**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 second ad-hoc for [111][127]FS\_NR\_IMT.

# Topic #3: 14800-15530 MHz frequency range

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**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)

Nokia: For the NR SI we set priority. We propose 1st priority is urban macro. 2nd priority is indoor. 3rd priority dense urban.

ZTE: Agree with Nokia. Encourage to consider both urban macro and indoor. For dense urban

Qualcomm: Do we agree on timeline

Agreement:

1st priority urban macro

2nd priority indoor

3rd priority dense urban

**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.

Moderator suggestion:

* Do not discuss this issue directly. Discuss dense urban, urban macro ISD and co-ordinated/un-co-ordinated separately. Then the rest of the models are the same.

**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)

Nokia: Relates to UE power. Proposal is OK. Does anyone have another number they would like to see ?

Samsung: Agree for two options. 450 should be highest priority

Qualcomm: What is the assumption behind 350 ?

Vivo: Just a value between FR2 and 10GHz.

Agreement:

* For indoor, agree 20m
* For outdoor, consider both 450m (1st priority) and 350 (2nd priority) until August.
  + Also other ISD not precluded as 3rd priority than 450 and 350.

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

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

Nokia: Why does Ericsson consider 0% ? We have 20% agreed with channel model. You would be changing the channel model.

Ericsson: We see that indoor users are out of coverage

ZTE: Agree with Ericsson. For Rel-14 we assumed indoor UEs but found all out of coverage and all UEs were outdoor. Better to keep two options here.

Spark: RAN1 channel model studies are updating the penetration loss.

Qualcomm: We are OK to have both options

Agreement: Keep both options

**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)

Nokia: We previously started with both. The worst case depends on the antenna.

Agreement: Both co-ordinated and un-coordinated

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

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

Agreement: Only co-ordinated

**Issue 3-7: Pathloss model**

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

Moderator suggestion: Follow Nokia TP, which follows 38.921

Agrement: Follow 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)

Nokia: It does matter because it impacts the antenna pattern

Spark: The sub-array size will impact the antenna HPBW and pattern in elevation

ZTE: Agree with Nokia that sub-array size matters. Regarding the options, depends on the whole antenna assumption. Option 3 is for 4k array size

CATT: We could merge option 1 and option 2

Apple: Most likely the impact is to the elevation domain. Does the sub-panels impact coverage

Spark: Do not know what the elevation coverage requirements are for existing services in this band. The constraints will be better satisficed with a larger sub-array size.

Huawei: For our proposal we consider coverage, based on the overall radiating elements. Then we consider a reasonable number of Pas, then the sub-arrays.

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

* Proposals
  + - Option 1: 1024 with SA size 4 over both polarization (CATT)
    - Option 2: 1024-2048 with SA size 4-6 per polarization (Ericsson)
    - Option 3: 16\*24 with SA size 4 (1536 elements) for one polarization (Nokia)
    - Option 4: 4096 with SA size 16 for both polarizations (Huawei)

Nokia: Is the array size for one or two polarizations

Answer: Total on two polarizartions

Spark: The array size for the 8GHz band was 1024. That was total number of elements. We need to make sure there is a correspondence between these two to get similar coverage. Nokia numbers sound more reasonable.

Ericsson: The intention is to keep the ISD for all ranges, but for 15GHz we may need to go closer to FR2 ISDs

ZTE: We are fine with the proposals to ensure coverage. With 2k there may be near field effects below 150m. This could impact beamforming gain.

Qualcomm: We propose more than 1k. We agree with Nokia option

CATT: We are not sure if we need to associate this range with 8GHz. If we consider the possibility of beamforming at the UE side then the UE and BS can share the load. We should consider feasibility

Fujitsu: Concerned on antenna size. We need to consider feasibility

CATT: We can add options

Nokia: Do you still want 16 SA size for simulation ?

Agreement:

Per polarization, for simulation only:

* 2048 (Sub Array size 8)
* 1536 (Sub Array size 4)
* Array size and Sub Array size for the response will be decided later, taking into account feasibility

Moderator suggestion: Check coverage for 350m and 450m with all of these options (1024, 1536, 2048, 4096)

**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. | | |

Moderator suggestion: Follow the Nokia TP for this part, no online discussion

Ericsson: For a physical perspective we may need to consider to change 0.7 in the vertical domain.

Spark: Ericsson has a point, if the number of antenna elements is 8 and the vertical spacing is 0.7 then the sub-array spacing is large and will create grating lobes.

Agreement: 0.7 is for simulation assumptions, double check for reply

**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)

Google: We think from an implementation perspective, the loss will be greater for >10GHz. We slightly prefer FR2 like for this reason.

CATT: Out preference is FR2 like, but for co-existence simulations we can consider both.

Apple: Our analysis as shown in our contribution is that it is difficult to put a panel into a handheld device. There could be larger devices where FR2 like approaches could be used. We could consider both for now.

Samsung: We have a similar result as Apple, slightly prefer FR1 like, consider both now

Mediatek: Share Apple concern, it may be difficult to put the panels on a smartphone. Evaulate both for now

Qualcomm: Considering feasibility, discussion is ongoing. Discuss in parallel

Agreement:

For simulations, consider both options.

* + - FR1 like
      * RX diversity gain: [0 or 5] dB assuming 4RX
      * TX: 0dBi omnidirectional
      * Power: 23 dBm, 26dBm
    - FR2 like
      * Two panels (one in each direction) 2x2 antenna
        + 5dBi element gain. Array gain comes on top
      * Power: 23 dBm TRP

Apple: we are not able to find the reference of diversity gain. We need check [5]dB in the next meeting.

Nokia: we need this in the simulation. Do you want to specify Rx diversity gain or not? It is OK to have 5dB.

Apple: In TR we found nothing.

**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)

Moderator suggestion: Check if we can narrow down. Assume at least 2TX, possibly even 4TX ? If we cannot narrow down, assume 23dBm for initial simulations in the first phase until August, but companies welcome to consider 26dBm if coverage is not enough.

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

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

Qualcomm: Concerned with 100MHz. Prefer just power

ZTE: Could we assume 52dBm power ?

Qualcomm: That would be >85dBm EIRP

Agreement:

Assume 43dBm BS power for simulations

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

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

Moderator suggestion: Prioritize 4RX for simulations for August, but do not rule out other options.

**Issue 3-10: Bandwidth**

* Proposals
  + - Option 1: 200-400MHz (Nokia, Qualcomm)
    - Option 2: 200MHz (CATT, 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)

Nokia: Should consider only one UE scheduled. NR SI considered only 1 UE scheduled. Beamforming gain is reduced with more than 1 UE

ZTE, moderator: Can use digital beamforming ?

Qualcomm: Rel-17 had single UE scheduled. Do we plan 3 UE per TTI or single ?

ZTE: Rel-17 one UE as baseline

Ericsson: 1, 2, 3 in 10GHz

Agreement:

* For number of UEs per slot:
  + 1 UE per slot as 1st priority
  + 3 UE per slot as 2nd priority

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

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

Agreement: For simulations, assume 8dB

Moderator suggestion: Check if we can agree 8dB, at least as a tentative assumption for August

**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)

Agreement: 11dB for simulations. Actual noise factor for reply will be decided based on feasibility.

Moderator suggestion: Check what convergence is possible. Otherwise, for an initial simulation assumption for August take 11dB (half way between the extremes of 8dB and 14dB) for 1st phase simulations, but discuss again in August.

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

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

# Topic #2: 7125 – 8400 GHz frequency range

**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 2-20: 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 2-22: 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)