**3GPP TSG RAN WG1 Meeting #103-e R1-200xxxx**

**e-Meeting, October 26th – November 13th, 2020**

**Source: Moderator (SoftBank)**

**Title: Summary of [103-e-NR-CovEnh-02] A.I. 8.8.1.1 baseline coverage performance using LLS for FR1**

**Agenda Item: 8.8.1.1**

**Document for: Information**

# Introduction

This document summarizes the contributions submitted to 8.8.1.1 and 8.8.3 (related to FR1) and the email discussion held in RAN1#103-e. The email discussion will beheld based on the Chairman’s guidance.

[103-e-NR-CovEnh-02] Eamil discussion for FR1 coverage performance – Yusuke (Softbank)

* 1st check point: 10/29
* 2nd check point: 11/4
* 3rd check point: 11/10
* Last check point 11/12

For the the 1st checkpoint, FL plans to progress the following high priority topics:

* Section 2.2 [H] Target metrics and values for bottleneck identification
* Section 2.3.1 [H] How to aggregate evaluation results from different companies and limit number of scenarios of interest for bottleneck identification (common for FR1 and FR2)

Even though we had an intensive discussion at the GTW session on 27th October, FL would like to gather the companies’ views again because they have not documented yet, and some companies have not have chance to speak up due to the limited time of discussion.

The deadline of the 1st round of discussion is **20:00 UTC of 27th October (Tue).**

# Issues for discussion

## [M] Finalization of parameters and values

The following issues were identified by the companies’ contributions.

Table 2.1-1. Companies’ proposals on the parameters

|  |  |  |
| --- | --- | --- |
| Topic | CompanyTdoc No | Proposal |
| (1) MCS and RB | vivoR1-2007683 | A fixed MCS/RB allocation is preferred for PUSCH evaluation. |
| IntelR1-2007957 | • For link budget analysis, it is more desirable to align simulation assumptions for PDSCH and PUSCH, especially MCS, TBS, number of PRBs and DMRS configuration for various deployment scenarios. - Consider Table 1 and Table 2 as a starting point of discussion for link level simulation assumptions in FR1 and FR2 for NR coverage enhancement. |
| (2) Antenna gain correction factor | VivoR1-2007683 | The correction factor for gNB Tx BF gain for broadcast channel, should be considered in link budget template. - In FR1, the correction factor is about 8dB for carrier frequency other than 700MHz; 0dB for 700MHz. - In FR2, the correction factor is about 8dB and 5dB in urban and indoor scenarios, respectively.  |
| ZTER1-2007741 | Consider the antenna gain correction factors in Table 1 for link budget calculation in FR1. |
| vivoR1-2007678 | Proposal 1: The correction factor for gNB BF gain for broadcast channel should be considered in link budget template.- In FR1, the correction factor is about 8dB for carrier frequency other than 700MHz; - 0dB for 700MHz. |
| vivoR1-2007683 | The gNB antenna gain loss, due to tilt angle from the boresight direction of antenna pannel, is about 2.65dB for FR1, and about 3.07dB and 3.48dB for FR2 in Urban and Indoor, respectively. |
| AppleR1-2008478 | Make an agreement on the value of antenna gain correction factor Δ1 and Δ2. |
| (3) Target error rate | EricssonR1-2008422 | •Enhancements for PRACH performance should provide gains at a miss detection rate of 10%•Enhancements for CSI performance on PUCCH or PUSCH should provide gains at an initial BLER of 10% |
| Sierra WirelessR1-2007931 | The rural PUSCH baseline configuration should be with HARQ enabled and without restrictions on iBLER |
| (4) VoIP latency requirement | InterDigitalR1-2008487 | - Study the optimum number of HARQ processes, number of repetitions and number of maximum retransmission of a bundle within 50ms and 100ms latency requirement for evaluation for TDD VoIP- Use multiple number of HARQ processes for evaluation of baseline performance and enhancement for uplink FR1 TDD VoIP- For TDD, assume configured grant and follow RV sequence labeling and HARQ process numbering |
| (5) DMRS configuration for PUCCH | ZTER1-2007741 | Support additional DMRS (i.e. 4 DMRS symbols for 14-OS PUCCH) for link level simulation for PUCCH Format 3 for FR1 |
| (6) Penetration margin | ZTER1-2007741 | Consider the penetration margins for different O2I cases in Table 2 for link budget calculation in FR1. |
| (7) PUSCH repetition | Sierra WirelessR1-2007931 | The rural PUSCH baseline configuration should use an aggregation factor (i.e. repeats) of 4 or 8 |
| (8) PUSCH frequency hopping | Sierra WirelessR1-2007931 | The rural PUSCH baseline configuration should use inter-slot frequency hopping. |
| (9) Channel Estimation for PUSCH | Sierra WirelessR1-2007931 | The rural PUSCH baseline configuration should be with practical channel estimation • FFS: on configuration details (e.g. maximum time and frequency averaging)  |
| (10) Tx/Rx loss | OPPOR1-2008269 | We prefer the option 2 for Cable, connector, combiner and body losses in LB template. For other rows without agreement, we can reuse the values for IMT-2020 self-evaluation. |
| (11) PUCCH F1 for HARQ-ACK for Msg.4 | ZTER1-2007741 | For link level simulation of PUCCH format 1 with 1-bit HARQ-ACK for Msg4 in FR1, reuse the simulation assumptions of normal PUCCH with assuming no PUCCH repetition. |

Considering the fact that this is the last meeting to conclude this study item, it would not be a good idea to re-open the discussion on evaluation assumption and values because it requires performing link level simulation again to obtain required SINR. Even when it has no impact on the LLS, all the companies are required to update the template, which requires huge efforts to the companies.

Given these reasons, FL strongly recommends that the parameters/values/configurations suggested in Table 2.1-1 should be treated as “reported by companies” manner, which means RAN1 will not spend time at this meeting on the resolution of these issues.

Please provide your view on the FL suggestion above if you have a concern on it.

|  |  |
| --- | --- |
| Company | Comments |
| CATT |  We agree with FL’s suggestion |
|  |  |
|  |  |

## [H] Target metrics and values for bottleneck identification

At RAN1#102e meeting, the following conclusion was made for the target metrics and values:

Agreements:

* RAN1 strives for satisfying appropriate targets identified by companies particularly operators
	+ The targets may be in the form of one or more of the following:
		- 1. Scenario dependent targets, e.g., ISD/MPL
		- 2. Service dependent targets, e.g., [MCL=147] dB for VoIP;
		- 3. Relative difference between channels, e.g, MIL(/[MCL])
	+ Further values and details of such targets will be clarified at RAN1#103-e
	+ Note: there is no intention in RAN1 to update the study item objectives due to the identified targets.

Companies have provided their views by their contributions, and they are summarized in Table 2.2-1:

**1. Scenario dependent targets, e.g., ISD/MPL**

Table 2.2-1. Proposals on target ISD values

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Urban FR1 | Rural FR1 | Rural L.D. FR1 | Dense UrbanFR2 | SuburbanFR2 | Indoor FR2 |
| R1-2007746 ZTE | 500m | 1732m or 5000m | 12km or 30km | 200m |  | 12BSs per 120m x 50m |
| R1-2007678vivo | 350m |  |  |  |  |  |
| R1-2007877 CATT | 400m | 1732m | 12km | 200m | 200m | 20m |
| R1-2007952 Intel | 400m(MIL 4GHz O2I=148.7) | 1732m(MIL 4GHz O2I=149.2)(MIL 4GHz O2O=147.2)5000m(MIL 700MHz O2I=149.4)(MIL 700MHz O2O=147.4) | 15km(MIL 144.7)30km(MIL 156.7) |  |  |  |
| R1-2007993 CTC | 500m(MPL=121.75) | 1732m(MPL 4GHz=131.57)1732m(MPL 2GHz=12.55) | 30km(MPL=142.91) |  |  |  |

Note: other target values for FR2 might be proposed under 8.8.1.2. The values for FR2 here are just for information

**2. Service dependent targets, e.g., [MCL=147] dB for VoIP;**

* R1-2007746 ZTE
	+ For service dependent targets, adopt 147dB + 10 \* log 10( N/k ) - Δ1 as the target MCL for different services at least in FR1.
		- The number of TxRU N = 64 and the number of Tx/Rx chains k = 2 or 4 for 2.6 GHz and 4 GHz, and N = k for other frequency carriers.
* R1-2008380 SoftBank
	+ Confirm the target MCL value of 147 dB for FR1 VoIP under the following condition:
		- Rural with 700MHz and/or 2GHz senarios
		- 2 trannsmit TxRUs and 2 receive TxRUs for BS
		- 1 Tx chain and 2 Rx chains for UE
		- Zero receiver interference density
			* Even when non-zero value can be used, it is not needed to adjust the target value
		- Zero recevier implementation margin
			* Even when non-zero value can be used, it is not needed to adjust the target value

**3. Relative difference between channels, e.g, MIL(/[MCL])**

Table 2.2-1. Proposals on target ISD values

|  |  |  |
| --- | --- | --- |
| Company | Preferred metric | Criteria to identify bottlenecks |
| R1-2007746 ZTE | MIL | Worse than PBCH |
| R1-2007877 CATT | MIL or MCL | Worst and 2nd worst |
| R1-2008624 Qualcomm | MCL | Worse than control coverage |
| R1-2008667 NTT DOCOMO | MIL |  |
| R1-2008024CMCC | MIL or MCL |  |
|  |  |  |

The input from companies is not enough to make a decision due to the following reasons.

* For, Scenario dependent targets, e.g., ISD/MPL
	+ The proposals by companies are not aligned yet: different values are proposed, and we still have multiple options for a scenario.
	+ It is desirable to convert the value to MPL or MIL, but it has been done by only two companies.
* For Service dependent targets, e.g., [MCL=147] dB for VoIP
	+ From companies evaluation results, it was found that most of the channels cannot satisfy MCL of 147dB
		- This is because the results have used non-zero value for interference and Rx margin, which is not aligned with the derivation of 147dB
		- It would not be good approach to request resubmission of additional link budget table with zero interference and Rx margin
		- Therefore, it is required to reconsider the value of 147dB taking into account the companies’ simulation assumptions
* For Relative difference between channels, e.g, MIL(/[MCL])
	+ Use of MIL got majority support, but not enough to make the final decision.
	+ It is not easy to decide the criteria to identify bottlenecks without seeing the final form of link budget. The level of enhancement should be realistic, but it is not clear at this moment.

Given the analysis above, FL would like to propose the following guidance for the next step discussion:

* The proponents of scenario-dependent targets are requested to come up with a single target value for each scenario
	+ It is also requested to provide either MIL or MPL value corresponding to the target ISD value.
* The proponent of service-dependent targets are requested to prepare an updated MCL value with non-zero interference and Rx margin, which are widely used by companies
	+ Considering this target is valid only for a limited number of scenarios, it is recommended to merge this requirement to other target metric(s).
* For Relative difference between channels,
	+ Discuss and decide how to identify the bottleneck channels
		- Option 1-1: worse than PBCH
		- Option 1-2: x-th worst channel (x=e.g.2)
		- Option 1-3: worse than control coverage (i.e. worst control channel)
		- Option 1-4: do not decide in RAN1
			* RAN1 will capture a comprehensive analysis in the TR, and RAN will make a decision when a subsequent WI is started.
		- Option 1-5: Other solution
	+ Discuss and decide which metric to be used
		- Option 2-1: MCL
		- Option 2-2: MIL
* Start the next step discussion after the issues in section 2.3.1 is concluded.

Please provide your view on the FL guidance.

|  |  |
| --- | --- |
| Company | Comments |
| SoftBank | Regarding MCL=[147]dB, we have re-evaluate the requirement taking into account Rx loss and interference value used for IMT-2020 self-evaluation (-165.7dBm/Hz for row No (15) and 2 dB for row No (20) respectively). It is fond that the requirement can be relaxed to 139.2dB instead of 147dB. Also, we are fine to focus on Rural 700MHz for simplicity. We are basically fine with merging this requirement to other metric, but the discussion should be done later, e.g. after checking the representative values.  |
| CATT | First of all, we want to clarify whether all of 3 target metrics including scenario-dependent targets, service-dependent targets and Relative difference between channels need be used or we can down-select 1 or 2 targets metric for bottleneck identification. In our view, if all of three target metrics are used, work load is very heavy so it is better to down-select 1 or 2 target metrics for bottleneck identification.MIL can be used for the metric of evaluation performance because MIL can consider more factors on antenna gain than MCL. |
| NTT DOCOMO | We are fine with the FL guidance, and we prefer to use the relative value for the target metric, since the absolute value may not reflect the real environment / deployments that have large difference over scenarios and variability. We also support to use Option 1-2 for the target performance derivation.We prefer to use Option 2-2 : MIL for the target metric, since it’s better to include the antenna gain including beamforming gain in the link budget analysis. |
|  |  |

## [H] Observation from evaluation results

### [H] How to aggregate evaluation results from different companies and limit number of scenarios of interest for bottleneck identification (common for FR1 and FR2)

Related to the discussion in section 2.2, it is necessary to define a single value from the evaluation results submitted by companies, which is used for the comparison with the target value(s). However, RAN1 has not decided how to define such value. We need to discuss how the single value (hereafter referred to as “representative value” in this document) can be derived from the evaluation results with different simulation assumptions/parameters. However, FL thinks this is not an easy exercise because of the following issues:

**Issue 1. Diversity of companies’ evaluation results**

As of Oct. 23rd, the word document of submission template reaches **90 pages for FR1 (and 40 pages for FR2, please check the FL document for the details)**, respectively. This huge amount of data makes our analysis very complicated. Here is an example below (these figures and table are made from the submission template version 034) explaining why it is not so easy:



Figure 2.3.1-1. An example of companies’ evaluation result

Table 2.3.1-1. Summary of companies’ evaluation results for Urban 4GHz TDD (DDDSU)

|  |  |  |  |
| --- | --- | --- | --- |
|  | MCL | MIL | MPL |
| 　 | mean | median | range | mean | median | range | mean | median | range |
| PUSCH eMBB | 130.0  | 130.5  | 18.6  | 139.4  | 139.3  | 14.4  | 110.7  | 110.0  | 16.9  |
| PUSCH VoIP | 142.7  | 142.5  | 21.5  | 152.2  | 151.9  | 24.8  | 119.7  | 120.8  | 11.4  |
| PUSCH CSI | 146.0  | 146.0  | 4.0  | 155.4  | 155.4  | 4.0  | 130.3  | 130.3  | 3.9  |
| PUCCH F1 2bit | 147.4  | 147.9  | 22.0  | 158.3  | 156.7  | 13.8  | 123.2  | 122.8  | 5.6  |
| PUCCH F3 11bit | 145.0  | 146.4  | 19.3  | 155.8  | 155.2  | 8.1  | 123.4  | 121.3  | 17.2  |
| PUCCH F3 22bit | 141.9  | 143.7  | 27.6  | 154.5  | 152.2  | 17.3  | 119.3  | 118.4  | 10.8  |
| SSB | 151.3  | 151.4  | 16.8  | 160.5  | 160.8  | 11.3  | 129.5  | 129.4  | 19.9  |
| PRACH | 144.5  | 144.8  | 20.7  | 155.4  | 153.6  | 12.3  | 124.8  | 121.8  | 21.0  |
| PDCCH Msg2 | 146.5  | 147.5  | 13.0  | 159.0  | 159.3  | 17.0  | 128.6  | 125.5  | 25.3  |
| PDSCH Msg2 | 150.4  | 151.0  | 18.8  | 159.8  | 160.5  | 16.8  | 131.8  | 130.0  | 22.4  |
| PUSCH Msg3 | 142.6  | 143.5  | 19.0  | 153.6  | 152.4  | 8.5  | 124.9  | 122.9  | 12.1  |
| PDSCH Msg4 | 148.4  | 148.5  | 22.0  | 157.6  | 157.5  | 18.8  | 129.2  | 129.2  | 24.5  |
| PUCCH w/ HARQ-ACK Msg 4 | 140.7  | 140.7  | 18.6  | 151.7  | 151.7  | 8.4  | 121.3  | 121.3  | 0.6  |
| PDCCH | 152.8  | 153.6  | 23.5  | 164.1  | 164.2  | 13.1  | 131.9  | 130.4  | 20.1  |
| PDSCH eMBB | 150.1  | 147.8  | 22.1  | 159.1  | 158.3  | 19.8  | 131.0  | 127.5  | 28.7  |

Note: Column “range” mans the gap between the best and the worst value submitted by companies.



Figure 2.3.1-2. Summary of companies’ evaluation result for Urban 4GHz TDD (DDDSU only)

Originally, it was expected that MCL could achieve a good alignment among companies because of the reduced flexibility of parameter/value choice. It seems that most of the companies have a good alignment, but there are exceptional results far from the average value (peak-to-peak gap reaches 20dB!). This tendency is common for MIL and MPL. Ideally, the reason for this divergence can be clarified by checking the detailed simulation assumptions, and we can decide if the value can be used for the statistical analysis. However, this approach will not be realistic because we might need to repeat this approach for approx. 100 times (#of channels \* #of scenarios \*#of categories) while the available time at RAN1#103-e is limited.

**FL observation 1**

* Evaluation results provided by companies display very large variance
	+ There might be a risk to draw unreasonable conclusion if the representative value is derived an inappropriate way
* On the other hand, it is quite challenging to discuss and clarify all the details of simulation results over email and/or GTW during the meeting period.

**Issue 2. Many scenarios for evaluation**

Ideally, we should look at all the scenario and frame structure to identify the bottleneck channels scenario by scenario. However, it was found from the latest evaluation template that the number of submissions is quite different depending on scenario.

Table 2.3.1-1. Number of contributors

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Urban 4GHz | Urban 2.6GHz | Rural 4GHz | Rural 2.6GHz | Rural 2Ghz | Rural 700Mhz | Rural L.D 700MHz | Rural L.D. 4GHz |
|  | DDDSU | DDDSUDDSUU | DDDDDDDSUU | DDDSU | DDDSUDDSUU | DDDDDDDSUU | UUUUU | UUUUU | UUUUU | DDDSU | DDDSUDDSUU |
| PUSCH for eMBB | 13 | 12 | 8 | 11 | 10 | 6 | 9 | 11 | 8 | 5 | 3 |
| PUSCH for VoIP | 9 | 10 | 6 | 9 | 8 | 5 | 9 | 9 | 8 | 3 | 3 |
| PDSCH for eMBB | 10 | 9 | 6 | 7 | 7 | 5 | 9 | 11 | 7 | 3 | 3 |

To accelerate the discussion in RAN1, it might be good to limit the scenario for bottleneck identification. One idea is to choose a representative scenario and/or frame structure, which has sufficient number of evaluation results.

**FL observation 2**

* Identification of bottleneck channel should be done by focusing on a limited number of scenarios/frame structures to accelerate the discussion in RAN1.
* There is a risk to make a wrong decision if we use the evaluation results with small number of samples.

**Issue 3. Need of categorization**

Similarly, we should also discuss if some categorization is necessary for deriving a representative value. For example, we have an agreement to perform evaluations for LOS/NLOS and O2I/O2O and companies are requested to submit the result separately. The result on PUSCH for eMBB (DDDSU) under Rural 4GHz TDD scenario is summarized in the table 2.3.1-1 below.

Table 2.3.1-1. Evaluation results on PUSCH (DDDSU) for eMBB under rural 4GHz scenario

|  |  |  |  |
| --- | --- | --- | --- |
|  | MCL | MIL | MPL |
| 　 | mean | median | range | mean | median | range | mean | median | range |
| NLOS O2I | 134.52  | 138.79  | 20.23  | 123.59  | 125.66  | 18.30  | 123.59  | 125.66  | 18.30  |
| NLOS O2O | 135.81  | 138.63  | 15.96  | 126.45  | 127.37  | 8.52  | 126.45  | 127.37  | 8.52  |
| LOS O2I | 133.65  | 133.10  | 18.69  | 123.84  | 126.11  | 7.49  | 123.84  | 126.11  | 7.49  |
| LOS O2O | 136.17  | 138.16  | 18.67  | 128.12  | 129.32  | 5.16  | 128.12  | 129.32  | 5.16  |

Note: Column “range” mans the gap between the best and the worst value submitted by companies.

This table shows that the difference between NLOS/LOS and O2I/O2O (~5dB) is marginal compared with the difference among companies (~20dB). In addition, the number of contributors is different, i.e. 11 results for NLOS O2I while 4 results for LOS O2O. Ideally, it would always be good if a representative value is derived by categorizing NLOS/LOS and O2I/O2O, but it is not clear if the categorization is so meaningful for this case from workload and statistical point of view. One solution would to focus on only one scenario (e.g. NLOS O2I for rural, and LOS O2O for rural with long distance) for coverage bottleneck analysis.

Other parameters such as delta value, UE speed, PRACH format and Tx power can potentially be used for the categorization. However, too many categories will lead to the huge workload and less number of samples for each category. FL thinks that RAN1 should be careful if we introduce categorization for the evaluation results.

**FL observation 3**

* RAN1 needs to take into account whether and how the evaluation results are categorized on top of scenario, frame structure, channel (including PUCCH format)
	+ Candidate categories are LOS/NLOS, O2O/O2I, UE speed, RACH format, DL Tx power etc.
		- It should be kept in mind that number of samples is quite deferent depending on the parameters. Hence, it is not clear if the categorization works well from statistical point of view.
	+ Smaller number of categories can help reduce the workload, while it is not so logical to apply averaging for the values derived using different parameters.
		- FL recommends to have a discussion on this issue at the beginning of RAN1#103e

Given the observations above, FL thinks the following approach can be considered at RAN1#103e.

* Define a representative value for each channel/scenario/frame\_structure/category from the submitted evaluation results, which is used for the comparison with target value(s).
	+ The following scenario/frame structure pairs, which have a sufficient number of evaluation results, are used for the analysis of bottleneck identification
		- For FR1:
			* Urban 4GHz TDD (DDDSU, [DDDSUDD~~D~~SUU – FL note: FL doesn’t think this format give us important information on top of DDDSU given that UL channels will be the bottleneck] )
			* [Urban 2.6GHz TDD – FL note: it should be discussed if it can give us different observation from 4GHz]
			* Rural 4GHz TDD (DDDSU, [DDDSUDD~~D~~SUU] )
			* [Rural 2.6GHz TDD – FL note: it should be discussed if it can give us different observation from 4GHz]
			* [Rural 2GHz FDD - FL note: it should be discussed if it can give us different observation from 700MHz]
			* Rural 700MHz FDD
			* Rural with long distance 700MHz FDD
			* [Rural with long distance 4GHz TDD (DDDSU, DDDSUDDSUU) – FL note: the number of samples is smaller than other scenarios]
		- For FR2:
			* To be discussed under A.I.8.8.1.2
	+ For each scenario, representative value(s) is/(are) derived for each channel/format, i.e.
		- PUSCH for eMBB
		- PUSCH for VoIP
		- [PUSCH for CSI: FL note – need more discussion because the number of data is not sufficient from statistical point of view]
		- PUCCH Format 1 with 2bits
		- [PUCCH Format 3 with 4bits – FL note: only one company submitted the results]
		- [PUCCH with 3-HARQ-ACK bits + SR - FL note: only one company submitted the results]
		- PUCCH Format 3 with 11bits
		- PUCCH Format 3 with 22bits
		- [PUCCH with HARQ-ACK for Msg.4 – FL note: only two companies submitted the results]
		- SSB
		- PRACH format 0
		- PRACH format B4
		- [PRACH format C2 – FL note: the number of samples is quite small]
		- PDCCH for Msg.2
		- PDSCH for Msg.2
		- PUSCH for Msg.3
		- PDSCH for Msg.4
		- PDCCH
		- PDSCH for eMBB
	+ For each channel/format of each scenario, apply the following approach for categorization to derive a representative value:
		- Option A-1: based on UE speed
			* FL note – it may not be easy because “key assumptions” do not always include this information.
		- Option A-2: based on NLOS/LOS + O2O/O2I (for rural)
			* FL note - If categorization is not introduced, RAN1 needs to chose one combination for analysis (or merge everything)
		- Option A-3: based on delta value (zero vs non-zero)
			* FL note – it may not be easy because “key assumptions” do not always include this information.
		- Option A-4: transmission power
			* For UL: normal UE (23dBm) and HPUE (26dBm)
			* For DL: normal BS and low power BS for urban 4GHz
			* FL note: the number of samples for low power BS and HPUE may not be sufficient
		- Option A-5: no further categorization
	+ ~~The means to derive a single representative value:~~
		- ~~Option B-1: use mean value~~
			* ~~For this case, it is also necessary to discuss how to handle the result(s) that is far from the average.~~
		- ~~Option B-2: use median value~~
	+ To derive a single representative value for MCL/MPL/MIL from the performance evaluation:
		- Take the mean value
			* Excluding the highest & the lowest values when the number of samples is more than 2

Companies are encouraged to provide their views on the FL perspective above.

|  |  |
| --- | --- |
| Company | Comments |
| CATT | For FR1, evaluation performance of both 4GHz and 2.6GHz performance evaluation need be used for the analysis of bottleneck identification because both 2.6GHz and 4GHz are the important frequency band of the operator NW deployment and evaluation performance of both 4GHz and 2.6GHz are a good reference to the operator for Network planning and network optimization in the future.For deriving a single representative value for MCL/MPL/MIL from the performance evaluation, we prefer to OptionA-5 because current category is enough.In addition, if we use mean value to drive the representative value from the performance evaluation, we need consider how many samples for performance evaluation.For channels with only one company or two companies’ input, the evaluation result is not enough to be persuasive. So we suggest no any conclusion on those channels with only one company or two companies’ input is made. |
| NTT DOCOMO | We are fine with the FL approach. For the categorization, we prefer Option A-4 since the Tx power difference is large for FR1 4GHz DL (24 dBm/MHz or 33 dBm/MHz), and FR2 DL (23 dBm for Indoor, and 40 dBm for Outdoor), and FR2 UL (23 dBm or 12 dBm). |
|  |  |
|  |  |

### [Not open] TBD

The next step discussion depends on the conclusion of 2.3.1.

## [L] Collection of simulation results

The collection of the simulation results is on-going under another email discussion, i.e. [103-e-CovEnh-EvaluationResults]. Companies are encouraged to monitor this email thread, and input the updated simulation results when available.

## [Not open] Identification of coverage bottleneck(s)

Most of the companies think PUSCH and PUCCH need enhancements while the amount (how many dBs) is not clear because the target metric and value are not decided yet. In addition, companies has different views on the details:

* which instance of PUSCH (eMBB, VoIP, CSI etc.) can be the bottleneck
* which format and bit size of PUCCH (Format 1,3 / bit size of 2, 11, 22/ UE-specific, Cell-specific) need to be enhanced

Furthermore, some companies think that PRACH, PDSCH, PDCCH should also be enhanced. It depends on the target value and the scenarios. This requires more discussion in RAN1.

At this stage, it is not easy to make a conclusion without the outcome of section 2.2 and 2.3. The discussion will be initiated after 2.2 and 2.3 is concluded.

## [Not open] Other issues

New discussion will be initiated if new issues are identified during RAN1#103e.

# Proposals for GTW sessions

To be incorporated later.

# Agreements

To be incorporated later.

# References

1. R1-2007581 Evaluation on the baseline performance for FR1 Huawei, HiSilicon
2. R1-2007678 Evaluation on NR coverage performance for FR1 vivo
3. R1-2007741 Discussion on baseline coverage performance for FR1 ZTE
4. R1-2007872 Baseline coverage performance for FR1 CATT
5. R1-2007904 Baseline coverage performance for uplink in FR1 Indian Institute of Tech (H)
6. R1-2007931 FR1 PUSCH Baseline Coverage Performance Sierra Wireless, S.A.
7. R1-2007952 On baseline coverage performance for FR1 Intel Corporation
8. R1-2007993 Updated baseline performance for NR coverage enhancements for FR1 China Telecom
9. R1-2008024 Discussion on the baseline performance in FR1 CMCC
10. R1-2008089 Baseline coverage performance for FR1 Xiaomi
11. R1-2008179 Baseline coverage performance using LLS for FR1 Samsung
12. R1-2008269 Evaluation on NR coverage performance for FR1 OPPO
13. R1-2008343 Link and System Evaluation of Coverage for FR1 Ericsson LM
14. R1-2008377 Baseline coverage performance analysis in FR1 Panasonic Corporation
15. R1-2008380 Target value for FR1 voice coverage enhancements SoftBank Corp.
16. R1-2008398 Link budget analysis for FR1 Sharp
17. R1-2008478 Evaluation on FR1 coverage performance Apple
18. R1-2008481 FR1 baseline coverage performance using LLS InterDigital, Inc.
19. R1-2008515 Discussion on scenarios for FR1 baseline performance evaluation MediaTek Inc.
20. R1-2008557 Baseline coverage performance for FR1 NTT DOCOMO, INC.
21. R1-2008624 Baseline FR1 coverage performance Qualcomm Incorporated
22. R1-2008701 Baseline coverage evaluation of UL and DL channels – FR1 Nokia, Nokia Shanghai Bell
23. R1-2007683 Considerations on Parameters for Coverage Evaluation vivo
24. R1-2007746 Discussion on target performance for NR coverage enhancements ZTE
25. R1-2007877 Discussion on remaining issues for coverage enhancement CATT
26. R1-2007957 On simulation assumptions for NR coverage enhancement Intel Corporation
27. R1-2008274 Functionality of Coverage Enhancement and other WI OPPO
28. R1-2008422 Coverage Parameter Sensitivity and Network Enhancement Ericsson
29. R1-2008487 Discussion on simulation assumptions for VoIP InterDigital, Inc.
30. R1-2008629 Other coverage enhancement aspects Qualcomm Incorporated
31. R1-2008706 Evaluation assumptions for NR coverage enhancement evaluation Nokia, Nokia Shanghai Bell

# Annex 1 – Agreements at RAN1#101e

Update on 6/1: to check 6/2

Update from 6/4 GTW:

Agreements:

* Adopt the following target data rates for eMBB performance evaluation for FR1.
* Urban scenario: DL 10Mbps, UL 1Mbps
* Rural scenario: DL 1Mbps, UL 100kbps
* Rural with long distance scenario: DL 1Mbps, UL 100kbps, ~~[~~30kbps~~]~~ (optional)

**Agreements:**

* For VoIP performance evaluation based on link-level simulation for FR1.
* A packet size of [320] bits with 20ms data arriving interval is adopted.
* ~~FFS~~TBD: TBS for SIP invite message. Payload of 1500 bytes can be a starting point.

Agreements:

* The basic evaluation methodology is based on link-level simulation for FR1.
* Step 1: Obtain the required SINR for the physical channels under target scenarios and service/reliability requirements.
* Step 2: Obtain the baseline performance based on required SINR and link budget template.
* Note: asepcts related to identifying target performance and coverage bottlenecks based on target performance metric is to be handled separately
* ~~FFS:~~ The evaluation methodology based on system-level simulation is optional for FR1.
* Note: The simulation assumptions for SLS are up to companies’ reports.

Agreements:

* For link level simulation, adopt the following table for PUSCH and PUCCH for FR1.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Scenario and frequency | Urban: 4GHz (TDD), 2.6GHz (TDD) Rural: 4GHz (TDD), 2.6GHz (TDD), 2GHz (FDD), 700MHz (FDD)Rural with long distance: 700MHz (FDD), 4GHz (TDD)  |
| Frame structure for TDD | DDDSU (S: 10D:2G:2U) only for 4GHzDDDSUDDSUU (S: 10D:2G:2U) only for 4GHz DDDDDDDSUU (S: 6D:4G:4U) only for 2.6GHzOther frame structures can be reported by companies. |
| Pathloss model (select from LoS or NLoS) | Urban: NLoSRural: NLoS and LoS |
| BWP | 100MHz for 4GHz and 2.6GHz.20MHz for 2GHz (FDD20MHz (optional for 10MHz) for 700MHz. (FDD) |
| SCS | 30kHz for TDD, 15kHz for FDD. |
| Channel model for link-level simulation | TDL-C for NLOS, TDL-D for LOS.[CDL] |
| UE velocity | Urban: 3km/h for indoorRural: 3km/h for indoor, 120km/h (optional 30km/h) for outdoor |
| Frequency hopping | w/ or w/o ~~Intra-slot~~ frequency hopping for PUSCHw/ frequency hopping for PUCCH ~~is enabled~~. |

* FFS whether there are any additional simulation considerations for the extreme coverage scenarios (e.g., rural)

Update on 6/5:

Agreement:

* Down selection on the following options for the link budget template for FR1 in next meeting.
* Option 1: Adopt single link budget template based on IMT-2020 self-evaluation with necessary revisions, including adding/removing/revising some parameters.
	+ FFS: The template provided by FL in Tdoc [R1-2005005](file:///D%3A%5C2020%E5%B9%B4%E5%BA%A6%E5%B7%A5%E4%BD%9C%5CRAN1%23102%5Cduring%20the%20meeting%5CDocs%5CR1-2005005.zip).
* Option 2: Adopt both templates, i.e. link budget template in IMT-2020 self-evaluation and link budget template in TR 36.824.
* Option 3: Adopt single link budget template in TR 36.824 with necessary revisions, including adding/revising some parameters.

Agreement:

Down selection on the following options for antenna array gain for LLS based methodology for FR1 in next meeting.

* Option 1: Antenna array gain is included in the link budget template.
* FFS: array gain = 10 \* 1og10 (number of antenna elements/number of TxRUs)
* FFS: For TDL channel model
* FFS: Values reflective of realistic implementation and network operation.
* Option 2: Antenna array gain is included in LLS.
* FFS: For CDL channel model

Agreement:

* For link level simulation, adopt the following table for PDSCH for FR1.

|  |  |
| --- | --- |
| Parameters | Values |
| Waveform | CP-OFDM |
| PRBs/MCS/TBS | Reported by companies. |
| PDSCH duration | 12 OS |
| Other parameters | FFS |

Agreements:

* For link level simulation, adopt following TBS for Msg3 for FR1
* 56 bits

Agreements:

* For link level simulation, the packet size of VoIP for FR2 is the same as FR1.

Agreements:

* For link level simulation, TBS of Msg3 for FR2 is the same as FR1.

Agreements:

* The evaluation methodology for FR2 is the same as FR1.

Agreements:

* The link budget template for FR2 is the same as FR1.

Agreements:

* For link level simulation, adopt the following table for PUSCH and PDSCH for FR2.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Scenario and frequency | 28GHz |
| Frame structure for TDD | DDDSU (S: 10D:2G:2U)DDSU (S: 11D:3G:0U)Other frame structures can be reported by companies. |
| Subcarrier Space | 120kHz |
| UE velocity | Indoor scenario:3km/hUrban scenario: 3km/h for indoor, 30km/h for outdoor. Suburban scenario: 3km/h for indoor, 30km/h, (optional: 120km/h) for outdoor. |
| Occupied channel bandwidth for | 100MHz, [400MHz] |
| Frequency hopping for PUSCH | w/ or w/o frequency hopping |

Final summary in R1-2005004.

**//Update on 6/7, post e-Meeting additional email approval**

**[101-e-Post-NR-Cov-Enh] Email discussion/approval focusing on remaining evaluation assumptions till 6/17 – Jianchi (CT)**

* **Focusing on high priority proposals first, target 6/11 for early approvals**
* **Followed by medium priority/low priority proposals**

Update on 6/11: check on 6/12 for potential agreements

Update on 6/12:

Agreements

* For link level simulation, adopt the following table for PUSCH for eMBB data or VoIP for FR1.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| BLER for PUSCH | For eMBB, w/ HARQ, 10% iBLER; w/o HARQ, 10% iBLER.For VoIP, 2% rBLER. |
| Number of UE transmit chains for PUSCH | 1，2 (optional)  |
| DMRS configuration for PUSCH | For 120km/h, (Optional: 30km/h): Type I, 2 or 3 DMRS symbol, no multiplexing with data.For frequency hopping: Type I, 1 or 2 DMRS symbol for each hop, no multiplexing with data.PUSCH mapping Type and DMRS position are reported by companies.Working assumption:For 3km/h: Type I, 1 or 2 DMRS symbol, no multiplexing with data. |
| Waveform for PUSCH | DFT-s-OFDM, CP-OFDM (optional) |
| Repetitions for PUSCH | For eMBB, w/o repetition as baseline, w/ repetition (optional).  For VoIP, w/ repetition. The actual number of repetitions is reported by companies.FFS: Repetition type B |
| HARQ configuration for PUSCH | For eMBB, whether HARQ is adopted is reported by companies. For VoIP, w/ HARQ.The maximum number of HARQ transmission (limited by frame structure and latency requirements) can be reported by companies. |
| Latency requirements for voice | 50ms/100ms |
| PUSCH duration  | 14 OS |

Agreements

* For link level simulation, adopt the following table for PUCCH for FR1.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| PUCCH format type | Format 1, 2bits UCI.Format 3, [4bits (3 bits A/N + 1 bit SR)]/11/22 bits UCI |
| BLER for PUCCH | For PUCCH format 1: DTX to ACK probability: 1%. NACK to ACK probability: 0.1%.ACK missed detection probability: 1%.For PUCCH format 3: BLER for Ack/Nack, SR: 1%FFS: BLER for CSI (10% or 1%) |
| Number of PRBs for PUCCH | 1 PRB |
| Number of UE transmit chains for PUCCH | 1 |
| Number of repetitions for PUCCH | w/ repetition (optional), w/o repetition for PUCCH.The maximum number of repetitions is 8. |
| PUCCH duration  | 14 OS |
| DMRS configuration for PUCCH | FFS: number of DMRS symbols for PUCCH Format 3. |

Agreements:

* For link level simulation, adopt the following table for eMBB data or VoIP on PUSCH and for PUCCH for FR1.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Number of ~~receive~~ antenna elements for BS | Urban: 192 antenna elements for 4GHz and 2.6GHz, (M,N,P,Mg,Ng) = (12,8,2,1,1)(optional) 128 antenna elements for 4GHz, (M,N,P,Mg,Ng) = (8,8,2,1,1)Rural: 64 antenna elements for 4GHz and 2.6GHz(M,N,P,Mg,Ng) = (8,4,2,1,1)32 antenna elements for 2GHz(M,N,P,Mg,Ng) = (8,2,2,1,1)16 antenna elements for 700MHz(M,N,P,Mg,Ng) = (4,2,2,1,1) |
| Number of ~~receive~~ TxRUs for BS | ~~TBD~~gNB architectures to study ~~for TDL~~:* 2 or 4 TXRUs for 2GHz, 700 MHz
* 64TxRUs for 2.6 and 4 GHz.
* Optional: 32 TXRUs at 2 GHz

~~[~~gNB modeling in LLS for TDL:* Option 1: 2 or 4 gNB receive chains in LLS ~~(as starting point)~~. FFS: correlation
* Option 2: Number of gNB receive chains = number of TXRUs in LLS. FFS: correlation.~~]~~

[gNB architectures to study for CDL: * Urban: 64 receive chains for 2.6 and 4 GHz in LLS
* Rural: 8 receive chains for 4GHz and 2.6GHz in LLS
* 4 receive chains for 2GHz and 700MHz in LLS.]

[gNB modeling in LLS for CDL: Number of gNB receive chains = number of TXRUs in LLS.] |
| Delay spread | Urban: 300nsRural: 300nsRural with long distance: 30ns |
| PRBs/TBS/MCS for eMBB for PUSCH | Any value of PRBs, and corresponding MCS index, reported by companies will be considered in the discussion. Companies are encouraged to use 30 PRBs for 1Mbps, 4 PRBs for 100kbps, 1 PRB for 30kbps as a starting point.TBS can be calculated based on e.g. the number of PRBs, target data rate, frame structure and overhead. |
| PRBs/MCS for VoIP for PUSCH | [4 PRBs] for VoIP as starting point. Other values of PRBs can be reported by companies.QPSK, pi/2 BPSK (optional) |

Note: For TDL models, companies report whether antenna array gain, ~~obtained from mapping antenna elements to TXRU,~~ is included in LLS or link budget template. Array gain calculation method and how channel estimation is accounted for is reported by companies

Agreements:

* Adopt the following target data rates for eMBB performance evaluation for FR2.
* Indoor: DL: 25Mbps, UL:5Mbps
* Urban: DL: 25Mbps, UL: 5Mbps
* Suburban: FFS: (DL: 1Mbps, UL: 50kbps)

Other proposals?

* # Number of receive TxRUs for BS – 6/15
* Others?

Update on 6/17

Regarding # Number of receive TxRUs for BS – see the update of the agreement above.

Agreements:

* ~~For link level simulation, adopt the following table for SSB for FR1.~~

|  |  |
| --- | --- |
| **~~Parameters~~** | **~~Values~~** |
| ~~Periodicity~~ | ~~20ms~~ |
| ~~Performance metric~~ | ~~Combination of 4 SSBs in 80ms.~~ |
| ~~Other parameters~~ | ~~Reported by companies.~~ |

* For link level simulation, adopt the following table for Msg.3 for FR1.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Number of PRBs | 2 |
| Waveform | DFT-s-OFDM |
| Number of DMRS symbol | w/o frequency hopping: 3,w/ frequency hopping: 2 for each hop |
| PUSCH duration | 14 OS |
| Other parameters | Reported by companies. |

Other proposals 6/18

Update on 6/18:

Agreements:

* For link level simulation, adopt the following table for PDCCH for FR1.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Aggregation level | 16 |
| Payload | 40 bits |
| CORESET size | 2 symbols, 48 PRBs |
| Tx Diversity | Reported by companies |
| BLER for PDCCH | 1% BLERFFS: 10% BLER |
| Number of SSB for broadcast PDCCH of Msg.2 | Reported by companies |
| Other parameters | Reported by companies |

Agreements:

* For link level simulation, adopt the following table for SSB for FR1.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Periodicity | 20ms |
| Performance metric | Combination of 4 SSBs in 80ms.Note: UE is not assumed to know the SS/PBCH block index |
| Other parameters | Reported by companies. |

Agreements:

* For link level simulation, adopt the following table for PRACH for FR1.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Format | Format 0, Format B4, or Format C2 |
| SCS | Reported by companies. |
| Performance metric | 1% missed detection at 0.1% false alarm probabilityFFS: 10% missed detection. |
| Other parameters | Reported by companies. |

Agreements:

* For link level simulation, for PDSCH of Msg.4 for FR1.
	+ Reuse the following simulation assumption for PDSCH
		- Waveform, [PDSCH duration]
	+ FFS: Payload size: [3000bits].
	+ Other parameters: Reported by companies.

Agreements:

* For link level simulation, for SSB, PDCCH, PDSCH and PDCCH of Msg.2, PDSCH of Msg.4 and PDSCH for FR1.
	+ Reuse following simulation assumptions agreed for PUSCH.
		- Scenario and frequency, frame structure, SCS, pathloss model, channel model, delay spread, UE velocity, number of antenna elements and TxRUs for BS.
	+ The number of UE receive chains: ~~is 2.~~
		- 4 for 4GHz/2.6GHz
		- 2 or 4 for 2GHz
		- 2 for 700MHz
	+ For PDSCH, reuse ~~DM-RS configuration,~~ BLER, HARQ, Latency requirements for voice agreed for PUSCH.
		- Reuse DM-RS configuration agreed for PUSCH except that 3 DMRS symbols is used for Msg2.
* For link level simulation, for PRACH and Msg.3 for FR1.
	+ Reuse following simulation assumptions agreed for PUSCH
		- Scenario and frequency, frame structure, pathloss model, channel model, delay spread, UE velocity, number of antenna elements and TxRUs for BS and Number of UE transmit chains.
	+ For Msg.3, reuse SCS, HARQ configuration, frequency hopping agreed for PUSCH.

Agreements:

* For link level simulation, adopt the following table for eMBB data or VoIP on PUSCH and on PDSCH for FR2.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| BLER | For eMBB, w/ HARQ, 10% iBLER, Optional: companies report rBLER.w/o HARQ, 10% iBLER.For VoIP, 2% rBLER. |
| DMRS configuration | For 30km/h (optional: 120km/h): Type I, 2 or 3 DMRS symbol, no multiplexing with data.For frequency hopping for PUSCH: Type I, 1 or 2 DMRS symbol for each hop, no multiplexing with data.PUSCH/PDSCH mapping Type and DMRS position are reported by companies.Working assumption:For 3km/h: Type I, 1 or 2 DMRS symbol, no multiplexing with data. |
| Waveform | DFT-s-OFDM for PUSCH, CP-OFDM for PDSCHFFS: CP-OFDM for PUSCH |
| Repetitions for PUSCH/PDSCH | For eMBB, w/o repetition as baseline, w/ repetition (optional).  For VoIP, w/ repetition. The actual number of repetitions is reported by companies.FFS: Repetition type B for PUSCH. |
| HARQ configuration for PUSCH/PDSCH | For eMBB, whether HARQ is adopted is reported by companies. For VoIP, w/ HARQ.The maximum number of HARQ transmission (limited by frame structure and latency requirements) can be reported by companies. |
| PUSCH/PDSCH duration | 14 OS for PUSCH, 12 OS for PDSCH |

Agreements:

* For link level simulation, adopt the following table for eMBB data or VoIP on PUSCH and on PDSCH for FR2.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Number of antenna elements for BS | Indoor scenario: 128(M, N, P, Mg, Ng) = (8, 8, 2, 1, 1)Urban/suburban scenario: 256, (M,N,P,Mg,Ng) = (4, 8, 2, 2, 2)Optional: 512, (M,N,P,Mg,Ng) = (8,8,2,2,2) |
| Number of TxRUs for BS | 2Note: Analog beamforming is assumed. |
| Number of UE Tx/Rx chains | 1T2R, 2T2R |
| Channel model for link-level simulation | CDL- A, TDL-A, [urban/suburban: TDL-C]Note: company can provide simulation results based on either TDL channel or CDL model |
| Delay spread | Indoor scenario: 30nsUrban scenario: 100nsSuburban scenario: 100ns |
| Latency requirements for voice | 50ms/100ms |
| PRBs/TBS/MCS for eMBB for PUSCH/PDSCH | Any value of PRBs, and corresponding MCS index, reported by companies will be considered in the discussion. Companies are encouraged to use [30] PRBs for 5Mbps for PUSCH and full bandwidth for 25Mbps for PDSCH as a starting point.TBS can be calculated based on e.g. the number of PRBs, target data rate, frame structure and overhead. |
| PRBs/MCS for VoIP for PUSCH/PDSCH | [4 PRBs] for VoIP as starting point. Other values of PRBs can be reported by companies.QPSK for PDSCH/PUSCHOptional: pi/2 BPSK for PUSCH |

Agreements:

* For link level simulation, adopt the following simulation assumption for eMBB data or VoIP on PUSCH and on PDSCH for FR2.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Number of UE antenna elements | 8, one panel:(M, N, P) = (2,2,2), FFS: Two panels in link budget, one panel in LLS, 16 for each panel: (M, N, P) = (4,2,2) |

Agreements:

* For link level simulation, adopt the following table for PUCCH for FR2.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Format | Format 1, 2bits UCI.Format 3, [4bits (3 bits A/N + 1 bit SR)]/11/22 bits UCIFFS: Format 0, 2 |
| BLER for PUCCH | The same as FR1 |
| Number of PRBs for PUCCH | The same as FR1 |
| Number of UE transmit chains for PUCCH | The same as FR1 |
| Number of repetitions for PUCCH | The same as FR1 |
| PUCCH duration | 14 OFDM symbolsFFS: 4 OFDM symbols |
| DMRS configuration for PUCCH | FFS: [4] DMRS symbols for PUCCH Format 3. |

Agreements:

* For link level simulation, adopt the following table for PDCCH for FR2.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Aggregation level | 16 |
| Payload | 40 bits |
| CORESET size | 2 symbols, 48PRBs  |
| Tx Diversity | Reported by companies |
| BLER for PDCCH | 1% BLER.FFS: 10% BLER |
| Number of SSB for broadcast PDCCH of Msg.2 | Reported by companies |
| Other parameters | Reported by companies |

Agreements:

* For link level simulation, adopt the following table for PRACH for FR2.

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Format | Format B4, (Optional: Format C2) |
| SCS | Reported by companies. |
| Performance metric | 0.1% false alarm, 1% miss-detectionFFS: 10% missed detection. |
| Number of SSB beams | Reported by companies |
| Other parameters | Reported by companies. |

Agreements:

* For link level simulation, for SSB, PDCCH, PDSCH and PDCCH of Msg.2, PDSCH of Msg.4 for FR2.
	+ Reuse following simulation assumptions for PDSCH
		- Scenario and frequency, frame structure, SCS, channel model, delay spread, UE velocity, number of antenna elements and TxRUs for BS, number of UE Tx/Rx chains and UE antenna elements.
* For link level simulation, for PUCCH, PRACH and Msg.3 for FR2.
	+ Reuse following simulation assumptions for PUSCH
		- Scenario and frequency, frame structure, channel model, delay spread, UE velocity, number of antenna elements and TxRUs for BS, number of UE antenna elements for PUSCH.
	+ For PRACH and Msg.3, reuse number of UE Tx chains for PUSCH.
	+ For PUCCH, reuse SCS for PUSCH.
	+ For Msg.3, reuse SCS, HARQ configuration, frequency hopping for PUSCH.

Final summary in R1-2005192.

# Annex 2 – Agreements at RAN1#102e

Agreements:

* TDL models are used to generate results in the link budget templates for FR1
	+ This does not preclude companies from performing the link-level simulations using CDL

Agreements (for both FR1 & FR2):

* For the definition of antenna array gain, adopt option 1, i.e. Antenna array gain is included in the link budget template, where there are four antenna gain components
	+ Note: the four components are illustrated below – the figure is for illustration purpose only
	+ FFS which component(s) are NOT part of the definition of antenna array gain
* 

Agreements:

* For TDL Option 1
	+ Definition of MCL
		- Total transmit power - Receiver sensitivity + gNB antenna gain (component 2)
	+ Definition of MIL
		- Total transmit power - Receiver sensitivity + gNB antenna gain (component 2 + 3 + 4) + UE antenna gain
	+ Definition of MPL
		- Further discussion offline the definition using below as a starting point:
			* Total transmit power - Receiver sensitivity + gNB antenna array gain (component 2+3+4 for TDL option 1) + UE antenna gain - (8) Cable, connector, combiner, body losses (Tx side) - (20) Receiver implementation margin + (21a/b) H-ARQ gain - (25a/b) Shadow fading margin + (26) BS selection/macro-diversity gain - (27) Penetration margin + (28) Other gains – (12) Cable, connector, combiner, body losses (Rx side)
	+ Note: whether/how to use the above definitions is to be discussed

Update on 8/20: to check on 8/21

Update on 8/21: to check on 8/24

Update from GTW on 8/24

Agreements:

* Adopt single link budget template for both FR1 and FR2 based on IMT-2020 self-evaluation with rows for MIL, MCL, MPL, and necessary revisions, including adding/removing/revising/simplifying some parameters
	+ [For LLS based methodology, ]coverage bottleneck(s) identification is performed using at least [MCL and] MIL.
	+ [MCL values can also be considered to compare channels with similar antenna (and antenna array) gain]

Agreements:

* MPL can be used as supplemental information for coverage bottleneck(s) identification
* The results based on MPL are to be captured in TR
	+ Note: this is uself to show the achievable ISD.
* The definition of MPL shall be determined in RAN1
* RAN1 will not further discuss on specific values for the parameters related to MPL
	+ IMT-2020 values are as a starting point, but:
		- companies may use other values, and
		- for the parameters that companies think IMT-2020 self-evaluation does not clearly define the values for some scenarios, it is up to companies to report

Agreements:

* RAN1 strives for satisfying appropriate targets identified by companies particularly operators
	+ The targets may be in the form of one or more of the following:
		- 1. Scenario dependent targets, e.g., ISD/MPL
		- 2. Service dependent targets, e.g., [MCL=147] dB for VoIP;
		- 3. Relative difference between channels, e.g, MIL(/[MCL])
	+ Further values and details of such targets will be clarified at RAN1#103-e
	+ Note: there is no intention in RAN1 to update the study item objectives due to the identified targets.

Agreements:

* Adopt single link budget template for both FR1 and FR2 based on IMT-2020 self-evaluation with rows for MIL, MCL, MPL, and necessary revisions, including adding/removing/revising/simplifying some parameters
	+ For LLS based methodology, coverage bottleneck(s) identification is performed using at least MIL or MCL (assuming the set of simuation assumptions)
		- Even when SLS is used to obtain some components of MIL or MCL, it is categorized as LLS based methodology.
		- MCL values can also be used to identify the coverage bottleneck(s) when applicable
			* “applicable” above means the following situation:
				+ [comparing channels with similar antenna (and antenna array) gain, and/or
				+ the simulation results with MIL from companies are diverse, and the comparison with MIL is not easy]

Update on 8/27:

Agreements:

* for SIP invite message
	+ Payload of 1500 bytes can be a starting point.
	+ The assumptions (TB size, time period etc.) are reported by companies.
	+ Contributions R1-2003464 and [R1-2005259](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2005259.zip) are taken into account for the evaluation.
		- In addition, 1 second time period can also be considered.

Agreements:

For PDSCH, other parameters are reported by companies.

Agreements:

* Confirm the working assumption on DMRS configuration for PUSCH:
	+ For 3km/h: Type I, 1 or 2 DMRS symbol, no multiplexing with data.
* The number of DMRS symbols is reported by companies

Agreements:

* Update the description on Repetitions for PUSCH as follows:
	+ For VoIP, w/ type A repetition. (optional for type B repetition)
	The actual number of repetitions is reported by companies.
	~~FFS: Repetition type B~~

Agreements:

* Update the row for BLER for PUCCH as follows:
	+ ~~FFS:~~ BLER for CSI (~~10% or~~ 1%, (optional for 10%) )

Agreements:

|  |  |
| --- | --- |
| Number of TxRUs for BS | gNB modelling in LLS for TDL:* ~~Option 1:~~ 2 or 4 gNB receive chains in LLS. ~~FFS:~~
* Optional ~~Option 2~~: Number of gNB receive chains = number of TXRUs in LLS~~. FFS: correlation.~~
* Companies can report if and how correlation is modelled
 |

Agreements:

* Remove the whole bullets about gNB architectures to study for CDL and gNB modelling in LLS for CDL
* Note: if CDL is used for link level simulation for a certain purpose, the assumption for the number of TxRUs for BS is reported by companies, which implies that the assumption will be captured in the TR.

Agreements:

* The same PDSCH duration as PDSCH is used for Msg.4 PDSCH (i.e. remove the square bracket)
	+ Note: this does not preclude Msg4 with retransmission as a baseline.

Agreements:

* Update the BLER for PDCCH as follows:

|  |  |
| --- | --- |
| BLER for PDCCH | 1% BLER~~FFS:~~ (optional for 10% BLER) |

Agreements:

* The agreement at RAN1#101-e remains: the simulation assumptions for SLS are up to companies’ reports
* The target performance of SLS based methodology, it is recommended to refer the agreements for LLS based methodology as much as possible.
* Note: these proposals are not necessary to be captured in the chairman’s note.

Update from 8/28 GTW

Agreements:

Update the agreements as follows:

* For VoIP performance evaluation based on link-level simulation for FR1

 A packet size of ~~[~~320bits~~]~~ with 20ms data arriving interval is adopted, ~~which component is as follows~~:

|  |  |
| --- | --- |
|   | Size (bits) |
| Payload | 256 |
| CRC | 16 (TBS size lower than 3824 bits) |
| MAC | 16 (with 12 bits SN size) |
| RLC | 8 (with 6 bits SN size) |
| PDCP | 16 |
| RTP/UDP/IP | 24 (w RoHC) |
|   |   |

~~­      The following packet component for AMR-WB 12.65 (kbit/s) is optionally adopted.~~

|  |  |
| --- | --- |
|  | ~~Size (bits)~~ |
| ~~Payload~~ | ~~264~~ |
| ~~CRC~~ | ~~16 (TBS size lower than 3824 bits)~~ |
| ~~MAC~~ | ~~16 (with 12 bits SN size)~~ |
| ~~RLC~~ | ~~8 (with 6 bits SN size)~~ |
| ~~PDCP~~ | ~~16~~ |
| ~~RTP/UDP/IP~~ | ~~32 (w RoHC)~~ |
|  |  |

~~­      [A packet size of 160 bits with 20ms data arriving interval is optionally adopted for rural scenario with long distance]~~

­      If applicable, companies report TB size assumed in evaluation

Agreements:

* For the evualation, it is assumed that Msg. 4 PDSCH payload size is 1040 bits.

Agreements:

* For receiver interference density
	+ Up to each company to report for all scenarios as baseline
		- E.g. obtained by SLS, the ones for ITU self-evulation, etc.

Agreements:

Further clarify the agreement on antenna gain and antenna gain components including antenna gain correction factors as follows:

* For both TDL option 1 (table A below) and TDL option 2 & CDL (table B below)
	+ The gain of antenna gain component 1 is included in LLS results
	+ The gain of antenna gain component 2 is included in link budget template
		- The gain is expressed by 10 \* log 10( N/k ) - Δ1
		- For TDL option 2 & CDL, the gain is 0 dB
	+ The gain of antenna gain component 3 is included in link budget template
	+ The gain of antenna gain component 4 is included in link budget template
		- The gain of antenna gain components 3 and 4 is expressed by Antenna Element Gain + 10 \* log 10( M/N ) -Δ2
		- For Tx, One row is used represent the gain of antenna gain component 3 + 4, i.e. row No. (4)
		- For Rx, One row is used represent the gain of antenna gain component 3 + 4, i.e. row No. (11)
		- Note: more appropriate name or explanation will be added to row No.(4) and (11). Details can be discussed when the link budget template is updated.

Agreements:

* Define PSD for DL Tx power, which is depend on deployment scenario
	+ For 4GHz frequency,
		- For rural with long distance scenario, PSD is 24 and 33 dBm/MHz
		- For rural scenario, PSD is 24 and 33 dBm/MHz
		- For urban scenario, PSD is 24 and 33 dBm/MHz
	+ For 2.6 GHz frequency,
		- For rural with long distance scenario, PSD is 33 dBm/MHz
		- For rural scenario, PSD is 33 dBm/MHz
		- For urban scenario, PSD is 33 dBm/MHz
	+ For 700MHz, 2GHz frequency
		- For rural with long distance scenario, PSD is 36 dBm/MHz
		- For rural scenario, PSD is 36 dBm/MHz
		- For urban scenario, PSD is 36 dBm/MHz
* Modify the description of row(s) of link budget template:
	+ Keep the meaning of Total transmit power (row (3) ) and adding a new row (3 bis):
		- (3bis) means the transmit power for occupied channel bandwidth for control channel (17a) or data channel (17b)
* Companies are requested to set appropriate values for parameters, which is used to determine total transmit power ( row (3) and/or (3bis) ), to satisfy the PSD value above
* Note: RAN1 will further check the consistency of the definition of row(s) in link budget table when the IMT-2020 based link budget tale is updated

Agreements:

For FR1 and FR2:

* Further clarify the Definition of MCL for downlink
	+ Total transmit power – Receiver sensitivity + gNB antenna gain (component 2), where
		- Total transmit power corresponds to row No.(3) + {(6) or -(7)} (for control & data channels)
		- Receiver sensitivity corresponds to row No.(22a/22b)
* Further clarify the Definition of MIL for downlink
	+ Total transmit power – Receiver sensitivity + gNB antenna gain (component 2 + 3 + 4) + UE antenna gain, where
		- Total transmit power + gNB antenna gain (component 2 + 3 + 4) corresponds to row No.(9a/9b), i.e.
			* (3) + (4) + (5) + (6) – (8) for control channel
			* (3) + (4) + (5) – (7) – (8) for data channel
			* Note: the derivation of (9a/9b) will be modified depending on the discussion on antenna gain & antenna gain correction
		- Receiver sensitivity corresponds to row No.(22a/22b)
		- (Working assumption for FR2) UE antenna gain corresponds to row No.(11)+No(11bis)
* Note: further refinement/definition of (3) and/or (22a/22b) can be discussed when link budget table is updated.

Agreements:

Definition of MPL for TDL option 1

* MPL = MIL + [(21a/b) H-ARQ gain] – [ (25a/b) Shadow fading margin – (27) Penetration margin ] + [(26) BS selection/macro-diversity gain ] + [(28) Other gains] – [(12) Cable, connector, combiner, body losses (Rx side) ]
* Note1: (8) is not necessary because it is included in the definition of MIL
* Note2: (20) is not necessary because it is included in receiver sensitivity, which is used to derive MIL

Update on 8/28:

Agreements:

·         As for the agreement on antenna gain and antenna gain components including antenna gain correction factors, Table A and Table B are defined as below



Table A. antenna gain components for TDL option 1



Table B. antenna gain components for TDL option 2 and CDL

Agreements:

* Latency requirements assumed in VoIP evaluation for TDD and FDD are reported by companies

Agreements:

* For link level simulations in FR2, only PUCCH format 1 and format 3 are considered for baseline performance evaluation.
* For link level simulations in FR2, only PUCCH duration of 14 OFDM symbols is considered for baseline performance evaluation.
* For link level simulations in FR2, consider 4 DMRS symbol for PUCCH Format 3.
* Consider only one panel at the UE in link budget in FR2.
* For link budget calculation in FR2, downlink transmit power is scaled by the occupied bandwidth. The following downlink transmit power vs occupied bandwidth values are considered as baseline for the calculations:
	+ 40 dBm for 100 MHz Urban scenario,
	+ 23 dBm for 100 MHz Indoor scenario.
* For link budget calculation in FR2, an uplink transmit power of 23dBm is considered for baseline performance evaluations. Other values can be reported by companies.
* Confirm the target throughput values of the REL-17 SID for the suburban scenario:
	+ DL: 1 Mbps, UL: 50 kbps
* Study performance of PUSCH in FR2 only for DFT-s-OFDM.
* For link level simulations, only 1% BLER should be considered for baseline performance evaluation of PDDCH in FR2.
* For link level simulations in FR2, only PUSCH repetition type A is considered for baseline performance evaluation.
	+ Note: companies are not precluded to report results for repetition type B.
* Suburban scenario is deprioritized for NR coverage enhancement SI.
* Baseline performance evaluation of msg1 transmission is studied for 1% missed detection probability in FR2.
* Only 1% BLER target should be considered for baseline performance evaluation of PUCCH in FR2, regardless of whether UCI includes CSI feedback or not.
* Simulation assumptions for SLS in FR2 are up to companies’ reports, i.e., no more clarification is needed, as per agreement during RAN1#101-e.

# Annex 3 – Agreements at post-email discussion of RAN1#102e

**Agreement:**

* Antenna array gain at a UE for FR1 and FR2 is clarified as follows:
	+ The meaning of *k, N* and *M:*
		- $k$ is the number of Tx/Rx chains, e.g., number of SRS/CSI-RS ports to be simulated in LLS.
		- $M$ is the number of antenna elements used both for transmission and reception, i.e., $\frac{M}{2}$ xpol antenna elements.
		- A formal definition of *N* is not necessary for UE antenna array gain modeling.
	+ The values for *k* and the relationship between *k* and *M* are clarified as follows:
		- For FR1, *k* = *M* is assumed for the simulations, and
			* $k=1$ for Tx (optional *k* = 2)
			* $k\in \{2,4\}$ for Rx
		- For FR2, there are two possibilities for simulations:
			* $k\in \{1,2\}$; for Tx and $k=2$ for Rx; or
			* $k=M$.
	+ Antenna array gain in transmission/reception to input in link budget template is given by
		- $Antenna Element Gain+10\*log\_{10}\left(\frac{M}{k}\right)-Δ3$, where
			* $Δ3(\geq 0 \left[dB\right]) $is a correction factor to account for various non-idealities impacting the actual antenna array gain, if any
				+ For FR1, $Δ3=0$.
				+ For FR2, 3 is channel procedure/dependent, and reported by companies.
* The values for antenna element gain:
	+ 0 dBi for FR1
	+ 5 dBi for FR2

**Agreement:**

* The working assumption for FR2 is updated as follows:
	+ UE receive antenna gain ~~corresponds to row~~ is given by row No.(11) + row No. (11bis) -$ Δ3$
* UE transmit antenna gain is given by row No. (4) + row No. (5) -$ Δ3$

**Agreement**

* The agreement on the definition of MIL for downlink is updated by adding Rx loss as follows:
	+ Total transmit power – Receiver sensitivity – Rx loss + gNB antenna gain (component 2 + 3 + 4) + UE antenna gain, where
		- Rx loss corresponds to row No. (12)
* MPL = MIL – (25a/b) Shadow fading margin + (26) BS selection/macro-diversity gain – (27) Penetration margin + (28) Other gains ~~[– (12) Cable, connector, combiner, body losses (Rx side) ]~~
* It is confirmed that H-ARQ gain is included in sensitivity
	+ H-ARQ gain should be included in LLS. In this case, “(21a/b) H-ARQ gain” is set to zero
	+ If not, “(21a/b) H-ARQ gain” can be used for companies report
* Note: as per the former agreement, the values for rows (25a/b) (26) (27) (28) and (12) are left to companies’ report, which includes the values for IMT-2020 self evaluation and/or using 0 dB
* Note: (12) Cable, connector, combiner, body losses (Rx side) is not included in MCL, but included in MIL and MPL
* The definition of MCL, MIL and MPL for TDL Option 2 & CDL is the same as that for TDL option 1
* Note: The agreements on MIL, MCL and MPL definition is used to show which components of link budget template are included / not included. The sophistication of MIL, MCL and MPL formula will be discussed under [102-e-Post-NR-CovEnh-02] email discussion by using draft link budget template prepared by the FL.
* ~~Note: Companies are encouraged to further check the values for (12) Rx losses proposed by a company, in addition to the values used for IMT-2020 self-evaluation~~
	+ ~~feeder loss at gNB (1dB for 700MHz, 0dB for 4GHz with AAS)~~
	+ ~~0dB for the loss at UE~~

**proposal 1:**

* Agree the following link budget template

|  |
| --- |
| **Transmitter** |
| (1) Number of transmit antenna elements. |
| (2) Number of [~~(~~transmit TxRUs~~) or (modelled transmit chains)~~]Note: this row is void (left empty) for uplink |
| (2a) Number of transmit chains modelled in LLS |
| (3) Total transmit power (dBm) Note: total transmit power for system bandwidth  |
| (3a) System bandwidth for downlink, or occupied bandwidth for uplink (Hz) |
| (3b) Power Spectrum Density = (3) - 10 log( (3a) / 1000000 ) (dBm/MHz) Note: For FR1 downlink, (3b) should satisfy the following:  For 4GHz frequency, 24 and 33 For 2.6 GHz frequency, 33 For 700MH and 2GHz frequency, 36Note: For FR2 downlink, the following should be satisfied: 40 dBm for 100 MHz Urban scenario, 23 dBm for 100 MHz Indoor scenario.Note: no PSD constraint for uplink |
| (3c) Bandwidth used for the evaluated channel (Hz)Note: (3c) is identical to the number of PRBs assigned to the channel evaluated. For uplink, (3a) = (3c)  |
| (3bis) Total transmit power for occupied bandwidth = (3b) + 10 log ( (3c) / 1000000 ) (dBm) |
| (4) Total antenna gain at antenna gain component 3 & antenna gain component 4 of transmitter = (4a) – (4b) (dB) |
| (4a) Antenna gain at antenna gain component 3 & antenna gain component 4 of transmitter = (4c) + 10 log ( (1) / (2) ) (dB) for downlink, and = (4c) + 10 log ( (1) / (2a) ) (dB) for uplink |
| (4b) Antenna gain correction factor at antenna gain component 3 & antenna gain component 4 of transmitter (dB) |
| (4c) Gain of antenna element (dBi)  |
| (5) Total antenna gain at antenna gain component 2 of transmitter = (5a) - (5b) (dB)Note: zero for uplink |
| (5a) Antenna gain at antenna gain component 2 of transmitter = 10 log( (2)/(2a)) (dB)Note: zero for uplink |
| (5b) Antenna gain correction factor at antenna gain component 2 of transmitter (dB)Note: zero for uplink |
| (8) Cable, connector, combiner, body losses, etc. (enumerate sources) (dB) (feeder loss must be included for and only for downlink) |
| (9) EIRP = (3bis) + (4) + (5) – (8) dBm |
| **Receiver** |
| (10) Number of receive antenna elements |
| (10a) Number of [ ~~(~~receive TxRUs~~) or (modelled receive chains)~~]Note: this row is void (empty) for downlink |
| (10b) Number of receive chains modelled in LLS |
| (11) Total antenna gain at antenna gain component 3 & antenna gain component 4 of receiver = (11a) - (11b) (dB)  |
| (11a) Antenna gain at antenna gain component 3 & antenna gain component 4 of receiver  = (11c) + 10 log ( (10)/(10a) ) (dB) for uplink = (11c) + 10 log ( (10)/(10b) ) (dB) for downlink |
| (11b) Antenna gain correction factor at antenna gain component 3 & antenna gain component 4 of receiver (dB) |
| (11c) Gain of antenna element (dBi) |
| (11bis) Total antenna gain at antenna gain component 2 of receiver = (11bis-a) - (11bis-b) (dB)Note: zero for downlink |
| (11bis-a) Antenna gain at antenna gain component 2 of receiver = 10 log( (10a)/(10b)) (dB)Note: zero for downlink |
| (11bis-b) Antenna gain correction factor at antenna gain component 2 of receiver (dB)Note: zero for downlink |
| (12) Cable, connector, combiner, body losses, etc. (enumerate sources) (dB) (feeder loss must be included for and only for uplink) |
| (13) Receiver noise figure (dB) |
| (14) Thermal noise density (dBm/Hz) |
| (15) Receiver interference density (dBm/Hz)  |
| (16) Total noise plus interference density = 10 log (10^(( (13) + (14))/10) + 10^((15)/10)) (dBm/Hz) |
| (18) Effective noise power = (16) + 10 log ((3c)) (dBm) |
| (19) Required SNR (dB) |
| (20) Receiver implementation margin (dB) |
| (21) H-ARQ gain (dB)Note: Only applicable if HARQ is not considered in LLS |
| (22) Receiver sensitivity = (18) + (19) + (20) – (21) (dBm) |
| (22bis) MCL = (3bis) – (22) + (5) + (11bis) (dB) |
| (23) Hardware link budget, a.k.a. MIL = (9) + (11) + (11bis) − (12) − (22) (dB)Note: MIL can also be derived by (22bis) + (4) – (8) + (11) − (12) |
| **Calculation of available pathloss** |
| (25) Shadow fading margin (function of the cell area reliability and lognormal shadow fading std deviation) (dB) |
| (26) BS selection/macro-diversity gain (dB) |
| (27) Penetration margin (dB) |
| (28) Other gains (dB) (if any please specify) |
| (29) Available path loss = (23) – (25) + (26) – (27) + (28) (dB) |
| **Range/coverage efficiency calculation** |
| (30) Maximum range (based on (29) and according to the system configuration section of the link budget) (m) |

**proposal 2:**

* The values for following parameters are provided together with the link budget template
	+ The details how to provide the values (i.e. by introducing rows in the same/different tab, by different excel file, by different tabs, etc. ) is up to rapporteur and feature leads.

|  |
| --- |
| Scenarios |
| Carrier frequency (GHz) |
| BS antenna heights (m) |
| UT antenna heights (m) |
| Cell area reliability (%) |
| Lognormal shadow fading std deviation (dB) |
| Pathloss model (select from LoS or NLoS) |
| UE speed (km/h) |
| Channel for evaluation |
| UL-DL configuration for TDD |
| Subcarrier Spacing |
| Channel model for link level simulation |
| Frequency hopping |
| Number of PRBs, TBS and MCS |
| BWP size |
| DMRS configuration |
| Waveform |
| Repetition |
| HARQ configuration |
| Latency requirements for voice  |
| PUCCH format type |
| Tx Diversity |
| Target error rate (BLER, miss detection, false alarm, etc.) |
| PRACH format  |
| Number of SSB  |
| Correlation for TxRU at BS |
| Description on how the value in antenna gain correction factor in (4b) is derived |
| Description on how the value in antenna gain correction factor in (5b) is derived |
| Description on how the value in antenna gain correction factor in (11b) is derived |
| Description on how the value in antenna gain correction factor in (11bis-b) is derived |
| Description on how the value in (8) is derived |
| Description on how the value in (12) is derived |
| Other parameters |

**proposal 3:**

* ~~For (13) Receiver noise figure, the following values are adopted~~
	+ ~~For FR1: 7dB for UE and 5dB for BS~~
	+ ~~For FR2: 10dB for UE and 7dB for BS~~
* For ~~other~~ parameters/values with FFS, square bracket or no agreement, interested companies are encouraged to continue their assessment aiming at the final resolution at RAN1#103-e.
	+ Detailed information can be find in the attached excel spreadsheet, i.e. link-budget-template-v013
	+ Note: link-budget-template-v013 is found from the following link:
	https://www.3gpp.org/ftp/tsg\_ran/WG1\_RL1/TSGR1\_102-e/Inbox/drafts/8.8.1.1/post\_meeting/102-e-Post-NR-CovEnh-02/1-link\_budget\_template/fine\_tuning/link-budget-template-v013.xlsx