. When supporting a large SCS from 480 kHz and 960 kHz, the number of PDCCH monitoring in a time unit should be further investigated, as pointed out in the SI. This aspect is directly related to the new numerology, and should be included in the WID, and a restriction of its applicability to new numerology can be added to limit its scope. |
| Lenovo, Motorola Mobility | In our view, PDCCH monitoring enhancement is possibly coupled with the enhancements related to multiple PDSCH/PUSCH scheduling and should be included as an objective in the WID |
| Qualcomm | Support adding PDCCH monitoring enhancements including slot level BD/CCE capability and span based (every multiple slots) PDCCH monitoring capability |
| Ericsson | We are supportive of adding an objective on the PDCCH monitoring capability scaling (e.g., BD/CCE budget) when the UE is configured to monitor PDCCH more sparsely (e.g., every B slots). |
| vivo | Support PDCCH enhancement with new SCS. |
| Huawei, HiSilicon | We would support specifying PDCCH monitoring enhancements, multi-PDSCH scheduling and related HARQ enhancements. |
| ZTE | We are fine with adding this objective. |
| Apple | We support adding PDCCH monitoring enhancements especially if 480 kHz/960 kHz is specified. |
| LG Electronics | We agree that this feature could be tied with Q5 (whether to support multi-PDSCH/PUSCH scheduling) and we also support to add objectives on PDCCH monitoring enhancement. |
| MediaTek | We support to discuss at least PDCCH monitoring capability, e.g., BD/CCE limit, and PDCCH monitoring configuration restriction for new SCSs, if introduced. |
| NTT DOCOMO | Support to discuss PDCCH monitoring. |
| Xiaomi | Support, especially when 480 kHz/960 kHz is specified. |
| Nokia | This could be included. The focus should be specifically limited to PDCCH monitoring enhancement with the new SCS(s). |
| Sony | We are fine with adding objectives on PDCCH monitoring enhancement in the WID. |

### Question 7: Adding objectives on beam management enhancement

2 companies [2] [11] are proposing to add objectives on beam management enhancement. 1 company [3] is proposing to specify in RAN4. 4 companies [3][8][7][14] think it 2nd/low priority. 2 companies [14][19] also mentioned it might be overlapped with the scope of R17 MIMO WI.

Companies are invited to provide their views on adding objectives on beam management enhancement.

|  |  |
| --- | --- |
| Company | Comments |
| FUTUREWEI | WID needs to clarify whether R15/16 beam management procedure or R17 new beam management procedure is used as starting point for this WI, or both are supported. |
| Charter Communications | No strong view |
| OPPO | WID should include the work for applying R16 BM function with new SCS. |
| InterDigital | R16 BM function should work with new SCS, which requires BM enhancement. Thus, the WID should include related objectives |
| CATT | Not needed. Reuse the solutions of beam management enhancement in feMIMO WI. |
| Intel | At the very least extension of existing beam management functionality (including any timing related aspects) should be updated and verified so that it will work with the new SCS being defined.  Therefore, application of existing BM features/functionality to 60GHz should be part of the scope. |
| Samsung | This can be second priority. |
| Lenovo, Motorola Mobility | We tend to agree that some of the beam-management enhancements might be overlapping with the scope of R17 MIMO WID. However, it would be useful to include an objective that clearly states that potential beam-management enhancements specific to high SCS is in scope of the WI (with enhancements that overlap with R17 MIMO WI are only discussed in the no R17 MIMO WI) |
| Qualcomm | Rel.15/16/17 BM should apply to this WI. On top of that, we support further discussion of BM enhancements specific for unlicensed band operation and high SCS operation. |
| Ericsson | In general, beam management enhancements should be covered in the MIMO WI.  In this WI, we should revisit the enhancements related to the timing associated with beam based operation |
| vivo | Low priority. |
| Huawei, HiSilicon | In terms of beam management, the only aspects that need to be handled in this WI are the beam switching gap (for the new SCS) and aspects related to LBT. This WI should avoid making changes to BM procedures since in Rel-17 the MIMO WI is redefining the BM framework. |
| ZTE | In general the Rel16 BM functionality should be reused with new SCS introduced. The BM issues related to LBT can be also included. |
| Apple | Beam management issues that arise from operation in the unlicensed band should be covered. |
| LG Electronics | On top of beam management features that we already have in Rel-15/16 and are discussing in Rel-17, we should further discuss which enhancements especially for this frequency range and/or unlicensed band operation are needed. |
| NTT DOCOMO | We support to discuss beam management in 52-71 GHz WI. It is essential to check if beam management in Rel-15/16/17 work in 52.6 – 71 GHz where new SCS to be supported. |
| Nokia | Enhancements are not needed, but necessary extensions to make existing functionality work with the new SCS(s) should of course be included, as mentioned by Intel. |
| Sony | Not needed. Beam management enhancements should be covered in the MIMO WI. |

### Question 8: Adding objectives on CSI processing timing line

1 company [2] is proposing to add objective on enhancement of CSI processing time line. 2 companies [3]~~[10]~~ think it 2nd/low priority. Companies are invited to provide their views on adding objectives to CSI processing timeline.

|  |  |
| --- | --- |
| Company | Comments |
| FUTUREWEI | We think timeline in general needs to be revisited for the new SCS |
| Charter Communications | Secondary priority |
| OPPO | We think CSI processing timeline is one of the processing timelines to be updated according to new SCS. Other processing timelines should also be spelled in the WID. E.g. (copied from the TR 38.808-v020)   * It was identified that for new subcarrier spacing, if agreed, will at least require investigation on the need for enhacnments and standardization, of the following processing timelines:   + Processing capability for PUSCH scheduled by RAR UL grant   + Dynamic SFI and SPS/CG cancellation timing   + Timeline for HARQ-ACK information in response to a SPS PDSCH release/dormancy.   + Minimum time gap for wake-up and Scell dormancy indication (DCI format 2\_6)   + BWP switch delay   + Multi-beam operation timing (timeDurationForQCL, beamSwitchTiming, beam switch gap, beamReportTiming, etc.)   + Timeline for multiplexing multiple UCI types   + Minimum of P\_switch for search space set group switching   + appropriate configuration(s) of k0 (PDSCH), k1 (HARQ), k2 (PUSCH),   + PDSCH processing time (N1), PUSCH preparation time (N2), HARQ-ACK multiplexing timeline (N3)   + CSI processing time, Z1, Z2, and Z3, and CSI processing units   + Any potential enhancements to CPU occupation calculation   + Related UE capability(ies) for processing timelines   + minimum guard period between two SRS resources of an SRS resource set for antenna switching |
| InterDigital | It is not essential but we can consider this as secondary priority |
| CATT | It is essential for any new SCS |
| Intel | We assume this will be just part of the general timeline discussion. |
| Samsung | This can be second priority. |
| Lenovo, Motorola Mobility | In our view, CSI processing timeline and CSI processing unit availability is an essential enhancement for high SCS and should be included in the WID |
| Qualcomm | All timelines have to be defined for new SCS for completeness. Over optimization may not be necessary. |
| Ericsson | In general, all UE processing timelines need to be considered. This is already included in the 2nd bullet of the proposed WID. It is not necessary to have a separate objective just for CSI. |
| vivo | Agree with Ericsson that it is already covered by current WID. |
| Huawei, HiSilicon | Agree with Ericsson |
| ZTE | Agree to consider it as part of the timeline discussions. |
| Apple | Anything to do with timelines should be investigated for new SCSs. |
| LG Electronics | In addition to CSI processing timeline, we are fine with adding objectives on CPU availability check enhancements. |
| MediaTek | We share the same view with Ericsson. |
| NTT DOCOMO | Agree to not have a separate objective only for CSI, although we are ok to consider it as a part of timeline related discussion. |
| NEC | We think it should be discussed for the new SCS. |
| Nokia | The CSI processing timeline will need to be set appropriately for the new SCS(s), along with other processing timelines, but beyond that, enhancements are not needed. |
| Sony | CSI processing timeline should be defined for new SCS. |

## Potential further updates on the objectives of channel access

In the TR38.808, following text was captured in the conclusion

*As an outcome of the channel access study, it is recommended to support both channel access with LBT mechanism(s) and a channel access mechanism without LBT for gNB and UE to initiate a channel occupancy. Further investigation of the details of the channel access mechanism may be needed.*

### Question 1: Support both channel access with and without LBT mechanism(s)

Regarding channel access mechanisms, RAN1 recommended to support both with LBT and without LBT based channel access. In order to better manage the subsequent work in WGs, companies are invited to share your view on whether to take licensed access as a baseline for channel access without LBT.

**Question: Could we agree to update the WID with support of both LBT and No-LBT related procedures, and for No-LBT case, to take the licensed access as a baseline.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| FUTUREWEI | Agree | No further enhancement on no-LBT is necessary. |
| Charter Communications | Agree | No further enhancement on no-LBT mode is necessary. |
| OPPO | Agree |  |
| InterDigital | Agree |  |
| CATT | Agree |  |
| Intel | Agree |  |
| Samsung | Agree. | RAN1 can priority the LBT mode since it has more spec impact. |
| Lenovo, Motorola Mobility | Agree | For regions where LBT is not mandated, it has been evaluated by a number of companies that no LBT could provide better performance in certain use-cases or traffic scenarios. Although, taking licensed access as a baseline for No-LBT case is somewhat not clear to us as it could mean a wide range of aspects and therefore, we think it is not needed to be included in the WID |
| Qualcomm | Agree to support both LBT and no-LBT | We also have an agreement to maximize the commonality between LBT mode and no-LBT mode. Take licensed access as baseline may not be accurate enough. |
| Ericsson | Agree | No further enhancement on no-LBT mode is necessary |
| vivo | Agree |  |
| Huawei, HiSilicon | Agree | No channel access mechanism (e.g. other sensing mechanism) needs to be specified in addition to LBT. |
| AT&T | Agree to support both LBT and no-LBT | No need to tie “no LBT” to licensed case |
| ZTE | Agree | Take the licensed access as baseline may not be accurate and flexible enough. Some limitation and fallback mechanism need to be considered. |
| Apple | Agree |  |
| LG Electronics | Agree to support both LBT and no-LBT, but | It’s not clear to us what “taking the licensed access as a baseline” stands for. |
| MediaTek | Agree |  |
| NTT DOCOMO | Agree |  |
| NEC | Agree |  |
| Nokia | Agree | For LBT, RAN1 should prioritize the functionality required by regulations and ETSI harmonized standards. Other LBT aspects should be deprioritized. |
| Sony | Agree |  |

### Question 2: Adding objectives on LBT BW

4 companies [6][2][15][11] are proposing to add objectives on specifying LBT BW. 1 company [6] is also proposing to clarify the relationship between nominal channel bandwidth defined in ETSI BRAN 302 567 and channel bandwidth in RAN4 specifications.

Companies are invited to provide their views on adding objectives to specify LBT BW.

|  |  |
| --- | --- |
| Company | Comments |
| FUTUREWEI | LBT BW definition and other BW related discussion can be handled at WG level. |
| Charter Communications | This is expected to be handled in RAN WG1 anyway |
| OPPO | We are fine to add objectives on specifying LBT BW. Moreover, we propose to add the clarification on the relationship between nominal channel bandwidth defined in ETSI BRAN 302 567 and LBT BW and channel BW in RAN1. |
| CATT | The LBT BW could be part of LBT discussion in RAN1 without update the objective |
| Intel | The details of this should be part of the normative work in RAN1 and RAN4. Not sure, if we need to explicitly specify the bandwidths in the WID without further technical discussion. |
| Samsung | No need to explicitly specify this aspect in the WID, since this is just one aspect for LBT mode. RAN1 will further investigate this aspect anyway. |
| Lenovo, Motorola Mobility | In our view, it is okay to include an objective specifying LBT BW |
| Qualcomm | This will be a part of channel access discussion. May not need a separate objective, but support to include this in the channel access objective. |
| Ericsson | To be handled in RAN1 as part of the channel access mechanism |
| **vivo** | This is already included in current WID and will be discussed in RAN1 |
| Huawei, HiSilicon | This needs to be decided at WG level, so it is ok to identify this as an objective of the WID. |
| AT&T | Okay to not mention explicitly as objective |
| ZTE | We share the similar view that this can be handled in RAN1 with or without adding a separate objective. |
| Apple | We are okay with adding it as an explicit objective. It will be discussed in detail in the WG with or without an explicit objective. |
| LG Electronics | Agree to discuss LBT BW definition in WG level, but fine with adding objectives related to LBT BW. |
| MediaTek | This should be handled by RAN1. |
| NTT DOCOMO | We support to discuss LBT BW in RAN1, although not to have a separate objective is also ok. |
| NEC | This can be handled in the WI phase. No need to be included in the WID. |
| Nokia | Can be handled in the WGs. No need for another objective. |
| Sony | LBT BW should be part of channel access discussion. |

### Question 3: Adding objectives on energy detection threshold enhancement

4 companies [2][15][17][11] are proposing to add objectives on specifying EDT enhancement considering LBT BW, beamforming gain and etc.

Companies are invited to provide their views on adding objectives to on energy detection threshold enhancement.

|  |  |
| --- | --- |
| Company | Comments |
| FUTUREWEI | Support. This is fundamental part of the work to support beam-based operation |
| Charter Communications | Not necessary since ED threshold can be lowered below EN BRAN requirements by implementation. |
| OPPO | Fine with specifying EDT enhancement considering LBT BW, beamforming gain and etc. |
| CATT | Not needed. The energy detection threshold is more related to the implementation and deployment scenarios. |
| Intel | Support, discussion of ED threshold details should be part of the normative work in RAN1 and RAN4. |
| Samsung | No need to explicitly specify this aspect in the WID, since this is just one aspect for LBT mode. RAN1 will further investigate this aspect anyway. |
| Lenovo, Motorola Mobility | In our view, it is okay to include an objective specifying EDT enhancements considering LBT BW and beamforming gain |
| Qualcomm | This will be a part of channel access discussion. May not need a separate objective, but support to include this in the channel access objective. |
| Ericsson | Not necessary as the regulation supports implementation flexibility. |
| Vivo | This is already included in current WID and will be discussed in RAN1 |
| Huawei, HiSilicon | We support enhancements in ED threshold to account for aspects such as LBT bandwidth, beamforming gain, transmit power, and the choice of LBT beam and transmission beam. |
| AT&T | Support |
| ZTE | Support as a fundamental part of beam-based operation. |
| Apple | Okay with providing an explicit objective on the energy detection threshold enhancement. |
| LG Electronics | Agree to discuss ED threshold adjustment in WG level, but fine with adding objectives related to ED threshold enhancement. |
| MediaTek | Share a similar view with Samsung that it is part of design of LBT mechanism and will anyway be discussed in RAN1. |
| NTT DOCOMO | Same as Q2. We support to discuss ED threshold in RAN1, although not to have a separate objective is also ok. |
| Nokia | No need for another objective |
| Sony | No need to add explicit objective on ED threshold enhancement. But, ED threshold could be discussed as a part of LBT. |

### Question 4: Adding objectives to specify LBT variants

7 companies [6][2][8][10][15][17][11]are proposing to add No LBT in the scope of WID according to RAN1 agreement.

1 company [8] is proposing to perform LBT according to ETSI BRAN 302 567.

5 companies [6][2][15][17][11]are proposing to add objectives on directional LBT into WID, while 1 company [7] think it low priority.

6 companies [6][2][10][15][17][11] are proposing to add objectives on receiver assisted LBT into WID, while 1 company [7]think it low priority.

Companies are invited to provide their views on adding objectives to specify LBT variants.

|  |  |
| --- | --- |
| Company | Comments |
| FUTUREWEI | Although No-LBT is included in the work, licensed access can be used and no further enhancement is needed. For directional LBT, we support as it is natural with beam-based operation. We also support receiver assisted LBT. |
| Charter Communications | No further design work is needed for no-LBT mode. |
| OPPO | From SI outcome the majority views on LBT is to support non-LBT, omni-LBT, directional LBT, Rx-assisted LBT. Thus, we are fine to include these variants in the WID. |
| InterDigital | Directional LBT and receiver assisted LBT should be included in the WID. |
| CATT | There are several LBT alternatives in the conclusion of SI. We are OK to narrow down with only receiver assisted LBT or leave it open for RAN1 discussion during WI. |
| Intel | Given the amount of interest from the companies in the SI, we are ok to add the objective to look further into this. |
| Samsung | Support including objectives on no LBT, as well as directional LBT and receiver assisted LBT into WID as details of LBT mode. |
| Lenovo, Motorola Mobility | We agree to include different variants of channel access mechanism in the scope of the WID including omni-directional LBT, directional LBT, receiver-assisted LBT and No-LBT to provide deployment flexibility. RAN1 has not spent much time discussing the specification effort involved with each of these variants and can consider any further down-selection, if needed, as part of the Work Item. |
| Qualcomm | We support to explicitly define directional LBT (beam relationship between transmission beam and sensing beam and the impact to ED threshold).  We also support to define mechanisms to support receiver assisted LBT at least to handle scenarios with consistent blocking. |
| Ericsson | We are not supportive specifying enhancements/restrictions beyond what are required by regulations, e.g. ETSI BRAN |
| vivo | We support to add no-LBT, omni-directional LBT, directional LBT, receiver-assisted LBT into WID and also specifying mode switching is also needed. |
| Huawei, HiSilicon | The WI should specify the most beneficial LBT mechanism(s) for the system performance among the LBT mechanisms identified and evaluated in the study, i.e., omni-directional LBT, directional LBT and receiver-assisted LBT. Receiver-assisted LBT is the most efficient solution to combat the interference from hidden nodes which cannot be avoided using the transmitter–side LBT mechanisms. So we support specifying receiver assisted channel access mechanisms wherein receiver assistance information is sent only to the transmitter, and specifying details of assistance information and LBT at the receiver side to provide such assistance information. |
| AT&T | Objectives for directional LBT and receiver assisted LBT should be included |
| ZTE | Support to add these objectives explicitly. |
| Apple | Given that the SI has discussed futher investigating of directional and receiver assisted LBT, we are open to include them in the scope. |
| LG Electronics | We are fine with adding objectives on no-LBT, omni-directional LBT, directional LBT, and receiver-assisted LBT, even though receiver-assisted LBT might not have an impact on specification. |
| MediaTek | We are ok to add these LBT variants in the WID for companies to investigate them in the WI phase. |
| NTT DOCOMO | Support to discuss directional LBT. Rx assisted LBT could also be discussed as a supplemental function of directional LBT. |
| NEC | We think the WID should specify what variants would be discussed in the WI phase. |
| Nokia | Only the functionality required by regulations and ETSI harmonized standards should be prioritized. Other aspects should be deprioritized. |
| Sony | We are fine to include no-LBT, directional LBT and Rx-assisted LBT in the WID. |

# Others

## Question 1: Capturing latest regulatory status

In contribution [4], it proposes to make a decision on where the latest 60GHz regulatory status can be discussed and captured, and the contribution also suggests the corresponding technical input can be prepared by RAN4 and captured in TR38.807.

Companies are invited to provide their views on how to reflect the latest regulatory status.

|  |  |
| --- | --- |
| Company | Comments |
| Nokia | The proposed approach is OK. Alternatively, RAN plenary could retain responsibility for this. |
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## Question 2: Definition of the frequency range 52.6-71GHz

Contribution [12] proposes to include a new RAN4 objective to “Extending NR operations to 71 GHz” WID to identify whether new FR (e.g. FR3) shall be defined for the 52.6-71GHz frequency range or the existing FR2 shall be extended to cover 52.6-71GHz range.

Companies are invited to provide their views on definition of this frequency range.

|  |  |
| --- | --- |
| Company | Comments |
| Nokia | Clearly some way is needed to refer to the frequency range over which new functionality is applicable, without including the whole of FR2. Specification impact should be the primary consideration in making a decision on how to do this. The simplest solution could be to define FR3 as 52.6-71GHz, with a statement that “all functionality of FR2 applies unless explicitly modified” in order to avoid having to duplicate a lot of specification work for the new FR. |
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# Round 2 of discussion

# Intermediate Summary

## Summary of the discussion on Key issue 1 SCS selection for data&control, and Maximum bandwidth

Based on the discussion on the key issue 1, there are some statistics as below:

|  |
| --- |
| 480KHz (NCP) only  Unacceptable (14): Charter Communications, OPPO, InterDigital, Intel, Samsung, Lenovo, Motorola Mobility, Qualcomm, vivo, NEC, Xiaomi, Nokia (not preferred), Sony |
| 960KHz (NCP) only  Unacceptable (6): FUTUREWEI, CATT, Ericsson, Apple, LG Electronics, MediaTek |
| 960KHz (NCP + ECP) only  Unacceptable(17): FUTUREWEI, OPPO, CATT, Samsung, Qualcomm, Ericsson,vivo, Huawei, HiSilicon, ZTE, Apple, LG Electronics, MediaTek, NTT DOCOMO, NEC, Xiaomi |
| 480KHz (NCP) + 960KHz (NCP)  Unacceptable(9): FUTUREWEI, CATT, Samsung, Huawei, HiSilicon, ZTE, LG Electronics, MediaTek, Xiaomi |
| 480KHz (NCP) + 960KHz (NCP+ECP)  Unacceptable (15): FUTUREWEI, Charter Communications, OPPO, InterDigital, Samsung, Qualcomm, Ericsson,vivo, Huawei, HiSilicon, ZTE, MediaTek, NTT DOCOMO, NEC, Xiaomi |

With above statistics, input contributions, as well as the discussion, we can have following observations:

1. No Supporting 240KHz on data&control channels;
2. 960KHz (NCP) only receives relatively weak resistance compared to all other options, which is unacceptable by 6 of 21 companies
3. Majority of companies show no interests in supporting ECP, which is unacceptable by 17 of 21 companies

So I would like to propose:

**Moderator’s Proposal 1:**

No supporting 240KHz for data&control channels

**Moderator’s Proposal 2:**

No supporting ECP for the additional SCS;

If we want this item done in this release and not to repeat the same status once again, we really need both camps to compromise a bit, I would like to refine the selection only between 960KHz and 480KHz+960KHz with common design.

**Question: Could you accept 960KHz SCS only, or both 480KHz and 960KHz with common design for these two numerologies?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 960KHz SCS only | Detailed comments | 480KHz+960KHz with common design | Detailed comments |
| Company | Y/N |  | Y/N |  |
| Charter Communications | Y | We favour inclusion of 960 kHz due to PN robustness and maximizing carrier BW. | Y | OK as a compromise. |
| Samsung | Yes | This is our first preference. | Yes | OK with it only when both of the SCSs are supported for SSB/initial BWP as well, otherwise there is no need to support two SCS. |
| CATT | N | As discussed in RP-202713, the 960 kHz SCS would change basic time unit Tc, which is used for RAN1/RAN4 timing related specification/requirements. | N | We don’t agree any change of Tc. If 960 kHz SCS is supported, the maximum system BW needs to be limited to 1.6 GHz. |
| OPPO | Yes | First preference | Yes | OK as compromise |
| InterDigital | Yes | This is our first preference | Yes | This is acceptable for the progress |
| Lenovo, Motorola Mobility | Y | We are okay to either support 960kHz only or both 960kHz and 480kHz. In our view, if we support 960kHz, specification effort for supporting 480kHz with common design would be minimal | Y | We are okay to either support 960kHz only or both 960kHz and 480kHz. In our view, if we support 960kHz, specification effort for supporting 480kHz with common design would be minimal |
| Intel | Yes | This would be our preference | Yes | We would be willing to accept this as well.  We would like to get further clarification on what it means to have common design. For majority of the system design they are going to be based on scalable SCS, meaning underlying design are pretty much identical but scaled in some manner. From our understanding this would be based on a common design framework.  Is this the correct understanding? |
| Ericsson | No | We have strong concerns with this option as we have indicated from the start of the SI. This option compromises performance in some deployment scenarios of interest. | Yes | We have been a strong proponent of 480 kHz only from the start of the SI since it provides good performance across a wide range of deployment scenarios.  However, we can accept this compromise with the understanding that for initial access, at least 120 kHz and 240 kHz SCS for SS/PBCH block and 120 kHz SCS for RMSI (SIB1) delivery and RACH-related messages in an initial BWP are supported (as in FR2). |
| AT&T | Yes | More important than the value is that all channels and signals support the new numerologies | Yes | More important than the value is that all channels and signals support the new numerologies |

6-2.2 Summary of the discussion on Key issue 2: Applicability of the additional SCS

Based on the feedback of “Applicability of the additional SCS on initial BWP”, 6 companies are positive to introduce additional (480 kHz SCS/960kHz) for initial BWP which facilitate single numerology deployment. 9 companies think reusing FR2 numerologies (120kHz /240kHz SSB and 120 kHz for initial BWP) is sufficient. 6 companies are neutral on this issue.

Based on the feedback of “Applicability of the additional SCS SSB for cases other than initial access”, 8 companies are positive to introduce additional (480 kHz SCS/960kHz) for SSB. 8 companies think it not necessary to introduce SSB with additional SCS only for cases other than initial access. 5 companies are neutral on this issue.

Given the company preferences, moderator proposes the following:

**Moderator’s proposal 3:**

For above 52.6GHz to 71GHz band, NR only supports 120kHz and 240kHz SCS for SSB and 120kHz for initial BWP.

**Moderator’s Proposal 4:**

No supporting additional SCS on the access signals/channels in initial access, as well as on SSB for cases other than initial access in this release.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications | Supportive of Proposal 3 and neutral on Proposal 4. |
| Samsung | We have strong concern on Proposal 3 and Proposal 4.  First, we’d like to clarify that the questions in the section were confusing such that companies are not referring to the same thing when replying. At least from our understanding, some companies’ (e.g. Intel, OPPO, Xiaomi) “No” to the second question means they don’t support different SCS set for PCell and SCell, and doesn’t show negative view on supporting the additional SCS on SCell. Maybe companies can clarify the question and response again and moderator can recheck the views.  We already addressed the benefit of using same numerology and so far we didn’t see concern on supporting the additional SCS for SSB and initial BWP.  Regarding the default SCS for PCell, actually this issue was never discussed in the SI, and we figured out there is issue with “reusing” 240 kHz SSB for PCell. I guess the intention to use 240 kHz SSB is for smaller spec impact (e.g. aiming for a direct reuse), but actually it cannot. The spec impact of supporting 240 kHz SSB has three aspects: sync raster (RAN4 spec), SSB pattern and CORESET#0 configuration (RAN1 spec). Since the minimum carrier bandwidth of the band in 52.6GHz to 71GHz will be larger than FR2, the sync raster design will be different accordingly; also, the 240 kHz SSB pattern was designed to be compatible with 60 kHz and 120 kHz data and control, so when it is utilized to be operated with the new SCS (480/860 kHz), there is serious collision issue with control channels for the new SCS, which implies the 240 kHz SSB pattern cannot be directly reused; lastly, as mentioned above, the sync raster will be different for 52.6 to 71 GHz, such that the CORESET#0 configuration (especially the frequency offset) cannot be reused for 240 kHz SSB. Based on above observations, we don’t think it is straightforward to conclude 240 kHz SSB can be supported directly without spec impact. We want to clarify whether the companies supporting 240 kHz SSB intends to make corresponding spec changes to make it work.  Comparing {120, 240} and {120, 480/960} as the default SCS for SSB in initial access, we believe the later one has broader use case. Anyway, this issue can be further discussed in WG level, since it is not impacting the working scope (at least not RAN1 scope). |
| CATT | We don’t prefer to limit initial BWP to 120/240 kHz SCS but would not object to the proposals |
| OPPO | A clarification from our side: in our first round comment, we intended to say that if we support new SCS SSB for SCell, it should naturally support the new SCS SSB for PCell too. We prefer supporting new SCS SSB for both PCell and SCell. |
| InterDigital | We are fine with the proposals from moderators |
| Lenovo, Motorola Mobility | We agree with Samsung and CATT and don’t see a strong reason to limit the SCS to just 120/240kHz for SSB. We are okay to have this discussion in RAN1 |
| Intel | We have concerns on Proposal 3 and 4.  As Samsung pointed out, we believe there was some confusion on the question itself and in some cases companies answers were interpreted in the wrong manner.  The question to proposal 4 could be reformulated to state there will be no difference to supported SCS for SSB used for initial access and non-initial access (i.e. PCell and Scell).  Furthermore, we expect there is some strong coupling with selected SCS and SCS for SSB. For example, Intel contribution in R1-2009379 pointed out that if 120 kHz is to used with 960kHz, there could be issues with OFDM symbol timing estimation. For use of 240 kHz SSB, we believe further technical review will be needed to see if pairing with subcarrier spacing such as 960 kHz is not possible.  Additionally, while some companies understood support of 120/240kHz for SSB and 120kHz for initial BWP may allow reuse of existing SSB pattern and design, we like to note that not all companies do not think this is the case. The SSB design for 240kHz was intended to be paired with 120 kHz CORSET and either 60 or 120 kHz data transmissions. Whether existing SSB designs for 240kHz could be further utilized is to be seen. Therefore, it is questionable whether supporting 240kHz SCS for SSB means the same things for all companies here.  If RAN1 needs to discuss all the SSB pattern designs, SSB/CORESET multiplexing designs, its not clear what proposal 3 brings to the table. |
| Ericsson | In general, we are okay with the direction of Proposal 3. However, this may be too restrictive, and perhaps the following modifications to Proposal 3 may have a better chance of achieving consensus:  For above 52.6GHz to 71GHz band, for initial access NR ~~only~~ at least supports 120kHz and 240kHz SCS for SSB and 120kHz for initial access related signals in an initial BWP. |
| AT&T | This seems to be the worst case as now even in connected mode UEs constantly have to change numerologies. Consequently, we have strong concerns. We also agree with Samsung, Intel, and others that there may be some confusion and misunderstandings. Regardless, in our opinion, at least in connected mode UEs should not be required to change numerologies. We appreciate the specification impact of this requirement, i.e., the need to design all signals and channels to support new numerologies. However, we strongly feel this is worth the effort based on the learnings from Rel. 15 in both FR1 and FR2 in regard to mixed numerologies. Once the specifications support all signals and channels in ann numerologies, it seems straight forward to allow also initial access in all new numerologies. However, we can accept leaving this aspect to RAN1 and RAN4 in the work item phase. |

#### 6-3.1.1 Summary of the discussion on 3.1.1 Question 1: Adding detailed objectives on initial access

13 companies think it is necessary to add objective on SSB pattern/DRS for the purpose of potential new SCS and/or potential LBT failure. 5 companies think it is not necessary and R15 pattern can be reused.

10 companies think it is necessary to add objective on SSB/CORESET0 multiplexing due to potential new SCS combination between SSB and initial BWP. 5 companies think existing pattern in R15 can be reused if no new SCS is introduced for initial access.

3 companies expressed that it is no need to add objective on sync raster as it will be done by RAN1 anyway and may already be implied in WID.

7 companies suggest deprioritizing the coverage enhancement of SSB as it can be achieved by using 120 kHz SSB. 1 company is open to coverage enhancement for SSB.

8 companies think PRACH is necessary because of potential new SCS and additional gap between RO. 2 companies think R15 design is sufficient.

**Moderator’s proposal 5:**

Coverage enhancement for SSB in the band above 52.6GHz to 71GHz is not pursued in Rel-17.

Defer the discussion on SSB patter/DRS, SSB/CORESET0 multiplexing and PRACH enhancement after decision on the SCS of SSB and initial BWP.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | We support Moderator’s proposal |
| OPPO | OK |
| InterDigital | Ok with the proposal |
| Lenovo, Motorola Mobility | We are okay with the moderator’s proposal |
| Intel | Agree |
| Ericsson | Support the moderator's proposal |
| AT&T | OK |

#### 6-3.1.2 Summary of the discussion on 3.1.2 Question 2: Interlace based resource mapping for uplink transmission

On the support of interlace, 2 companies express that it is beneficial for power boosting purpose. 17 companies think it is not needed (11) or lower priority (6).

**Moderator’s proposal 6:**

Interlace based resource mapping for uplink transmission is not supported in the band above 52.6GHz to 71GHz

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. To be more precise, it should be “not included in the WID”, since there can potential enhancement in the future releases. |
| CATT | We support Moderator’s proposal |
| OPPO | OK |
| InterDigital | Ok with the proposal |
| Lenovo, Motorola Mobility | We support the moderator’s proposal |
| Intel | Ok in principle. Agree with Samsung’s suggested formulation. |
| Ericsson | Support the moderator's proposal |
| AT&T | OK |

#### 6-3.1.3 Summary of the discussion on 3.1.3 Question 3: Adding objectives on PUCCH

11 companies think objective should be added to specify coverage enhancement of PUCCH under PSD limitation, with 5 companies suggesting limiting to PUCCH format 0/1/4. 4 companies think it is low priority. 4 companies think it is not needed.

**Moderator’s proposal 7:**

Add objective of coverage enhancement for PUCCH format 0/1/4 under PSD limitation in shared spectrum operation.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | We are OK with Moderator’s proposal |
| OPPO | OK |
| InterDigital | We are ok in principle but it should be clarified how the topic overlap with CovEnh WI will be handled |
| Lenovo, Motorola Mobility | We are okay with the moderator’s proposal |
| Intel | Agree |
| Ericsson | We support the moderator's proposal for PF 0/1.  For PF4 we do not think that enhancements are necessary, since PF3 can be used (not limited to single PRB). The user multiplexing aspect of PF4 seems not necessary for operation in the B52 band. |
| AT&T | OK |

#### 6-3.1.4 Summary of the discussion on 3.1.4 Question 4: Adding objectives on enhancement of PTRS/DMRS

For PTRS enhancement, 8 companies support to add the objective at least for 120 kHz SCS considering the higher phase noise than FR2. 8 companies think R15 design is sufficient.

For DMRS enhancement, 12 companies support to add objectives while 8 companies do not see the necessity.

**Moderator’s proposal 8:**

Continue discussion. Investigate the possibility to restrict the PTRS enhancement for 120kHz SCS and DMRS enhancement for the new SCS (i.e. 480kHz and/or 960kHz).

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| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | Since RS is used for radio channel related estimation (channel gain, phase, time, frequency, and Doppler), the performance depends on the proprietary algorithms in the implementation. The current PTRS and DMRS pattern are sufficient for the estimation algorithms. We don’t see the need for further enhancement |
| OPPO | We don’t think the PTRS enhancement is needed. But we can live with moderator’s proposal as a compromise. |
| InterDigital | Not sure if continue the discussion will help for the progress. As proposed in the draft WID, those two items could be studied in RAN1 and specified if RAN1 concludes that it is beneficial. Therefore, those two should be just included in the WID with the condition “Study and specify” |
| Lenovo, Motorola Mobility | We suggest including the objective with at least potential enhancement for DMRS for the new SCS. |
| Intel | While we are ok with the proposal, not sure if putting restrictions on new PTRS patterns to specific SCS is the best thing to do. RAN1 specification has been typically agnostic to SCS, and we assume any new PTRS configurations could in theory to apply to any SCS. They may not have been optimized for other SCS, but it seems odd to put restrictions on what combination of configuration would be allowed in the WID. That could be better discussed later in the WI stage.  I think we should put a note that whether the new PTRS/DMRS enhancements for the target SCS may be applicable to other SCS could be further discussed in the WI. |
| Ericsson | To be more precise, we think that a WID objective on PTRS/DMRS enhancements should be worded as "evaluate, and if needed specify" where the "if needed" decision should be taken at the next plenary. |
| AT&T | OK |

#### 6-3.1.5 Summary of the discussion on 3.1.5 Question 5: Adding objectives on multiple PDSCH/PUSCH scheduling

18 companies support to add objective on multiple PDSCH/PUSCH scheduling because it can save PDCCH monitoring especially when higher SCS is introduced. Some companies also mentioned this question is related to the question 6 in section 3.1.6. 3 companies think it is not necessary.

**Moderator’s proposal 9:**

Add objective on multiple PDSCH/PUSCH scheduling.

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| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | We don’t see the need of adding this objective. |
| OPPO | OK |
| InterDigital | Ok with the proposal |
| Lenovo, Motorola Mobility | We support the moderator’s proposal |
| Intel | While we are ok in principle. The formulation of the description will need some work as multiple PDSCH/PUSCH scheduling is bit broad and ambiguous. |
| Ericsson | Support the moderator’s proposal |
| AT&T | OK |

#### 6-3.1.6 Summary of the discussion on 3.1.6 Question 6: Adding objectives on PDCCH monitoring enhancement

16 companies support to add objective on PDCCH monitoring enhancement for the new SCS, e.g. CCE/BD limit. 4 companies think it is not necessary.

**Moderator’s proposal 10:**

Add objective on PDCCH monitoring enhancement for new SCS.

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| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | We would like to clarify the objective “PDCCH monitoring enhancement” whether this is UE capability or additional specifications on PDCCH monitoring, such as search space, number of blind decoding, |
| OPPO | OK |
| InterDigital | As mentioned in the initial round, we are not supportive for the proposal |
| Lenovo, Motorola Mobility | We support the moderator’s proposal |
| Intel | Ok in principle. Similar to above some improvement in the description would be preferred when putting the proposed text in the WID. |
| Ericsson | Support the proposal. But to be more precise, we think the scope of the objective should be "PDCCH monitoring capability scaling" where it is necessary to discuss how the scaling occurs with the larger SCS values when the UE is configured to monitor PDCCH more sparsely (e.g., every B slots). |
| AT&T | OK |

#### 6-3.1.7 Summary of the discussion on 3.1.7 Question 7: Adding objectives on beam management enhancement

13 companies express the views to clarify in WID that the existing BM mechanisms in R15/16 and the output from R17 FeMIMO can be the baseline for the band above 52.6GHz to 71GHz. 8 companies also mentioned that additional work might be necessary to check whether these mechanisms can be applied to the new SCS and in unlicensed band. 5 companies think the enhancement is not necessary.

**Moderator’s proposal 11:**

Beam management defined in R15/16/[17] is the baseline for operation in the band above 52.6GHz to 71GHz.

Add objective on extending existing beam management to new SCS and potential enhancement for shared spectrum operation.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal, and we prefer to use R17 BM as a baseline. |
| CATT | We are OK with Moderator’s proposal |
| OPPO | OK, prefer set the R15/R16 as the baseline |
| InterDigital | Support the proposal |
| Lenovo, Motorola Mobility | We support the moderator’s proposal |
| Intel | Agree. |
| Ericsson | We agree that R15/16/17 is the baseline.  However, we think the proposal is too broad. The main aspect needed to investigate to support new SCS is the timing associated with beam-based operation. |
| AT&T | OK |

6-3.1.8 Summary of the discussion on 3.1.8 Question 8: Adding objectives on CSI processing timing line

15 companies comment that CSI processing timing line should be one part of general timing line discussion. 2 companies proposed to have a separate objective on the CSI process unit availability check. 3 companies think it is low priority.

**Moderator’s observation:**

CSI processing timing line is already captured in the WID proposal.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | We support Moderator’s proposal |
| OPPO | OK |
| InterDigital | Ok with the proposal |
| Lenovo, Motorola Mobility | We are okay with the moderator’s proposal |
| Intel | agree |
| Ericsson | Agree with the moderator's observation |
| AT&T | OK |

6-3.2.1 Summary of the discussion on 3.2.1 Question 1: Support both channel access with and without LBT mechanism(s)

All companies agree to support both no LBT and LBT as recommended by TR38.808.

**Moderator’s proposal 12:**

Update the WID with support of both LBT and No-LBT related procedures, and for No-LBT case, take the licensed access as a baseline.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications | Supportive of Proposal 12. Our interpretation of licensed access is that all L1/L2 procedures are followed without the need to refer to a special case of shared spectrum access or to a separate spec such as 37.213. |
| Samsung | We are ok with the proposal. |
| CATT | We support Moderator’s proposal |
| OPPO | OK |
| InterDigital | Ok with the proposal but if we don’t find any standards impact, we could also explicitly mention that no enhancement is needed for no-LBT case in the WID |
| Lenovo, Motorola Mobility | Although, we are okay with the proposal, but would still prefer to remove “take the licensed access as a baseline” from the proposal or at least add some further clarification on what it entails |
| Intel | agree |
| Ericsson | We are OK with the proposal. However, similarly Lenovo, we think more clarification is needed on interpretation “on licensed access as baseline” and whether the interpretation described by Charter is the intention. |
| AT&T | OK with the proposal with clarifications on “on licensed access as baseline” |

6-3.2.2 Summary of the discussion on 3.2.1 Question 2: Adding objectives on LBT BW All companies think the LBT BW should be defined in RAN1. 5 companies think it should be added explicitly in the objective while other 15 companies think the work will be done anyway without adding objective.

**Moderator’s observation:**

LBT BW will be specified for channel access mechanism in WGs without the need to update the WID

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| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | We support Moderator’s proposal |
| OPPO | OK |
| InterDigital | Ok with the proposal |
| Lenovo, Motorola Mobility | We are okay with the moderator’s proposal |
| Intel | agree |
| Ericsson | OK with the proposal |
| AT&T | OK |

#### 6-3.2.3 Summary of the discussion on 3.2.3 Question 3: Adding objectives on energy detection threshold enhancement

16 companies think the enhancement on EDT should be specified in channel access mechanism considering such as LBT bandwidth, beamforming gain, transmit power, and the choice of LBT beam and transmission beam. 10 out of 16 companies are fine to have a separate objective while the 6 out of 16 companies think it is not necessary to have an explicit objective. Another 3 companies express the views that enhancement on EDT can base on implementation.

**Moderator’s proposal 13:**

Add objective on energy detection threshold enhancement under channel access in the WID.

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| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | The energy detection threshold should be associated with the LBT BW. We should combine the discussion of LBT BW and energy detection threshold in LBT discussion. |
| OPPO | OK |
| Lenovo, Motorola Mobility | We are okay with the moderator’s proposal |
| Intel | agree |
| Ericsson | We don’t think there is a need for specific objective. If it is added, the scope should be clearly clarified to avoid over-doing unnecessary specification work beyond the requirements by regulations. |
| AT&T | OK |

#### 6-3.2.4 Summary of the discussion on 3.2.4 Question 4: Adding objectives to specify LBT variants

12 companies support to add objective of no LBT, omni-directional LBT, directional LBT and receiver assisted LBT into the WID. 5 companies support to add objective of directional LBT and receiver assisted LBT. 1 company are open to narrow down the scope to receiver assisted LBT. 2 companies mentioned that no additional enhancement for no LBT scheme. 2 companies are not supportive specifying enhancements/restrictions beyond what are required by regulations

**Moderator’s proposal 14:**

Add objective on omni-directional LBT, directional LBT and receiver assisted LBT into the WID.

Note: No-LBT is already covered by question 1 in section 3.2.1.

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| --- | --- |
| **Company** | **Comments** |
| Samsung | We are ok with the proposal. |
| CATT | We support narrow down the number of LBT schemes supported in WID. |
| OPPO | OK |
| InterDigital | We support the proposal |
| Lenovo, Motorola Mobility | We are okay with the moderator’s proposal |
| Intel | agree |
| Ericsson | We are not supportive of addition enhancements on LBT procedures beyond what it is required by regulations. |
| AT&T | Strongly support |

#### 6-4.1 Summary of the discussion on 4.1 Question 1: Capturing latest regulatory status

#### Due to limited time, only one company provide his feedback on this issue and agree with the proposal “RAN4 prepare update for capturing the 60GHz regulatory status in TR38.807”

#### Let’s continue the discussion in the intermediate round

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| --- | --- |
| **Company** | **Comments** |
| Samsung | We are OK with the proposal “RAN4 prepare update for capturing the 60GHz regulatory status in TR38.807” |
| Intel | Ok in principle. As Balazs clarified this can be done outside the WID, and by a company CR to TR38.807. We suggest interested companied to bring the CR directly to RAN Plenary. |

#### 6-4.2 Summary of the discussion on 4.2 Question 2: Definition of the frequency range 52.6-71GHz

Similarly, only one company provide his feedback on this issue and show preference on introducing FR3 for this frequency range.

#### Let’s continue the discussion in the intermediate round

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications | Fine with introducing a convenient name such as FR3. |
| Samsung | Prefer defining it as FR3. |
| CATT | We don’t see the need in defining 52.6-71 GHz as FR3 since all specification related to FR2 could not apply to FR3 directly. All physical layer and performance related specifications would need to be specified and evaluated for FR3. This needs tremendous standard works |
| OK | Prefer FR3. |
| InterDigital | Slightly prefer to name it with a new frequency range (e.g., FR3) as we may have a new feature/functionality which may only apply to the new frequency range and not applicable for the existing FR2. |
| Lenovo, Motorola Mobility | We are okay to define 52.6-71GHz as FR3 |
| Intel | We think RAN4 would need to further discuss this matter as depending on how the new frequencies are handled, it may result in different specification work for RAN4 (and possibly RAN1 and RAN2).  We think adding the objective for RAN4 to determine whether to introduce a new FR or extend the existing FR2 should be sufficient, and no need to try to down select during the RAN Plenary. Especially given that this particular subject has not been discussed at all in the SI (so far).  We suggest adding the following objective:   * Identify whether new FR (e.g. FR3) shall be defined for the 52.6-71GHz frequency range or the existing FR2 shall be extended to cover 52.6-71GHz range [RAN4] |
| Ericsson | We share similar view as CATT. We prefer to consider this frequency range as extension of FR2. |

# Contacts

Please provide a company contact that the email discussion moderator can contact if required.

|  |  |
| --- | --- |
| Company | Contact name and email |
| CMCC | Xiaodong Xu, xuxiaodong@chinamobile.com |
| Charter Communications | Amitav.mukherjee@charter.com |
| Samsung | Hongbo.si@samsung.com |
| Lenovo, Motorola Mobility | abhamri@lenovo.com |
| Qualcomm | jingsun@qti.qualcomm.com |
| Ericsson | sorour.falahati@ericsson.com |
| vivo | [sunpeng@vivo.com](mailto:sunpeng@vivo.com) |
| AT&T | ralf\_bendlin@labs.att.com |
| ZTE | tian.li150@zte.com.cn |
| LG Electronics | [seonwook.kim@lge.com](mailto:seonwook.kim@lge.com) |
| NTT DOCOMO | naoya.shibaike@docomo-lab.com |
| NEC | [Hans.vanderVeen@neclab.eu](mailto:Hans.vanderVeen@neclab.eu) |
| Nokia | matthew.baker@nokia.com |
| CATT | fcc@catt.cn |
| InterDigital | moonil.lee@interDigital |

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