**3GPP TSG-RAN WG4 Meeting # 111 R4-2410568**

**Fukuoka, 20th ‒ 24th May, 2024**

**Agenda item:** 10.3.6

**Source:** Moderator (Ericsson)

**Title:** Ad-hoc minutes for [111][127] FS\_NR\_IMT

**Document for:** Information

# Introduction

This document contains minutes and agreements from the ad-hoc for [111][127]FS\_NR\_IMT.

# Topic #1: 4400-4800 MHz LS response and TR updates

This topic covers the 4400-4800 MHz range. A reply LS to ITU-R should be send t from RAN4#111. A draft LS is available and was already reviewed at RAN3´4#110bis. The aim of the discussion is to clear up any remaining changes and send the LS, as well as to agree on the wording for the duplex mode in the TR.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2408402 | Qualcomm | Text proposals on duplexing mode for all three frequency ranges |
| R4-2407021 | Spark | Proposals to correct SNIR to SINR and add to note 9 on the antenna parameters where the ranges of and can be found |
| R4-2407365 | Fujutsi | Observation 1: WP5D requested RAN4 the initial response by June 2024 meeting. Considering it, RAN4 plans to send the LS reply on 4400 to 4800 MHz to WP5D at May meeting.  Observation 2: The WI for SBFD is planning to continue to more than one year.  Proposal: Considering the current situation, RAN4 should not add a note for SBFD to the parameter in LS reply. |
| R4-2407435 | Nokia | Proposal 1: Slightly modify the first statement in Annex 2 to avoid using the wording ‘is created’.  Proposal 2: Refer to M.2102 instead of Table 3 for Small cell outdoor/Micro urban in Row 1.1.  Proposal 3: Remove ‘sub-’ in row heading of row 1.6.  Proposal 4: Remove ‘/elements’ in row 1.6 and Note 4 and clarify the meaning of ‘8x8 elements’ in Note 4.  Proposal 5: Add ‘or element’ into row heading of row 1.7.  Proposal 6: Change row 1.9 to per antenna sub-array or element and change the values and Note 3 accordingly.  Proposal 7: Add a statement in Note 1 to clarify ‘This range includes the mechanical downtilt given in row 1.12.’.  Proposal 8: Replace ‘dv’ with ‘vertical sub-array spacing’ in Note 5.  Proposal 9: Further qualify the terms ‘θ\_etilt and φ\_escan’ in Note 9. |
| R4-2407537 | CATT | Proposal 1: Capture the note for SBFD in the SI TR.  Proposal 2: Send out the first reply LS with parameters agreed in RAN4#110bis with corrections identified on the section “SINR operating range and mapping function”. |
| R4-2408084 | Ericsson | TP to add background to the TR on 4400-4800 parameters |
| R4-2408085 | Ericsson | Draft LS response on 4400-4800 MHz |
| R4-2409054 | Google | Proposal 1: Considering that SBFD may be a 6G candidate feature and it is pre-matured to determine the details for technical parameters, it would be better to follow the previous agreement for the frequency range 4400 to 4800 MHz. Hence, it is proposed to capture only TDD as the duplex method in the reply LS and the usage of SBFD for the frequency range 4400 to 4800 MHz can be captured in the SI TR. |
| R4-2409403 | Huawei | Propose to change conducted power to per sub-array/element. Also to clarify the source of the small cell outdoor/micro urban antenna model. |
| R4-2409461 | Samsung | Observation 1: Although SBFD could be a promising duplex method for future IMT as the study is aimed at WRC-27, there is not enough information to provide ITU-R for their study as it is being discussed under a Rel-19 Work Item.  Proposal 1: LS on 4GHz can be sent as proposed in Annex without SBFD in this meeting. |
| R4-2409606 | ZTE | Proposal 1: fine to either indicate the ongoing Rel-19 SBFD feature in ITU-R reply LS or not.  Observation 1: not to indicate the SBFD in ITU-R reply LS looks better to minimize the impacts on the schedule of ITU-R sharing and compatibility study due to the uncertain RF requirements for SBFD BS. |

## Open issues summary

**Issue 1-1: Duplex mode**

* + Option 1: Do not mention duplex mode in the reply LS, but do capture in the TR
    - For the TR note, there are two proposals:
    - Qualcomm (R4-2408402):
    - *The 4400 – 4800 MHz frequency range is part of an 3GPP-defined n79 band (4400 – 5000 MHz), which according to [4], is a TDD band. TDD is widely used in commercial NR deployments, where time domain resources are split between downlink and uplink. Allocation of a limited time duration for the uplink in TDD would result in reduced coverage, increased latency, and reduced capacity. 3GPP has been investigating since Rel-16 the dynamic allocation of downlink and uplink resources in TDD deployments. An enhancement of TDD duplex operation via allowing the simultaneous existence of downlink and uplink subband at the gNB side within a TDD carrier in a conventional TDD band (subband non-overlapping full duplex), was studied in Rel-18 [5]. Currently 3GPP is specifying in Rel-19 SBFD operation at the gNB side within a TDD carrier, gNB-to-gNB CLI handling schemes and UE-to-UE CLI handling schemes for SBFD operation, and requirements for SBFD operation at gNB [6]. To provide timely response to WP5D regarding the requested RF parameters, RAN4 considered TDD as a current candidate duplexing for the 4400 – 4800 MHz frequency range. The requirements and conformance aspects for Rel-19 SBFD work item can be tracked through the list of impacted specs captured in [6].*
    - Ericsson (R4-2408084):

*For this frequency range it is most likely that TDD will be used as duplex method. As an addition to regular TDD some DL slots can be configured as UL slots using framework developed for SBFD in Rel-19.*

Discussion:

Apple: Important to refine the text offline so as not to take online time. Propose to use Ericsson as starting point.

CATT: Agree to capture in TR for now. Wording is not important. Prefer Ericssion version for now.

Huawei: Share similar view with CATT. Need to agree on LS. Text for TR can have more time to discuss.

**Issue 1-1: Text corrections / updates**

Agreements:

* Correct SNIR to SINR (Spark, R4-2407021, CATT)
* Use linear SINR, not dB SINR in the log equation (Spark, R4-2407021)

Apple: Previous response had dB, but this is OK

Spark: The SNR should be linear, fundamental

* Add a sentence to note 9 on the antenna parameters where the ranges of and can be found (Spark, R4-2407021)
* Slightly modify the first statement in Annex 2 to avoid using the wording ‘is created’. (Nokia- R4-2407435)
* Refer to M.2101 instead of Table 3 for Small cell outdoor/Micro urban in Row 1.1. (Nokia- R4-2407435)

Ericsson: The intention is to refer to 2101 ?

Nokia: The existing one we referred to

* Remove ‘sub-’ in row heading of row 1.6. (Nokia- R4-2407435)
* Remove ‘/elements’ in row 1.6 and Note 4 and clarify the meaning of ‘8x8 elements’ in Note 4. (Nokia- R4-2407435)
* Add ‘or element’ into row heading of row 1.7. (Nokia- R4-2407435)
* Change row 1.9 to per antenna sub-array or element and change the values and Note 3 accordingly. (Nokia- R4-2407435)
* Add a statement in Note 1 to clarify ‘This range includes the mechanical downtilt given in row 1.12.’. (Nokia- R4-2407435)
* Replace ‘dv’ with ‘vertical sub-array spacing’ in Note 5. (Nokia- R4-2407435)
* Further qualify the terms ‘θ\_etilt and φ\_escan’ in Note 9. (Nokia- R4-2407435)
* Change the conducted power to per sub-array/element (Huawei, R4-2404903)
* Remove’ used in the coexistence study’ in Note 9 (Huawei, R4-2404903)
* Add a sentence into the overall description ‘the parameters can be updated with further notices subjecting to ongoing Rel-19 discussions in RAN4.’ (Samsung, R4-2409461)

CATT: We can always update anyhow if there are new parameters. Nothing can stop that. If we state this explicitly, our concern is it may cause misunderstanding. Prefer to avoid

ZTE: Better to say parameters for SBFD can be updated. For legacy BS the parameters will not change

Ericsson: We need to take care nt to indicate that parameters can change easily. We should not say more

Qualcomm: We could refer to the SI TR instead with additional text on SBFD/non SBFD etc.

Samsung: Our intention is not about SBFD here, but in general. We are OK to refine the text offline.

Ericsson: Good suggestion to add reference to the TR in the LS response.

Samsung: Also OK to refer to the TR

CATT: If the reference is to the TR, is it the whole TR ?

Apple: OK to refer to TR, but it is not under version control.

Agreement: Refer to the TR in the LS

RAN4 is developing a technical report (TR 38.922) on the IMT parameters described in this LS, which will be published later in the year

**Issue 1-3: TP on 4400-4800 parameters**

Assuming the LS is agreed and sent, the TP in R4-2408402/R4-2408084 should be reviewed and added to the TR.

Discussion:

Apple: Please send a kick-off e-mail

# Topic #2: 7125 – 8400 GHz frequency range

The aim of this discussion is to review the detailed parameters for the 7125-8400 range and agree as much as possible. There is a TP for UE parameters in R4-2407051. Depending on the level of progress with the parameters, it can be discussed in the meeting whether the discussion is mature enough to add information to the TR.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2408629 | Nokia | (15GHz proposals from this document captured in the following topic)  Proposal 1: 100-200 MHz is considered as typical maximum channel bandwidth for 7125 – 8400 MHz.  Proposal 3: ACLR 30dB is proposed for PC3 and 31dB (n104) for PC2 for Frequency 7125 – 8400 MHz.  Proposal 4: Maximum UE output power is 23 and 26 dBm to align with NR band n104.  Proposal 5: UE noise figure is 9-10 dB for 7125 – 8400 MHz. |
| R4-2407050 | Apple | Proposal 1: For the UE maximum output power, +23dBm can be assumed as a baseline noting in the TR that other higher power classes are not excluded (following the same approach that was taken for 6.4-7.1GHz range).  Proposal 2: For UE ACLR and ACS, 26dB and 32dB can be assumed (i.e. same values as for the 6.4-7.1GHz range).  Proposal 3: For the UE noise figure, 12-13dB range can be assumed. |
| R4-2407051 | Apple | Text proposal for general characteristics and UE characteristics for the TR. |
| R4-2407415 | Skyworks | Proposal on duplex method:  • TDD as baseline and used for the LS response.  • SBFD may be further studied in the WI phase.  Proposal on signal BW:  • 100MHz RB BW of 273RB/30kHz SCS as baseline and can be used for the LS response.  • 200MHz may be further studied in the WI phase according to SCS and actual spectrum availability and use an equivalent signal BW of 2x273RB/30kHz SCS.  Proposal on UE spectrum mask:  • n104 SEM as baseline and can be used for the LS response.  • SEM mask relaxation may be further studied in the WI phase together with ACLR relaxation.  Proposal on UE ACLR:  • Since this is consistent with our earlier response to ITU for the 6-24GHz range 26dB or 27dB PC3 ACLR is baseline and can be used for the LS response.  • ACLR relaxation for PC2 and PC1.5 may be further studied in the WI phase together with SEM relaxation.  Proposal on UE maximum power:  • 23dBm as baseline and can be used for the LS response.  • PC2 and PC1.5 w/wo multiple Tx may be further studied in the WI phase including related SEM and ACLR relaxations.  Proposal on UE noise figure:  • Option 3 (NF was 9-13dB) is consistent with former LS covering this frequency range and compatible with n104 and can be used for the LS response.  • PC2 and PC1.5 w/wo multiple Tx may be further studied in the WI phase. |
| R4-2407436 | Nokia | Proposal 1: Use an AAS with 8x16 sub-arrays (4 rows of elements per sub-array) in sub-urban and urban macro cases.  Proposal 2: Use the same element gain, vertical and horizontal 3 dB beam width of single element, and vertical coverage range for the Suburban macro and Urban macro scenarios. |
| R4-2407538 | CATT | Proposal 1: Set TDD as the duplex method in the reply LS to WP5D regarding the frequency range 7125 – 8400 MHz, and ensure that SBFD is not excluded in the SI TR.  Proposal 2: Set 100MHz channel bandwidth and its transmission bandwidth configuration in the reply LS to WP5D regarding the frequency range 7125 – 8400MHz.  Proposal 3: The power dynamic range of a UE operating at 100MHz channel bandwidth is 56dB and 59dB for PC3 and PC2 respectively.  Proposal 4: Revisit ΔfOBUE, ΔfOOB , and for BS hybrid and OTA spectrum masks for the frequency range 7125 – 8400 MHz as a single band.  Proposal 5: For UE power class, consider both PC3 and PC2, and for UE ACLR take 30dB for PC3 and 31dB for PC2 for the frequency range 7125 – 8400MHz.  Proposal 6: Follow n104 noise figures for both BS and UE. |
| R4-2407912 | Mediatek | ACLR: Prefer 26/27dB  Power: Option 4 29dBm  Noise figure: Prefer option 3 13dBm  Sensitivity: -84.8dBm for 100MHz with 60KHz SCS with 4Rx  ACS: Propose 31dBc |
| R4-2408087 | Vivo | Observation 1: It is not necessary to provide maximum value of channel bandwidth in the reply LS for ITU.  Proposal 1: Only provide 100MHz as a typical value for channel bandwidth, and no need to further decide the maximum channel bandwidth at this stage.  Proposal 2: In the reply LS, only provide 23dBm as typical value for MOP. Other powers are not precluded and can be discussed in the future release.  Observation 2: UE can benefit from lower ACLR to reduce the MPR and achieve better UL performance, which is also good for the coverage.  Proposal 3: Use the co-existence outcome from TR 38.921 as the ACLR/ACS value, i.e., 26 dB ACLR/32dB ACS.  Observation 3: There are different reasons behind each NF value, it is hard to do the down selection.  Proposal 4: Provide a range of NF in the reply LS, e.g., 9-13 dB.  Proposal 5: The SINR operation range can be ≥-10 dB. |
| R4-2408416 | CMCC | Duplex mode TDD in response to ITU  BW: 100MHz typical, consider also 200MHz  Power dynamic range: 0dB for BS, 56dB for UE  Spectrum mask: As in BS/UE specs  ACLR: As n104 for BS. 30/31dB for UE  Maximum output power: BS: Defined by the conducted power per antenna element, 22dB for macro suburban, 22dB for macro urban, 16dB for small cell outdoor/micro urban, 9dB for small cell indoor/indoor urban  UE MOP: 23dBm. 26dBm as optional  Noise figure: 6/11/14dB for BS, 9dB for UE  Blocking: Follow UE/BS spec  ACS: 42dB for BS, 32dB for UE  Antenna array: Apply the legacy sub-array modelling |
| R4-2408403 | Qualcomm | Observation 1: 3GPP has been studying flexible duplexing (i.e., SBFD) at the gNB in Rel-18 and Rel-19 and it is desired to document such progress in this SI TR (i.e., TR 38.922).  Proposal 1: RAN4 to agree on TDD as the current duplexing candidate for 7125 – 8400 MHz frequency range and capture more text on SBFD in TR 38.922.  Proposal 2: RAN4 to reply in the LS to WP5D that 200MHz is a typical value and that other channel bandwidths are not precluded for the 7125 – 8400 MHz frequency range.  Proposal 3: As signal bandwidth depends on CHBW and SCS, no need to specify a fixed signal bandwidth but rather mention its dependency on SCS and number of RBs.  Proposal 4: RAN4 to reuse the existing BS RF parameters, captured in TR 38.921 for the power dynamic range, ACLR, ACS, spectral mask (i.e., OBUE), spurious emission, noise figure, and blocking response.  Proposal 5: RAN4 to study the feasibility of employing larger number of antenna elements in the BS compared to Rel-17 parameters captured in TR 38.921.  Observation 2: From adjacent channel coexistence point of view, increasing UE maximum output power from 23 dBm (TR 38.921 assumptions) to 26 dBm (proposed for 74125-8400 MHz) does not impact derived ACLR/ACS values from TR 38.921.  Proposal 6: RAN4 to agree on 26 dBm (i.e., PC3) as UE maximum output power.  Proposal 7: RAN4 to agree on 59 dBm as UE power dynamic range.  Proposal 8: For UE ACLR, RAN4 to agree on 31 dB value for PC2.  Proposal 9: RAN4 to reuse the existing UE RF parameters for n104 for the spectral mask (i.e., OBUE), ACS, spurious emission, noise figure, and blocking response for the 7125 - 8400 MHz frequency range. |
| R4-2408703 | Ericsson | Proposal1: To avoid any delay, RAN4 should reply to WP5D LS with already agreed parameters. RAN4 should capture in the TR the possible options (e.g. wider channel bandwidth) to be further studied when specifying the band.  Proposal2: As a general principle, to facilitate coexistence with adjacent services, reply to WP5D LS with n104 requirements, not considering any relaxation  Proposal3: As done for the 10.0-10.5 GHz study, confirm urban macro and sub-urban macro scenarios should be considered for the 7125-8400 MHz frequency range.  Proposal4: Agree with the following Table 1 summarizing our proposals for IMT parameters in the 7125-8400 MHz frequency range, highlighting what should be reply in ITU-R WP5D LS and what should be captured in TR 38.922.  Proposal5: Consider the following antenna parameters (Table 2) when answering ITU LS on IMT parameters for the 7125 to 8400 MHz frequency range. |
| RP-2409063 | Google | Proposal 1: Considering that SBFD may be a 6G candidate feature and it is pre-matured to determine the details for technical parameters, it would be better to follow the previous agreement for the frequency range 4400 to 4800 MHz. Hence, it is proposed to capture only TDD as the duplex method in the reply LS and the usage of SBFD for the frequency range 7125 to 8400 MHz can be captured in the SI TR.  Proposal 2: Considering that the spectrum sharing and interference mitigation might be the main issue for this frequency range, it is proposed not to introduce HPUE and only apply 23 dBm (PC3) and 20 dBm (PC5) to the frequency range for 7125 to 8400 MHz. |
| R4-2409404 | Huawei | Proposal 1: TDD should be used for the range, and the text about SBFD can be captured in the TR and no need to be mentioned in the WP5D reply LS.  Proposal 2: to take 100 MHz typical in the reply LS  Proposal 3: on ΔfOBUE and ΔfOOB, it is proposed to use n104 as baseline  Proposal 4: Existing assumption for n104 can be reused, i.e. 6 dB (macro), 11 dB (micro) and 14 dB (pico/femto) for base station.  Proposal 5: 26 dB ACLR for PC3 UE  Proposal 6: For the purpose of co-existence analysis, the UE maximum/typical output power for the considered frequency ranges could be 23 dBm.  Proposal 7: Follow n104 noise figure (12dB)  Proposal 8: The blocking characteristic specified in clause 7.6 of TS 38.101-1 [4] for frequency larger than 3300 MHz could be applied for the range.  Proposal 9: The antenna characteristics for IMT in 7125 to 8400 MHz is proposed in following Table 2.2-1. |
| R4-2409462 | Samsung | Observation 1: most parameters of Table 1 (IMT technology related parameters in 7125 to 8400 MHz) were discussed and reached a consensus that n104 can be baseline parameters for this range.  Observation 2: Existing values for the same or adjacent frequency ranges captured in previous LS and/or TR can be reused as much as possible for Table 2 (beamforming antenna characteristics for IMT in 7125 to 8400 MHz).  Proposal 1: Both index and unit in Table 2 should be aligned with the previous LS for 4 GHz.  Proposal 2: Based on the agreed baseline, proposed Table 1 and Table 2 should be considered for the radio and antenna parameters for 7125-8400 MHz, respectively.  Proposal 3: In considerations of the meeting schedule of WP 5D in June, if possible, it can be considered to send out both 4 GHz and 8 GHz parameters together in this meeting. |
| R4-2409607 | ZTE | Proposal 1: assume TDD duplex mode as default assumption unless there are other operation mode proposals from certain regions/countries or certain operators and indicate Rel-19 SBFD operation in the LS if necessary.  Proposal 2: for carrier bandwidth and transmission bandwidth configuration, reuse NR channel bandwidth and transmission bandwidth configuration as baseline (e.g. 100MHz for 30kHz SCS and 50MHz for 15kHz) for IMT-2020, and indicate the potential lager channel bandwidth for IMT-2030 .  Proposal 3: for f\_OBUE requirements, more analog filter studies are needed from the feasibility perspective.  Proposal 4: for NF for 7125-8400MHz, to reuse the assumption for 6125-7125MHz (e.g. 6dB for WA BS and 11dB for MR BS and 14dB for LA BS).  Proposal 5: for OOBB requirement and f\_OOBB requirement, more analog filter studies are needed from the feasibility perspective.  Proposal 6: for transmission power and antenna assumptions for 7125-8400MHz, the existing assumptions for 6425-7125MHz in reply LS RP-210037 could be reused.  Observation 1: this coexistence situation between TN and FSS for 7125-8400MHz might be similar as U6GHz n104, however it seems that there are no hard-limits for protection of GSO yet for 7125-8400MHz.  Proposal 7: at least PC3 and PC2 should be supported for 7125-8400MHz; PC1.5 is also preferred.  Proposal 8: propose 56dB/59dB/62dB power dynamic range for PC3/PC2/PC1.5 respectively according to the -33dBm/100MHz minimum transmission power.  Proposal 9: reuse the same ACLR and SEM requirement for band n104 for 7125-8400MHz instead of referring to TR 38.921.  Proposals 10: more discussions are needed for NF and sensitivity.  Proposal 11: reuse the same ACS requirements for band n104 for 7125-8400MHz instead of referring to TR 38.921.  Proposal 12: for IBB and OOBB requirements, not reuse the existing band requirement for band n104 and further discuss the exact requirement for it. |
| R4-2409740 | Cablelabs, Charter, Cox | Proposal 1: The 7125 – 8400 MHz band is currently licensed to national mission-critical links. It is not feasible to clear this band for public mobile networks (e.g., IMT-2030 or 6G) in many markets, instead, this 7125 – 8400 MHz band will need to be shared. A set of low-power assumptions could make sharing more feasible and a larger portion of the band more available, such as using power class 5 (PC5) for UE.  Proposal 2: Non-AAS with omnidirectional BS antenna and small array sizes (e.g., 2×2, 2×4, or 4×4) parameters are of interest for the 7125 – 8400 MHz band for medium-range and local-area microcells.  Proposal 3: Macro-cell deployment in the 7125 – 8400 MHz band may not be feasible due to large losses in these high frequencies. RAN4 will need to study the feasibility of: (1) what is the coverage with a 500 m UMa ISD? And (2) what is the maximum urban macro (UMa) inter-site distance (ISD) to achieve 95% coverage (> -10 dB SINR) in both DL and UL?  Observation 1: The 7125-8400 MHz band has large path loss and outdoor-to-indoor loss due to high frequency. The UL coverage cannot achieve 95% with a 500 m ISD and 4×8 or 8×8 BS antenna array. This band will require a large 8×16 or 16×16 BS array to maintain a 95% UL coverage.  Observation 2: The 7125 – 8400 MHz band has large path loss and outdoor-to-indoor loss due to high frequency. The UL coverage at 4 GHz achieves almost 95% with a 500 m ISD and 4×8 BS antenna array. The 7125 – 8400 MHz band will need to reduce the ISD to 325 m (58% coverage area reduction) to maintain 95% UL coverage with a 4×8 BS antenna array, reduce the ISD to 400 m (36% coverage area reduction) to maintain 95% UL coverage with an 8×8 BS antenna array. |

## Open issues summary

### Sub-topic 2-1 General / system issues

**Issue 2-1: Duplex mode**

* Proposals
  + Option 1: Do not mention duplex mode in the reply LS, but do capture in the TR (Skyworks, CATT, CMCC, Qualcomm, Google, Huawei, Ericsson)
    - If option 1 is agreeable, discuss the following TP from Qualcomm in R4-2408402:
      * There is no defined 3GPP band for the 7125 - 8400 MHz frequency range, however, it is adjacent to existing TDD band n104 (6425 – 7125 MHz). Similar to the 4400 – 4800 MHz frequency range, SBFD can be a candidate duplexing method for this frequency range. To provide timely response to WP5D regarding the requested RF parameters, RAN4 assumed TDD as a candidate duplexing for the 7125 – 8400 MHz frequency range. The requirements and conformance aspects for Rel-19 SBFD work item can be tracked through the list of impacted specs captured in [6].
* Recommended WF
  + Agree option 1, discuss wording for TP

Agreement: Do not include SBFD in the LS, but add information in the TR. Add a reference to the TR in the LS

**Issue 2-2: Timing for LS response**

* Proposals
  + Option 1: Aim to send the LS response also for 8GHz from this meeting considering ITU-R meeting schedule (Samsung)
  + Option 2: Keep to August time schedule
* Recommended WF
  + Do not discuss in detail when to send the LS but focus on the parameters. If all parameters can be agreed in this meeting then afterwards check if the LS response can be sent this meeting

Discussion:

Issue not discussed

**Issue 2-3: Typical channel bandwidth**

Previous agreement:

Typical Channel Bandwidth (100MHz is maximum bandwidth)

* n104 (100MHz) baseline
  + FFS higher bandwidths (e.g. 200MHz)
* Proposals
  + Option 1: 100-200MHz considered as typical maximum channel bandwidth (Nokia)
  + Option 2: 100MHz as typical and also consider 200MHz (CMCC)
  + Option 3: 100 MHz as LS response (Skyworks, CATT, vivo, Ericsson, Huawei, Samsung, ZTE assuming 30k SCS)
  + Option 4: Study 200MHz during the WI phase (Skyworks)
    - Which WI does this option refer to ? 6G ?
  + Option 5: 200MHz as LS response (Qualcomm)
  + Option 6: Other channel bandwidths in the TR (Ericsson, Qualcomm)
* Recommended WF
  + TBA

Discussion:

Apple: Support to mention 100MHz in LS response and mention other options in the TR.

Qualcomm: OK to mention 100MHz in LS and other options in the TR. But can we say 100MHz is typical in the LS and that higher BW can occur

ZTE: Fine to mention other options in TR. This LS and TR is 5G and 6G. 5G timeframe 200MHz is not possible. 6G it is OK.

CATT: We prefer 100MHz in LS. For 200MHz, as ZTE commented it is not possible to specify for the time being

CATT: Prefer no third bullet

Huawei: We prefer not to have the 3rd bullet

Skyworks: 200MHz does not require a new RAT; can use SCS 60kHz

Charter: Would like to keep simple; no third bullet

Intel: Prefer original version. Want to indicate in the LS

Qualcomm: We do not want to close the door for this band

Agreement:

* Mention 100MHz as typical bandwidth in the LS
  + FFS whether to mention wider bandwidths may be possible in future in the LS
* Describe other possibilities for bandwidth in the TR, mentioning that additional specification effort needed for >100MHz

**Issue 2-4: Typical signal bandwidth**

Previous agreement:

Transmit bandwidth configuration (Signal bandwidth)

* n104 spectrum utilization assumed
  + FFS check for higher bandwidth
* Proposals
  + Option 1: For 100MHz, 273 RB, 30k SCS as 38.104 (Skyworks, CATT, Ericsson, Huawei, Samsung, ZTE)
* Recommended WF
  + TBA

Outcome of discussion (Not agreed):

Option 1: 273 RB, 30k SCS as 38.104

Option 2: Quote formula of RBs \* SCS without number of RBs

Option 3: Directly quote the signal bandwidth in MHz

**Issue 2-5: SINR operating range**

Previous agreement:

SINR operating range

* To be discussed further
* Proposals
  + Option 1: Same as 4GHz response

Discussion: Not discussed

**Issue 2-6: Deployment scenarios**

Previous agreement:

Issue 2-14: Deployment scenarios to consider

* Include urban and sub-urban macro, but double check coverage
* Proposals
  + Option 1: 325m with 4x8 antenna array or 400m with 8x8 antenna array at BS (Cablelabs, Charter, Cox)
  + Option 2: n104 coverage can be achieved (Ericsson)

Discussion:

Cablelabs: Simulation study on urban macro coverage. Can we capture in the TR ?

Apple: Are we going to run simulations here ? We have the impression no. Why do we need to talk about this.

Charter: We brought simulations as we are concerned on urban macro feasibility. The cable labs simulations show such a concern.

Agreement: Confirm Urban macro and urban micro should be considered

* This is based on assumed antenna size that is sufficient for 450m or lower ISD for urban macro

### Sub-topic 2-2 BS parameters

**Issue 2-7: Emissions mask**

Previous agreement:

Spectrum mask

* BS:
  + n104 as basis for emissions levels
    - ΔfOBUE and ΔfOOB for the BS side can be considered further.
* Proposals
  + Option 1: Further study ΔfOBUE and ΔfOOB (ZTE, CATT)
  + Option 2: ΔfOBUE and ΔfOOB are the same as for n104 (100MHz) (CMCC, Qualcomm, Ericsson, Huawei, Samsung, Nokia)
* Recommended WF
  + TBA

Discussion:

Charter: One of our concerns is that we believe the band will share different technologies. A wider spectrum emissions mask may make co-existence difficult. We propose instead to use the n96 emissions mask. The skirts of the emission mask do not widen as the channel bandwidth widens.

ZTE: n96 targets an unlicensed band without AAS. Currently we talk about delta\_obue. The band is wider, so we need to re-evaluate the filter design.

CATT: The frequency range is almost 1.3 GHz. The 200MHz as n104, which is half size is too hasty

Huawei: We are discussing about AAS. 100MHz is for 1-H or 1-O. Response to Charter is that for 1-C we had the same OOB for the conducted requirement. We do not know how the band will be defined in the future, keep n104 requirement for now.

Charter: Are we discussing AAS and non-AAS here ? Yes. We are trying to find a worst-case scenario for ITU.

Skyworks: n96 is related to applying LBT; emissions are relaxed but there is a price

Ericsson: n96 is not IMT

Qualcomm: We did not mention n96 in previous response. Would it look odd to change now ?

Charter: The band will contain multiple technologies. Do we want to reply in a way that enables sharing ? Does n96 or n104 make it easier ?

ZTE: For the emission mask, it aligned between different BS types. Regulators can define emissions masks as needed. The target is IMT operations.

Agreement:

* AAS BS:
  + Use n104 unwanted emissions mask
  + [Aim to use 100MHz for delta\_obue, conclude feasibility until RAN4#112]
* Non-AAS BS:
  + [n104 unwanted emissions mask for IMT response]
    - Double check on whether there are any concerns towards sharing by RAN4#112 and in case concerns are identified, consider n96 if needed to resolve concerns

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End of ad-hoc \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

The remaining topics below were not discussed during the ad-hoc but are retained for information

**Issue 2-8: ACLR**

Previous agreement:

ACLR

* BS
  + Use n104

No need for discussion

**Issue 2-9: Spurious emission**

Previous agreement:

Spurious Emissions

* BS:
  + Use n104

No need for discussion

**Issue 2-10: Noise figure**

Previous agreement:

Noise Figure

* BS
  + Option 1: Follow 38.820, i.e., 6dB WA, 11dB MR, 14dB LA
  + Option 2: Follow n104 if different
* Proposals
  + Option 1: 6/11/14 dB for WA, MR, LA (CATT, CMCC, Ericsson, Huawei, Samsung, ZTE, Nokia)
* Recommended WF
  + Adopt option 1

Agreement: Follow 38.820, i.e., 6dB WA, 11dB MR, 14dB LA for noise figure of BS

**Issue 2-11: Sensitivity**

Previous agreement:

Sensitivity

* To be discussed further
* Proposals
  + Option 1: As for n104 in 38.104 (CMCC, Samsung, Nokia)
* Recommended WF
  + Adopt option 1 conditional on the noise figure being agreed.

Qualcomm: this is for LS or TR.

Ericsson: in LS.

Apple: Do we need say sensitivity in LS? ITU does not use it at all.

Ericsson: It is not key information. Fine not to put it in LS.

Agreement:

* Agree on option 1.
  + Capture it in the TR only.

**Issue 2-12: Blocking response**

Previous agreement:

Blocking response

* BS:
  + Follow n104
    - Discuss ΔfOOB
* Proposals
  + Discuss delta\_f\_oob in issue 2-7.

CATT: Agree with moderator. Treat it in the next meeting.

**Issue 2-13: ACS**

Previous agreement:

Issue 2-12 ACS

* BS:
  + Follow n104 (42dB)
* No need for discussion

**Issue 2-14: BS antenna array parameters**

A combined set of proposals from those companies that have provided parameters is presented below. In addition, Cablelabs/Charter/Cox suggest to consider small arrays with omnidirectional antenna for medium and local area microcells.

The tables contain parameters that are inter-related and so the underlying issues should be discussed. These include:

* Whether to include rural-macro
* Consideration of small arrays and omnidirectional antennas
* For macro-cells, sub-array sizes
* For micro-cells, whether to consider sub-arrays
* Array sizes

|  |  | **Rural macro**  **(If it’s available)**  **Parameters proposed by ZTE** | **Suburban macro** | **Urban macro** | **Urban small cell (outdoor)/Micro cell** | **Indoor  (small cell)** |
| --- | --- | --- | --- | --- | --- | --- |
| **1** | **Base station antenna characteristics** | | | | | |
| 1.1 | Antenna pattern |  | Refer to Table 3 | | Refer to Recommendation [ITU-R M.2101](https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2101-0-201702-I!!PDF-E.pdf) | |
| 1.2 | Element gain (dBi) (Note 2) | 7.1 | Option 1: 6.4 (Nokia, Ericsson, Huawei, Samsung)  Option 2: 7.1 (ZTE) | 6.4 | Option 1: 5.5 (Nokia)  Option 2: 6.4 (Ericsson, Huawei, ZTE) | Option 1: 5.5 (Nokia)  Option 2: 6.4 (Samsung) |
| 1.3 | Horizontal/vertical 3 dB beam width of single element (degree) | 90º for H 54º for V | 90º for H Option 1: 65º for V (Nokia, Ericsson, Huawei, Samsung)  Option 2: 54º for V (ZTE) | 90º for H 65º for V | 90º for H Option 1: 90º for V (Nokia)  Option 2: 65º for V (Ericsson, Huawei, Samsung, ZTE) | 90º for H Option 1: 90º for V (Nokia)  Option 2: 65º for V (Samsung) |
| 1.4 | Horizontal/vertical front‑to‑back ratio (dB) | 30 for both H/V | 30 for both H/V | 30 for both H/V | 30 for both H/V | 30 for both H/V |
| 1.5 | Antenna polarization | Linear ±45º | Linear ±45º | Linear ±45º | Linear ±45º | Linear ±45º |
| 1.6 | Antenna array configuration (Row × Column) (Note 4) | 8 × 8 elements | Option 1: 8 × 16 (Nokia, Ericsson, Huawei)  Option 2: 8 x 8 (ZTE, Samsung) | Option 1: 8 × 16 (Nokia, Ericsson, Huawei)  Option 2: 8 x 8 (ZTE, Samsung) | 8 × 8 | 4 × 4 |
| 1.7 | Horizontal/Vertical radiating element/sub-array spacing, *dh* /*dv* (Note 5) | 0.5 of wavelength for H, 0.9 of wavelength for V | 0.5 of wavelength for H,  Option 1: 2.8 of wavelength for V (Nokia)  Option 2: 2.1 of wavelength for V (Ericsson, Huawei, Samsung)  Option 3: 0.9 of wavelength for V (ZTE) | 0.5 of wavelength for H, Option 1: 2.8 of wavelength for V (Nokia)  Option 2: 2.1 of wavelength for V (Ericsson, Huawei, Samsung)  Option 3: 0.7 of wavelength for V (ZTE) | 0.5 of wavelength for H, 0.7 of wavelength for V | 0.5 of wavelength for H, 0.7 of wavelength for V |
| 1.7a | Number of element rows in sub-array, *Msub* |  | Option 1: 4 (Nokia)  Option 2: 3 (Ericsson, Huawei, Samsung) | Option 1: 4 (Nokia)  Option 2: 3 (Ericsson, Huawei, Samsung) | N/A | N/A |
| 1.7b | Vertical radiating element spacing in sub-array, *dv,sub* |  | 0.7 of wavelength of V | 0.7 of wavelength of V | N/A | N/A |
| 1.7c | Pre-set sub-array down-tilt, *θsubtilt* (degrees) |  | 3 | 3 | Option 1:N/A (Nokia, Samsung. Huawei)  Option 2: 3 (Ericsson) | N/A |
| 1.8 | Array Ohmic loss (dB) (Note 2) | 2 | 2 | 2 | 2 | 2 |
| 1.9 | Conducted power (before Ohmic loss) per antenna element/sub-array (dBm) (Note 3) | 25 | Option 1: 22 (Nokia, Ericsson, Huawei)  Option 2: 46 (Samsung)  Option 3: 25 (ZTE) | Option 1: 22 (Nokia, Ericsson, Huawei)  Option 2: 46 (Samsung)  Option 3: 25 (ZTE) | Option 1: 16 (Nokia, Ericsson, Huawei, ZTE)  Option 2: 37 (Samsung) | Option 1: 9 (Nokia)  Option 2: 31 (Samsung) |
| 1.10 | Base station horizontal coverage range (degrees) | 120 | +/-60 | +/-60 | +/-60 | N/A |
| 1.11 | Base station vertical coverage range (degrees) (Note 1) | 90-100 | 90-100 | Option 1: 90-100 (Nokia, Ericsson, Huawei, Samsung)  Option 2: 90-120 (ZTE) | Option 1: 90-120 (Nokia, Huawei, ZTE)  Option 2: 90-100 (Ericsson, Samsung) | N/A |
| 1.12 | Mechanical downtilt (degrees) | 3 | Option 1: 0 (Nokia)  Option 2: 6 (Ericsson, Huawei, Samsung) | Option 1: 4 (Nokia) Option 2: 6 (Ericsson, Huawei, Samsung)  Option 3: 10 (ZTE) | Option 1: N/A (Nokia, Huawei, Samsung, ZTE) Option 2: 6 (Ericsson) | N/A |
| 1.13 | Maximum base station output power/sector (e.i.r.p.) (dBm) |  | Option 1: 79.58 (Nokia)  Option 2: 78.3 (Ericsson)  Option 3: 75.2 (Samsung) | Option 1: 79.58 (Nokia)  Option 2: 78.3 (Ericsson)  Option 3: 75.2 (Samsung) | Option 1: 60.63 (Nokia)  Option 2: 66.2 (Ericsson)  Option 3: 61.5 (Huawei, Samsung) | Option 1: N/A (Nokia)  Option 2: 49.4 (Samsung) |

Agreement:

|  |  | **~~Rural macro~~**  **~~(If it’s available)~~**  **~~Parameters proposed by ZTE~~** | **Suburban macro** | **Urban macro** | **Urban small cell (outdoor)/Micro cell** | **Indoor  (small cell)** |
| --- | --- | --- | --- | --- | --- | --- |
| **1** | **Base station antenna characteristics** | | | | | |
| 1.6 | Antenna array configuration (Row × Column) (Note 4) | ~~8 × 8 elements~~ | Option 1: 8 × 16 (Nokia, Ericsson, Huawei, Spark)  Option 2: 8 x 8 (ZTE, Samsung) | Option 1: 8 × 16 (Nokia, Ericsson, Huawei, Cable Labs)  Option 2: 8 x 8 (ZTE, Samsung) | 8 × 8 | 4 × 4 |
| 1.7a | Number of element rows in sub-array, *Msub* |  | Option 1: 4 (Nokia, Spark, Cable Labs, Charter)  Option 2: 3 (Ericsson, Huawei, Samsung) | Option 1: 4 (Nokia, Spark, Cable Labs, Charter)  Option 2: 3 (Ericsson, Huawei, Samsung) | N/A | N/A |

Spark: 4 for 1.7a

Charter: agree with Spark and Cable Labs.

Agreement:

* Remove the **rural macro scenario from the table.**

Agreement:

* non-AAS can be used for Urban small cell/Micro cell scenario
* non-AAS can be used for indoor scenario
* FFS on where to capture the above two bullets

### Sub-topic 2-3 UE parameters

**Issue 2-15: Maximum output power**

Previous agreement:

Maximum output power (UE)

* Option 1: 23dBm only.
* Option 2: 20dBm
* Option 3: Use n104 (23 and 26dBm)
* Option 4: 29dBm
* Proposals
  + Option 1: 23dBm only (Vivo, Apple, Ericsson for LS response. Ericsson propose 23, 26, 29 for TR., Huawei, Samsung)
  + Option 2: 20dBm and 23dBm (Google)
    - Option 2a: Consider 20dBm (Cablelabs, Charter, Cox)
  + Option 3: PC3 and PC2 (23, 26dBm) (CATT, CMCC ?, ZTE)
    - Option 3a: Also include PC1.5 (ZTE)
  + Option 4: 29dBm (Mediatek)
  + Option 5: 26dBm (Qualcomm)

Moderator: For TR, 23dBm will be captured. Capture 20dBm in TR. For LS, Qualcomm proposed higher level.

Apple: 23dBm in LS to ITU and capture other power classes in TR.

Google: In the band, there will be spectrum sharing in US. Minimizing the uplink interference is important. We propose 20dBm in LS.

Cablelabs: Fully agree with Google. This band will be shared. It is better to have lower power option to make sharing possible.

Nokia: we also need to include high power UE in LS.

Qualcomm: Sharing is ITU sharing. We need PC3 and PC2 using n104 as baseline.

ZTE: Tend to agree with Qualcomm. 29dBm is also preferred. Regarding analysis, on the sharing study, it is difficult for RAN4 to conclude.

Spark: Tend to agree with ZTE. Sharing is ITU topic. We should also include high power UEs.

Charter: as Google and Cable labs, we should include all regions. For region 2, we should include 20dBm for sharing.

Ericsson: 23dBm is typical and should be mentioned in LS.

Mediatek: Share the same view as ZTE. We do not preclude 29dBm.

Huawei: HPUE is not precluded. For LS, comparing to the previous LS, I do not think the situation will be changed. We proposed 23dBm as typical.

CATT: For this maximum power, we propose to capture PC3 and PC2. For Macro urban, PC2 and indoor PC3. We have scheme to control the power in the cell.

Charter: 23dBm is typical and other power classes are not precluded.

Intel: prefer to 23dBm and 26dBm. For lower power, we do not see the need. There is sufficient tech to control the power.

Cable Labs: 20dBm is important to conclude that the sharing is possible.

Samsung: we also consider the consistence. We can just leave 23dBm and leave other power classes in the TR.

Qualcomm: Same view as Samsung. We can directly refer to n104 spec without the number.

Charter: There is difference in the band, which is shared with others.

For LS response:

Tentative agreement:

* Capture 23dBm as typical maximum output power in the LS to ITU.
  + Other output powers are not precluded and refer to TR
* Capture 20dBm, 23dBm, 26dBm, and higher power classes in TR

**Issue 2-16: Power dynamic range**

Previous agreement:

Power dynamic range (UE)

* Use n104, as appropriate for maximum output power
* Proposals
  + Keep current agreement. The exact figure in dB can be derived based on the agreed output power.

**Issue 2-17: Emissions mask**

Previous agreement:

Spectrum mask

* UE:
  + n104 as basis for emissions levels
  + No need for further discussions

**Issue 2-18: ACLR**

Previous agreement:

ACLR

* UE
  + Option 1: 26dB, 27dB (study) for PC3
  + Option 2: 30dB (n104) for PC3, 31dB (n104) for PC2
* Proposals
  + Option 1: 26dB, 27dB (previous study and LS response) for PC3 (Apple, Skyworks, Mediatek, vivo, Huawei
  + Option 2: 30dB (n104) for PC3, 31dB (n104) for PC2 (Nokia, CMCC, Qualcomm, Ericsson, ZTE, Samsung)
* Recommended WF

**Issue 2-19: Spurious emission**

Previous agreement:

Spurious Emissions

* UE:
  + Use n104

No need for discussion

**Issue 2-20: Noise figure**

Previous agreement:

Noise Figure

* UE
  + Option 1: Follow n104 noise figure (12dB)
  + Option 2: Be consistent with information sent previously IMT-2020 28GHz, e.g. 10dB
  + Option 3: Be consistent with Previous LS to ITU-R on 6, 10GHz, NF was 9-13dB
* Proposals
  + Option 1: Follow n104 noise figure (12dB) (CATT, Qualcomm, Ericsson, Huawei, Samsung, (Apple??))
  + Option 2: Be consistent with information sent previously IMT-2020 28GHz, e.g. 10dB
    - Option 2a 9-10dB (Nokia)
    - Option 2b: 9dB (CMCC, ZTE)
  + Option 3: Be consistent with Previous LS to ITU-R on 6, 10GHz, NF was 9-13dB(Skyworks, Vivo))
    - Option 3a: 12-13dB (Apple)
    - Option 3b: 13dB (Mediatek)
* Recommended WF
  + Adopt option 1

**Issue 2-21: Sensitivity**

Previous agreement:

Sensitivity

* To be discussed further
* Recommended WF
  + Discuss after the noise figure is agreed.

**Issue 2-22: Blocking response**

Previous agreement: No previous agreement (FFS)

* Proposals
  + Option 1: As in 38.101-1 (CMCC, Qualcomm, Ericsson, Huawei, Samsung)
  + Option 2: Do not use the existing requirement and discuss further (ZTE)

**Issue 2-23: ACS**

Previous agreement:

Issue 2-12 ACS

* UE:
  + Follow n104 or follow previous studies
* Proposals
  + Option 1: 31dBc (Mediatek)
  + Option 2: 32dBc (Vivo, CMCC, Apple)
  + Option 3: 33dB as in 38.101-1 (Ericsson, Qualcomm, Samsung, ZTE)

# Topic #3: 14800-15530 MHz frequency range

The aim in this discussion should be to make progress on parameters that are important for co-existence simulations. Proposals for some parameters not impacting co-existence (such as spurious emissions, blocking response, power dynamic range etc.) are omitted and can be discussed in following meetings when the co-existence issues have been resolved.

There are TPs for simulation parameters in R4-2407437, R4-2408088, R4-2409064. Depending on progress, these can be merged if agreements are sufficiently mature to add to the TR.

There is a TP for UE parameters in R4-2407053. If the discussion on the parameters is mature enough, the meeting may decide whether to add information to the TR.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2408629 | Nokia | Proposals relevant to the 15GHz range are captured here. Proposals from this document for the 8GHz frequency range are captured in the previous section.  Proposal 2: 200-400 MHz is considered as typical maximum channel bandwidth for 14800 – 15350 MHz.  Proposal 6: UE noise figure is 10 dB for 14800 – 15350 MHz. |
| R4-2407052 | Apple | * Prefer FR1 like antenna array¨ * Other proposals for parameters are reflected in the discussion points |
| R4-2407053 | Apple | TP on UE parameters for the 15GHz range |
| R4-2407416 | Skyworks | • LS response to WP5D should be based on minimum set implementation: FR1 like, 1Tx PC3 and 4Rx  • In the SI phase coexistence studies assume the same UE characteristics than in the LS to derive ACLR, ACS requirements. Applicable relaxations to SEM are also studied.  • In the WI phase:  o Single stream digital beam forming based on 2Tx and 4Tx may be studied together with further ACLR/ACS relaxations.  o 6/8Rx may also be studied.  o Phase array beam forming may be studied for large UE form factors. |
| R4-2407539 | CATT | Proposal 1: RAN4 to take Option 1 (“UE beamforming” FR2-like) as the common understanding on UE’s antenna array options for the frequency range 14.8 – 15.35 GHz and Option 2 (TR 38.803) as the initial deployment scenarios.  Proposal 2: Take 8 x 16 dual-polarized sub-arrays with each sub-array consisting of 4 antenna elements, resulting in 1024 antenna elements in total for BS antenna array architecture.  Proposal 3: Consider the Annex as the third reply LS to WP5D for the frequency range 14800 – 1535MHz. |
| R4-2407908 | Murata | Observation 1: FR1 like is preferred if UE can achieve the required performance for expected scenario for this frequency range with FR1 like antenna.  Observation 2: It needs further study whether 23 dBm Tx power could be achieved with one Tx chain or by combining two or more Tx signals.  Proposal 1: For FR1 like antenna, RAN4 investigates whether 23 dBm Tx power is feasible with one Tx chain or by combining two or more Tx signals. |
| R4-2409066 | Google | Proposal 1: Considering that the PCB tracing loss may become much higher if the frequency range is higher than 10GHz and that the heterodyne architecture can be the possible RF transceiver architecture, it is proposed to adopt FR2-like UE beamforming as the UE antenna array option for the frequency range 14800 to 15350 MHz. |
| R4-2407437 | Nokia | Text proposal for system simulation parameters |
| R4-2408088 | Vivo | Proposal for system simulation parameters |
| R4-2408404 | Qualcomm | Observation 1: Urban macro deployments for the 14800 – 15350 MHz frequency range is feasible based on the SINR statistics for both downlink and uplink transmissions.  Proposal 1: RAN4 to same deployment scenarios as TR 38.921 (UMa with ISD=450m, InH, and dense urban).  Proposal 2: RAN4 to consider coordinated indoor and uncoordinated outdoor deployments in the adjacent channel coexistence framework.  Proposal 3: RAN4 to consider 200 MHz as a baseline in the adjacent channel coexistence framework.  Proposal 4: RAN4 to reuse the network layout model and relevant propagation models in TR 38.803 for urban macro, indoor hotspot, and dense urban deployments.  Proposal 5: RAN4 to consider for noise figure for urban macro deployments 9 dB and [9-13] dB for BS and UE, respectively.  Proposal 6: RAN4 to study feasibility of deploying larger number of antenna elements in the BS compared to FR1 for the 15 GHz range.  Proposal 7: RAN4 to adopt 1024 antenna elements as a baseline for the adjacent channel coexistence and further study the feasibility of employing higher number of antenna elements.  Observation 2: BS AAS parameters should be selected to facilitate the coexistence with other incumbent services.  Proposal 10: RAN4 to agree on 15dB as UL SNR target and 26 dBm as UE maximum output power.  Proposal 11: To progress the adjacent channel coexistence, RAN4 to consider two cases for UE beamforming: UE with and without beamforming. For the former, a 0 dBi isotropic antenna can be assumed, while for the latter, similar modelling as done in TR 38.803 for UE beamforming can be reused. |
| R4-2409064 | Ericsson | Observation 1 RAN4 should define common way to model the FR1 like UE antenna array option, including more than 1TX/RX if other companies prefer this option.  Observation 2 It is reasonable to also perform feasibility studies on 6X1 sub-arrays, when considering deployment challenges in terms of costs and performance efficiency.  Observation 3 A well-balance should be thought of when defining antenna characteristics – EIRP, TRP and others, to ensure coverage feasibility with reasonable cost considerations.  Observation 4 20% indoor probability assumption is not optimal for outdoor scenarios.  Based on the discussion in the previous sections we propose the following:  Proposal 1 RAN4 to consider UE beamforming antenna configuration of 2 panels, where each panel consists of a 2x2 rectangular array antenna.  Proposal 2 RAN4 to follow a prioritized approach and discuss simulation assumptions for the deployment scenarios starting with Urban Macro, followed by Indoor Scenario and others, considering time constraints and simulation efforts.  Proposal 3 RAN4 to study both coordinated and uncoordinated for the outdoor deployment scenarios.  Proposal 4 It is also important to specify what BW proposed power refers to, so ITU-R can scale the power to maintain PSD (Power Spectral Density) and coverage accordingly.  Proposal 5 RAN4 to consider using 43 dBm/ 100 MHz per polarization for co-existence simulation studies at this stage.  Proposal 6 RAN4 to consider 100 MHz as a baseline and further discuss the feasibility of higher channel bandwidth.  Proposal 7 RAN4 should clarify the common assumption on the UL bandwidth and number of actives UEs to be considered for concurrent allocation.  Proposal 8 RAN4 should start with 0% indoor probability for co-existence evaluations, considering indoor coverage will not be a use-case for outdoor scenarios.  Proposal 9 Approve the given co-existence simulation assumptions in Section 3. |
| R4-2409405 | Huawei | Proposal 1: It is proposed to follow TR 38.921 to study urban macro scenarios for the frequency range.  Proposal 2: it is proposed to consider 4096 antenna elements for Macro BS  Proposal 3: sub-array size 16 is also be considered for Macro BS |
| R4-2409608 | ZTE | Proposal 1: for coexistence study for 14.8-15.35GHz, consider the coexistence cases as shown in Table 2.1-1 for further evaluation.  Proposal 2: for the network layout,Propagation model,Transmission power control model,Received power model,ACLR and ACS modelling,Link level performance for 5G NR coexistence for 14.8-15.35GHz, consider the existing assumption in TR 38.921 as baseline and further discuss the cell radius for Urban Macro and Dense Urban scenario.  Proposa1 3: Regarding the noise figure at 15GHz, consider the NF value in Table 6.2.1-1 of TR 38.921 as starting point.  Proposal 4: for antenna array and transmission power assumption of BS and UE, this need more discussions. |
| R4-240738 | Nokia | Proposal 1: Use an AAS with 16x24 sub-arrays (1536 elements with sub-array size 4) for sub-urban and urban macro. |
| R4-2407700 | Mediatek | Proposal 1: In the study of IMT parameters for the 14800 to 15350 MHz frequency range, it is important to ensure the same coverage as FR1 deployment while also supporting the smartphone market.  Proposal 2: Considering constraints of the FR2-like antenna system, RAN4 should aim to implementation an FR1-like omni-directional antenna system in UE. This approach would leverage high-efficiency active technology, enable conductive conformance testing, and support four or more downlink layers within the UE at 15GHz.  Proposal 3: For the 15GHz UE, it is proposed to implement multiple FR1-like antennas that are co-directional and co-located, along with coherent Tx. This approach in antenna system design aims to relaxes the power requirements for the individual antenna PAs and to extend the coverage distance at 15GHz. |
| R4-2408089 | Vivo | Proposal 1: Take 2Tx (23 dBm for each Tx) and 4Rx as the baseline assumption for the UE in frequency range from 14800 to 15350 MHz.  Proposal 2: The typical channel bandwidth for 14800 to 15350 MHz can be 200MHz.  Proposal 3: For the regulation related requirement, e.g., SEM, spurious emission, etc., it is necessary to check whether the current requirements in FR1/FR2 are still applicable for new frequency range. |
| R4-2408405 | Qualcomm | Observation 1: 3GPP has been studying flexible duplexing (i.e., SBFD) at the gNB in Rel-18 and Rel-19 and it is desired to document such progress in this SI TR (i.e., TR 38.922).  Proposal 1: RAN4 to agree on TDD as the current duplexing candidate for 14800 – 15350 MHz frequency range and capture more text on SBFD in TR 38.922.  Proposal 2: RAN4 to adopt 200MHz is a typical channel bandwidth. Other channel bandwidths should not be precluded at this stage.  Proposal 3: As signal bandwidth depends on CHBW and SCS, no need to specify a fixed signal bandwidth but rather mention its dependency on SCS and number of RBs.  Proposal 4: RAN4 to study the feasibility of employing large number of antenna elements (i.e. >1k elements) at the BS.  Proposal 5: RAN4 to agree on 26 dBm (i.e., PC3) as UE maximum output power as a baseline.  Proposal 6: RAN4 to agree on 59 dBm as UE power dynamic range.  Proposal 7: For UE ACLR and ACS, RAN4 to decide on the UE ACLR and ACS based on the outcome of the adjacent channel coexistence study.  Proposal 8: RAN4 to study the feasibility of UE beamforming. |
| R4-2409065 | Ericsson | Proposal 1 RAN4 to consider TDD duplexing method as baseline.  Proposal 2 RAN4 to consider 100 MHz as a baseline and further discuss the feasibility of higher channel bandwidth.  Proposal 3 RAN4 to consider feasibility of the proposed BS array and sub-array antenna architectures as starting point and discuss other relevant parameters as per the BS array antenna parameters Table 2.2.1-2 from TR 38.803.  Proposal 4 RAN4 to agree on 0 dB as power dynamic range.  Proposal 5 RAN4 to consider BS spurious emission limits in Table 2.2.3-1 and 2.2.3-2 as baseline for initial discussions.  Proposal 6 RAN4 to consider BS NF as 8 dB for WA BS, 13 dB for MR BS and 16 dB for LA BS respectively based on information in TR 38.820 and TR 38.921.  Proposal 7 RAN4 to further discuss based on the agreements of BS NF and Antenna model, if should be agreed to mention any value for this parameter.  Proposal 8 RAN4 to consider UE beamforming antenna configuration of 2 panels, where each panel consists of a 2x2 rectangular array antenna.  Proposal 9 RAN4 to consider UE spurious emission limits from TS 38.101-1, - 30 dBm / 1 MHz as baseline for initial discussions.  Proposal 10 RAN4 to consider as 23 dBm UE maximum output power as starting point.  Proposal 11 RAN4 to consider UE NF as 8 dB based on information in TR 38.820.  Proposal 12 RAN4 to further discuss based on the agreements of UE NF and Antenna model, if should be agreed to mention any value for this parameter. |
| R4-2409406 | Huawei | Proposal 1: TDD should be used for frequency range 14.8 to 15.35 GHz  Proposal 2: 400 MHz is the max channel bandwidth and 95% spectrum utilization is proposed for the frequency range.  Proposal 3: 0 dB power dynamic range is proposed for BS power dynamic range.  Observation 1: The co-existence simulation needs to be carried out to derive the required DL ACIR  Proposal 4: the typical Noise Figure for a Wide Area BS operating at 15 GHz is 8 dB.  Proposal 5: It is proposed to not mention any value for receiver sensitivity.  Observation 2: The co-existence simulation needs to be carried out to derive the required UL ACIR |
| R4-2409463 | Samsung | Observation 1: For Option 1, taking the complexity of beam management into account, the benefit from using a beam steering antenna system with such a small number of elements need to be considered.  Observation 2: It would not make sense to expect the similar uplink and downlink performances when compared with FR2, considering the estimated antenna array size and number of modules.  Observation 3: For Option 2, it should be also noted that increasing the number of antennas is not necessarily guarantee the better performance given the higher frequency ranges and the limited form factor.  Observation 4: RAN4 needs more discussions to find out the optimal balance between Option 1 and Option 2 for the better performance than legacy UEs in FR1 and FR2. |
| R4-2409609 | ZTE | Proposal 1: assume TDD duplex mode as default assumption unless there are other operation mode proposals from certain regions/countries or certain operators.  Proposal 2: prioritize the following BS RF requirements for the following discussions: ACLR, UEM, f\_OBUE requirement, NF, ACS requirements, OOBB and f\_OOBB requirements.  Proposal 3: prioritize the following UE RF requirements for the following discussions: Maximum output power, Power dynamic range, spectral mask, ACLR, Noise figure, Sensitivity, ACS, Blocking.  Observation 1: given the wide area coverage assumption for 15GHz as baseline, even with 4096 antenna elements implementation assuming FR2 hybrid architecture, its total transmission power might be still limiting factor to achieve similar coverage as 4GHz from BS perspective.  Observation 2: UE with phase antenna array assumption could offer the additional help on mitigation the coverage gap between 4GHz and 15GHz.  Observation 3: for BS with 4096 antenna elements assumption at 15GHz, both near filed problem should be taken into account according to the current WA BS class assumption.  Observation 4: UE with phase antenna array assumption could offer the additional help on mitigation the coverage gap between 7GHz and 15GHz. |

*.*

### Sub-topic 3-1

**Issue 2-1: Duplex mode**

* Proposals
  + Option 1: Do not mention duplex mode in the reply LS, but do capture in the TR (Skyworks, CATT, CMCC, Qualcomm)
    - If option 1 is agreeable, discuss the following TP from Qualcomm in R4-2408402:

There is no defined 3GPP band for the 14800 - 15350 MHz frequency range. Similar to the 7125 - 8400 MHz frequency range, SBFD can be a candidate duplexing method for this frequency range. To provide timely response to WP5D regarding the requested RF parameters, RAN4 assumed TDD as a candidate duplexing for the 14800 - 15350 MHz frequency range. The requirements and conformance aspects for Rel-19 SBFD work item can be tracked through the list of impacted specs captured in [6].

* Recommended WF
  + Agree option 1, discuss wording for TP

**Issue 3-1: Simulation scenarios**

* Proposals

Maximum set of scenarios:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No. | Usage scenario | Aggressor | Victim | Direction | Simulation frequency | Deployment Scenario |
| 1 | eMBB | NR, TBD MHz | NR, TBD MHz | DL to DL | 15 GHz | Indoor hotspot |
| 2 | eMBB | NR, TBD MHz | NR, TBD MHz | DL to DL | 15 GHz | Urban macro |
| 3 | eMBB | NR, TBD MHz | NR, TBD MHz | DL to DL | 15 GHz | Dense urban |
| 4 | eMBB | NR, TBD MHz | NR, TBD MHz | UL to UL | 15 GHz | Indoor hotspot |
| 5 | eMBB | NR, TBD MHz | NR, TBD MHz | UL to UL | 15 GHz | Urban macro |
| 6 | eMBB | NR, TBD MHz | NR, TBD MHz | UL to UL | 15 GHz | Dense urban |

* + Option 1: Consider all of the above scenarios (Nokia, Qualcomm, ZTE)
  + Option 2: Consider urban macro and indoor hotspot (Vivo, Ericsson)
    - Prioritize urban macro first (Ericsson)
  + Option 3: Consider urban macro (Huawei)

**Issue 3-2: Layout**

* Proposals
  + Option 1: Follow 38.803 layout except possibly ISD, indoor/outdoor ratio, grid shift, which will be discussed with other issues
  + Option 2: Follow 38.921 layout except possibly ISD, indoor/outdoor ratio, grid shift, which will be discussed with other issues

Note: Option 1 and option 2 differ only for urban macro ISD and coordinated/uncoordinated deployment so this issue can be solved automatically with agreement on issues 3-1 and 3-5, and option 2 does not contain dense urban.

**Issue 3-3: ISD**

* Proposals
  + Urban macro:
    - Option 1: 350m (Vivo)
    - Option 2: 450m (Qualcomm, Huawei)
      * Start with 450m but do not preclude smaller (Ericsson)
  + Indoor:
    - Option 1: 20m (Nokia, Vivo, Ericsson)

**Issue 3-4: Percentage indoor users for urban macro**

* Proposals
  + - Option 1: 0% (Ericsson)
    - Option 2: 20% (Nokia, Vivo, Huawei in tables in contributions)

**Issue 3-5: Co-ordinated and un-coordinated for outdoor**

* Proposals
  + - Option 1: Both co-ordinated and un-coordinated (Ericsson)
    - Option 2: Un-coordinated (Qualcomm)
    - Option 3: Only co-ordinated (0% GS) (Nokia, Vivo)

**Issue 3-6: Co-ordinated and un-coordinated for indoor**

* Proposals
  + - Option 1: Only co-ordinated (0% GS) (Nokia, Vivo, Ericsson)

**Issue 3-7: Pathloss model**

* Proposals
  + - Option 1: As 38.803 (follows 38.900)
    - Option 2: As 38.921 (follows 38.901)

**Issue 3-6: BS antenna array sub-array size**

* Proposals
  + - Option 1: 4 (Nokia, CATT)
    - Option 2: Consider 4 - 6 (Ericsson)
    - Option 3: 16 (Huawei)

**Issue 3-6: BS antenna array size**

* Proposals
  + - Option 1: 1024 (Qualcomm, CATT)
    - Option 2: 1024-2048 (Ericsson)
    - Option 3: 16\*24 (1536 elements) (Nokia)
    - Option 4: 4096 (Huawei)

**Issue 3-7: BS antenna array other parameters**

* Proposals

|  |  |  |
| --- | --- | --- |
| Parameter | Macro suburban | Macro urban |
| Element gain (dBi) (Note 2) | 6.4 | 6.4 |
| Horizontal/vertical 3 dB beam width of single element (degree) | 90º for H 65º for V | 90º for H 65º for V |
| Horizontal/vertical fronttoback ratio (dB) | 30 for both H/V | 30 for both H/V |
| Antenna polarization | Linear ±45º | Linear ±45º |
| Horizontal/Vertical radiating sub-array spacing | 0.5 of wavelength for H, TBD of wavelength for V | 0.5 of wavelength for H, TBD of wavelength for V |
| Vertical element separation in sub-array () | 0.7 of wavelength of V | 0.7 of wavelength of V |
| Pre-set sub-array down-tilt (degrees) | 3 | 3 |
| Array Ohmic loss (dB) (Note 2) | 2 | 2 |
| Conducted power (before Ohmic loss) per sub-array (dBm) (Note 3) | 28 | 28 |
| Base station horizontal coverage range (degrees) | +/-60 | +/-60 |
| Base station vertical coverage range (degrees) (Note 1) | 90-100 | 90-100 |
| Mechanical down-tilt (degrees) | 6 | 6 |
| Note 1: The vertical coverage range is given for the elevation angle θ, defined between 0° and 180°.  Note 2: The element gain includes the loss and is per polarization. | | |

**Issue 3-8: UE type**

* Proposals
  + - Option 1: FR1 like (Apple, Skyworks, Murata, Mediatek, Vivo)
    - Option 2: FR2 like (CATT, Google, Ericsson)
      * 2x2 antenna (Ericsson)
    - Needs further discussion (Samsung)
    - Consider both options for co-existence simulation (Qualcomm)

**Issue 3-9: UE output power**

* Proposals
  + - Option 1: 26dBm (Qualcomm, Mediatek (assuming 2TX))
    - Option 2: 23dBm
    - Option 3: Even 23dBm may be difficult for 2TX, needs more checking (Murata)

**Issue 3-9: BS output power**

* Proposals
  + - Option 1: 43dBm TRP / 100MHz (Ericsson)

**Issue 3-9: UE number of RX (for FR1 like)**

* Proposals
  + - Option 1: 4 as baseline (Skyworks)
    - 6RX
    - 8RX

**Issue 3-10: Bandwidth**

* Proposals
  + - Option 1: 200-400MHz (Nokia)
    - Option 2: 200MHz (Qualcomm, Vivo)
    - Option 3: 100MHz (Ericsson, Apple (possibly also larger))
      * Consider smaller BW for UL with several UEs (e.g. 1-3 UEs) (Ericsson)
    - Option 4: 400MHz (Huawei)

**Issue 3-11: BS noise factor**

* Proposals
  + - Option 1: 11dB (Vivo)
    - Option 2: 8dB (WA), 13dB (MR), 16dB (LA) (Nokia, Ericsson)
    - Option 3: 9 dB for WA (Qualcomm)
    - Option 4: 8dB for WA (38.921) (Huawei, ZTE)

**Issue 3-11: UE noise factor**

* Proposals
  + - Option 1: 10dB (38.921) (Nokia, ZTE)
    - Option 2: 9-13dB (Qualcomm)
    - Option 3: 8dB (Ericsson)
    - Option 4: 14dB (Apple)

**Issue 3-12: UL SNR target**

* Proposals
  + - Option 1: 15dB (Qualcomm)

**Issue 3-13: TP on simulation assumptions**

* Proposals
  + - TP in R4-2404737 should be revised to include agreements in this meeting so companies can prepare preliminary simulation results to be presented in August meeintg.

# Topic #4: Other

This topic handles other issues relating to the ITU-R LS questions.

The discussion should focus around the antenna parameters TP, and whether any of the proposed conclusions are agreeable, or what should be discussed to resolve them.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2408083 | Ericsson | Observation 1: To model the interference level at the non-mobile adjacent system victim receiver, reasonable knowledge about the transmitter out-of-carrier and out-of-band characteristics could be on top of the antenna characteristics. Typically, the transmitter characteristics is gathered from information in the BS RF specification.  Observation 2: Information on relevant correlation factor as function of frequency offset is currently not captured in 3GPP technical reports.  Observation 3: RAN4 need to find appropriate method to determine the correlation roll-off profile. Potential methods are establishing profile based on measured characteristics from multiple vendors and/or simulation of PA characteristics.  To progress the work, we propose following:  Proposal 1: Capture array antenna model and corresponding description presented in [1] in TR 38.922, clause 7. A text proposal to [2] is attached at the end of this contribution.  Proposal 2: Within the scope of the SI continue to discuss how to model the correlation factor roll-off with the goal to find a representable model. |
| R4-2409610 | ZTE | Sub-array downtilt:  For the pre-set sub-array downtilt, please find the following values for different deployment scenarios  ACLR correlaiton factor:  Indeed this partial correlation factor in adjacent channel has been discussed in AAS SI phase during the Rel-13.  Based on the radiation pattern of wanted signal and IMD3 products, the ACLR pattern can be derived as [TR 38.842]:  +  where is the ACLR performance of each transmitter.  In addition, from our understanding, the correlation level at the adjacent channel is highly dependent on the implementation and exact level should be also up to the filed measurement results. From our understanding, the correlation level on the adjacent channel will have limited or marginal impacts on the coexistence study. In addition, if considering the varying correlation level in the adjacent channel, then simulation case will be increased a lot.  Receiver algorithm:  regarding the ZF or MMSE based scheme for MU-MIMO paring, at least from RAN4 evaluation perspective, this is not relevant since ZF or MMSE based scheme could be only enabled in SLS with small scale channel characteristic. Usually in RAN4 coexistence study, we focus on BS or UE beamforming is pointing to its serving targets with maximum power at DL or targeted power under the power control in UL ideally instead of considering MMSE based approach. |

## Open issues summary

### Sub-topic 4-1

**Issue 4-1: TP on Antenna array parameters**

* Proposals
  + Discuss and revise the TP in R4-2408083

**Issue 4-2: ACLR correlation**

* Proposals
  + Option 1: Discuss whether the following is agreeable

Indeed this partial correlation factor in adjacent channel has been discussed in AAS SI phase during the Rel-13.

Based on the radiation pattern of wanted signal and IMD3 products, the ACLR pattern can be derived as [TR 38.842]:

+

where is the ACLR performance of each transmitter.

In addition, from our understanding, the correlation level at the adjacent channel is highly dependent on the implementation and exact level should be also up to the filed measurement results. From our understanding, the correlation level on the adjacent channel will have limited or marginal impacts on the coexistence study. In addition, if considering the varying correlation level in the adjacent channel, then simulation case will be increased a lot.

**Issue 4-2: Receiver type**

* Proposals
  + Option 1: Discuss whether the following is agreeable

regarding the ZF or MMSE based scheme for MU-MIMO paring, at least from RAN4 evaluation perspective, this is not relevant since ZF or MMSE based scheme could be only enabled in SLS with small scale channel characteristic. Usually in RAN4 coexistence study, we focus on BS or UE beamforming is pointing to its serving targets with maximum power at DL or targeted power under the power control in UL ideally instead of considering MMSE based approach.