**3GPP TSG RAN WG1 Meeting #101-E R1-2004754**

**e-Meeting, May 25 – June 05, 2020**

**Source: Moderator (Intel Corporation)**

**Title: Summary of email discussions for [101-e-NR-52\_71\_GHz]**

**Agenda item: 8.1**

**Document for: Discussion**

# Introduction

In this contribution, we summarize the email discussion approved for discussion during RAN1 #101-E. Chairman has approved one email discussion thread for RAN1 #101-E for Agenda 8.1. The guidance was to focus on evaluation assumptions and if time allows (and feasible to conclude) to discuss high-level issues for NR 52.6 GHz to 71 GHz SI.

A summary of evaluation assumptions and simulation parameters from submitted contribution is available in R1-2004703 [1]. The following sections have been tagged with outline levels so that companies can easily search and move between tables and sections. Companies can go to ‘View’ panel of the Office Ribbon and select ‘Navigation Pane’ to show the outline bookmarks and click on specific outlines to go to the specific text or table.

# Email Discussion [101-e-NR-52\_71\_GHz]

It would be useful to categorize the discussion into three components, evaluation methodology for link level simulation, evaluation methodology for system level simulation, and high-level issues for supporting NR from 52.6 GHz to 71 GHz SI. The third topic, high-level issues, will be de-prioritized compared to the first two. The feature lead suggests to only aim for conclusion if wide support from numerous companies are available for specific issues.

## 2.1 Evaluation Methodology for Link Level Simulation

Moderator suggests identifying some of the evaluation objective (i.e. purpose) and related evaluation assumptions. Identification of the objective could be crucial to understand whether a single evaluation assumption is sufficient for all objectives or whether RAN1 needs to define multiple link level evaluation assumptions targeting different objective sets.

Based on contributions submitted, Moderator has identified the following evaluation objectives:

* Phase noise impact for various numerology (i.e. subcarrier spacing, and CP type)
* Performance analysis for PDSCH/PUSCH
* Performance analysis for SSB
* Channel delay spread impact for various CP type/lengths

Also put together a table for initiating discussions on the evaluation assumptions.

Table 1. Suggested harmonized link level simulation parameters as baseline for discussion

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Notes** |
| Carrier Frequency [GHz] | 60 GHz  Optional: 70 GHz |  |
| Subcarrier Spacing [kHz] | 240 kHz, 480 kHz, 960 kHz  Optional: 60 kHz, 120 kHz, 1920 kHz, 3840 kHz |  |
| Bandwidth [MHz] | 2000 MHz  Optional: 400 MHz, 500 MHz |  |
| Number of RB | For 2000 MHz:  320 (480 kHz), 160 (960 kHz), 80 (1920 kHz), 40 (3840 kHz)  For 400 MHz:  256 (120 kHz), 128 (240 kHz), 64 (480 kHz), 32 (960 kHz), 16 (1920 kHz), 8 (3840 kHz)  For 500 MHz:  330 (120 kHz), 165 (240 kHz), 82 (480 kHz), 41 (960 kHz), 20 (1920 kHz), 10 (3840 kHz) | Do not exceed 4k FFT size |
| CP Type | Normal CP, Extended CP |  |
| Channel Model | TDL-A (5ns, 10ns DS)  Optional:  TDL-D (1ns, 10ns DS)  Optional:  CDL-A (10ns, 30ns DS)  CDL-B (10ns, 20ns, 50ns DS)  CDL-D (20ns, 30ns, 40ns, 50ns DS) |  |
| Antenna Configuration (Mg,Ng,M,N,P) | For TDL model:  2x2  Optional: 1x2  For CDL model:  (1,1,8,16,2) BS, (1,1,4,4,2) UE with (0.5 dv, 0.5 dH)  Optional BS configuration:  (1,1,4,8,2), (2,2,4,8,2), (1,1,4,8,2)  Optional UE configuration  (1,1,2,4,2), (1,2,2,4,2), (1,1,2,2,2) |  |
| PA Model | Optional:  Companies to provide modeling | In lieu of pre-loaded Tx EVM |
| Tx PN Model | 3GPP TR38.803 example 2 BS  Optional:  3GPP TR38.803 example 1  Companies to provide modeling |  |
| Rx PN Model | 3GPP TR38.803 example 2 UE  Optional:  3GPP TR38.803 example 1  Companies to provide modeling |  |
| Pre-loaded Tx EVM | Optional:  3% at Tx | In lieu of PA model |
| Additive Rx EVM | Optional:  5% at Rx |  |
| I-Q Imbalance | Optional:  -26dBc, -31dBc |  |
| Channel Estimation | Realistic channel estimation |  |
| Mobility | 3 Km/hr |  |
| Transmission Rank | Rank 1  Optional: Rank1+2 adaptive, Rank 2 |  |
| PDSCH SLIV | (S=2, L=12)  Optional:  (S=3, L=11), (S=0, L=14) | Starting symbol, S, (indexed from 0) and length, L. |
| DMRS Configuration | Front loaded, 1 DMRS symbol  Optional:  2 DMRS symbol at (2,11) symbol index |  |
| PTRS Configuration | (K = 4, L = 1)  Optional:  (K = 2, L = 1) | PTRS per K number of PRBs, and PTRS every L number of OFDM symbols |
| MCS/TBS | MCS 16 (16QAM), MCS 22 (64QAM)  Optional:  MCS 1 (QPSK), MCS 7 (QPSK),  MCS 23 (256QAM), MCS 27 (256QAM) |  |
| Frequency Offset | Optional:  0.1 ppm (for data channel)  10 ppm (for initial access) |  |

**Discussion Summary:**

Companies are encouraged to provide comments on

* Evaluation objectives
  + Including whether we should define a separate evaluation parameter set for a group of objective(s) separately or whether single set of evaluation parameters is sufficient.
* Comment on individual parameters, including whether anything is missing from the evaluation parameter set.
  + Including whether or not to define ‘optional’ values or whether RAN1 should just simply provide a list of parameters without providing optionality.

Table 2. LLS Parameter Set 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter**  **Set 1** | **Evaluation Objectives** | **Carrier Frequency [GHz]** | **Subcarrier Spacing [kHz]** | **Bandwidth [MHz]** | **Number of RB** |
| **Value** | Phase noise impact for various numerology (i.e. subcarrier spacing, and CP type)  Performance analysis for PDSCH/PUSCH  Performance analysis for SSB  Channel delay spread impact for various CP type/lengths | 60 GHz    Optional: 70 GHz | 240 kHz, 480 kHz, 960 kHz    Optional: 60 kHz, 120 kHz, 1920 kHz, 3840 kHz | 2000 MHz    Optional: 400 MHz, 500 MHz | For 2000 MHz:  320 (480 kHz), 160 (960 kHz), 80 (1920 kHz), 40 (3840 kHz)    For 400 MHz:  256 (120 kHz), 128 (240 kHz), 64 (480 kHz), 32 (960 kHz), 16 (1920 kHz), 8 (3840 kHz)    For 500 MHz:  330 (120 kHz), 165 (240 kHz), 82 (480 kHz), 41 (960 kHz), 20 (1920 kHz), 10 (3840 kHz) |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Table 3. LLS Parameter Set 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter**  **Set 2** | **CP Type** | **Channel Model** | **Antenna Configuration (Mg,Ng,M,N,P)** | **Mobility** |
| **Value** | Normal CP, Extended CP | TDL-A (5ns, 10ns DS)    Optional:  TDL-D (1ns, 10ns DS)    Optional:  CDL-A (10ns, 30ns DS)  CDL-B (10ns, 20ns, 50ns DS)  CDL-D (20ns, 30ns, 40ns, 50ns DS) | For TDL model:  2x2  Optional: 1x2  For CDL model:  (1,1,8,16,2) BS, (1,1,4,4,2) UE with (0.5 dv, 0.5 dH)  Optional BS configuration:  (1,1,4,8,2), (2,2,4,8,2), (1,1,4,8,2)  Optional UE configuration  (1,1,2,4,2), (1,2,2,4,2), (1,1,2,2,2) | 3 Km/hr |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Table 4. LLS Parameter Set 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter Set 3** | **PA Model** | **Tx PN Model** | **Rx PN Model** | **Pre-loaded Tx EVM** | **Additive Rx EVM** | **I-Q Imbalance** | **Frequency Offset** |
| **Value** | Optional:  Companies to provide modeling (in lieu of pre-loaded Tx EVM) | 3GPP TR38.803 example 2 BS  Optional:  3GPP TR38.803 example 1  Companies to provide modeling | 3GPP TR38.803 example 2 UE  Optional:  3GPP TR38.803 example 1  Companies to provide modeling | Optional:  3% at Tx  (In lieu of PA model) | Optional:  5% at Rx | Optional:  -26dBc, -31dBc | Optional:  0.1 ppm (for data channel)  10 ppm (for initial access) |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

Table 5. LLS Parameter Set 4

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter Set 4** | **Channel Estimation** | **Transmission Rank** | **PDSCH SLIV** | **DMRS Configuration** | **PTRS Configuration** | **MCS/TBS** |
| **Value** | Realistic channel estimation | Rank 1  Optional: Rank1+2 adaptive, Rank 2 | (S=2, L=12)  Optional:  (S=3, L=11), (S=0, L=14)  Note: Starting symbol, S, (indexed from 0) and length, L. | Front loaded, 1 DMRS symbol  Optional:  2 DMRS symbol at (2,11) symbol index | (K = 4, L = 1)  Optional:  (K = 2, L = 1)  Note: PTRS per K number of PRBs, and PTRS every L number of OFDM symbols | MCS 16 (16QAM), MCS 22 (64QAM)  Optional:  MCS 1 (QPSK), MCS 7 (QPSK),  MCS 23 (256QAM), MCS 27 (256QAM) |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

## 2.2 Evaluation Methodology for System Level Simulation

The submitted system level simulations were utilized to obtain analysis for the following purposes:

* Channel delay spread impact for various CP type/lengths
* NR-NR multi-operator coexistence analysis
* Performance analysis for PDSCH/PUSCH
* Performance impact for using various CCA levels and LBT schemes (e.g. receiver-aided LBT, omni-directional LBT, directional LBT, etc)

Table 6. Suggested harmonized system level simulation parameters as baseline for discussion

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Notes** |
| Carrier Frequency [GHz] | 60 GHz  Optional: 70 GHz |  |
| Subcarrier Spacing [kHz] | 960 kHz  Optional: 60 kHz, 120 kHz, 240 kHz, 480 kHz, 1920 kHz, 3840 kHz |  |
| Bandwidth [MHz] | 2160 MHz  Optional: 500 MHz |  |
| Number of RB | For 2160 MHz:  340 (480 kHz), 178 (960 kHz), 89 (1920 kHz), 44 (3840 kHz)  For 500 MHz:  330 (120 kHz), 165 (240 kHz), 82 (480 kHz), 41 (960 kHz), 20 (1920 kHz), 10 (3840 kHz) | Do not exceed 4k FFT size |
| Deployment Scenario | **Indoor Office:**  Scenario A) InH open office model:  Office box 120m x 50 m, 12 BS per operator, 2 operator, BS height at 3m (ceiling), UE height 1m, ISD = 20m, BS randomly deployed within 10m x 10m virtual box    Optional:  Scenario B) small InH open office model:  Office box 20m x 20 m, 1 BS per operator, 2 operator, BS height at 3m (ceiling), UE height 1m, BS randomly deployed within 10m x 10m virtual box    Optional:  Scenario C) InH open office model:  Office box 120m x 50 m, 12 BS per operator, 1 operator, BS height at 3m (ceiling), UE height 1m, BS fixed position, ISD = 20m    Optional:  Scenario D) InH open office model:  Office box 120m x 50 m, 6 BS per operator, 2 operator, BS height at 3m (ceiling), UE height 1m, BS fixed position, ISD = 40m    Optional:  Scenario E) InH open office model:  Office box 120m x 80 m, 3 BS per operator, 2 operator, BS height at 3m (ceiling), UE height 1m, BS fixed position, a=20m, b=40m, c=20m, and d=40m  **Dense Urban:**  Scenario F) Dense Urban with 1 layer  Hexagonal grid, single layer, 3 sectors per site, 19 sites locations, BS height 10m, UE height 1.5m, ISD = 150m    Optional:  Scenario G) Dense Urban with 2 layers  Macro layer (sub 7GHz):  Hexagonal grid, single layer, 3 sectors per site, 19 sites locations  BS height 25m, UE height 1.5m, ISD = 200m, fixed BS position  Micro layer (above 52.6 GHz):  BS height 10m, UE height 1.5m, 2 operator, 1 BS per hexgrid per operator, random position within macro hexagonal grid per operator, minimum distance between TRP and UE: 10m,    **Indoor Factor Hall:**  Optional:  Indoor factory with Dense cluster & low BS (InF-DL)  Grid, 300m x 150m x 10m factor hall  ISD 50m, BS height 1.5m, UE height 1.5m, Typical clutter size 2m, Clutter height 6m, Clutter density 20%  Optional:  Indoor factory with sparse clutter & High BS (InF-SH)  Grid, 300m x 150m x 10m factor hall  ISD 50m, BS height 8m, UE height 1.5m, Typical clutter size 10m, Clutter height 2m, Clutter density 60% |  |
| UE distribution | Average of 10 UE per BS  For InH open office: 100% indoor UEs  For Dense urban: 100% outdoor UEs  For InF: 100% indoor UEs | UE randomly distributed over the entire deployment area |
| Channel Model | InH open office:  InH – office channel & PL model from TR38.901  Dense Urban:  UMi street canyon channel & PL model from TR38.901  Indoor factor:  InF channel & PL model from TR38.901 |  |
| Mobility | 3 Km/hr |  |
| BS Antenna Configuration (Mg,Ng,M,N,P) | (1,1,8,16,2) with (0.5 dv, 0.5 dH)  Optional:  (1,1,4,4,2), (1,1,8,4,2), (1,1,8,8,2), (1,1,16,16,2), (1,1,32,8,2) |  |
| BS Antenna Pattern | Antenna power pattern given in Table 7.3-1 of TR38.901  (with exception of antenna element gain) |  |
| BS Antenna element gain | 5 dBi |  |
| UE Antenna Configuration (Mg,Ng,M,N,P) | (1,1,2,4,2) with (0.5 dv, 0.5 dH)  Optional:  (1,1,1,2,2), (1,1,2,2,2), (1,1,4,4,2) |  |
| UE Antenna Pattern | Antenna power pattern given in Table 7.3-1 of TR38.901  (with exception of antenna element gain) |  |
| UE Antenna element gain | 0 dBi  Optional:  5dBi |  |
| BS Power Limitation | 40 dBm EIRP  Maximum TxP adjusted to meet EIRP limits |  |
| UE Power Limitation | 25 dBm EIRP with 21 dBm max TxP  Optional:  40dBm EIRP with 21 dBm max TxP |  |
| BS NF | 7 dB |  |
| UE NF | 13 dB  Optional:  10 dB |  |
| Transmission Rank | Rank adaptative transmission between Rank 1 and 2 |  |
| PDCCH Overhead | 2 Symbol per slot |  |
| DMRS Overhead | 1 Symbol per slot |  |
| CSI-RS Overhead | - |  |
| SRS Overhead | - |  |
| Other Overhead | - | This can include overhead from beam management, PRACH, RAR, SR, etc. |
| TDD DL/UL Ratio | - |  |
| CSI feedback | Ideal feedback |  |
| Additive Rx EVM | Optional:  5% at Rx | In lieu of PA model, Tx/Rx PN Model, I-Q imbalance, and other RF impairments |
| Traffic Model | FTP Model 3 (0.5MByte file)  Optional:  Full buffer,  FTP Model 1 (27Mbyte file)  FTP Model 3 (27Mbyte file) |  |
| UE Receiver | MMSE-IRC |  |
| Cell selection criteria | Random select from strongest RSRP with 1 dB HO Marginhysterisys |  |
| DL/UL Traffic Ratio | 50% DL, 50% UL  Optional:  100% DL, 0% UL,  80% DL, 20% UL  0% DL, 100% UL |  |

**Discussion Summary:**

Companies are encouraged to provide comments on

* Evaluation objectives
  + Including whether we should define a separate evaluation parameter set for a group of objective(s) separately or whether single set of evaluation parameters is sufficient.
* Comment on individual parameters, including whether anything is missing from the evaluation parameter set.
  + Including whether or not to define ‘optional’ values or whether RAN1 should just simply provide a list of parameters without providing optionality.

Table 7. SLS Parameter Set 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter Set 1** | **Evaluation Objectives** | **Carrier Frequency [GHz]** | **Subcarrier Spacing [kHz]** | **Bandwidth [MHz]** | **Number of RB** |
| **Value** | Channel delay spread impact for various CP type/lengths  NR-NR multi-operator coexistence analysis  Performance analysis for PDSCH/PUSCH  Performance impact for using various CCA levels and LBT schemes (e.g. receiver-aided LBT, omni-directional LBT, directional LBT, etc) | 60 GHz    Optional: 70 GHz | 960 kHz    Optional: 60 kHz, 120 kHz, 240 kHz, 480 kHz, 1920 kHz, 3840 kHz | 2160 MHz    Optional: 500 MHz | For 2160 MHz:  340 (480 kHz), 178 (960 kHz), 89 (1920 kHz), 44 (3840 kHz)    For 500 MHz:  330 (120 kHz), 165 (240 kHz), 82 (480 kHz), 41 (960 kHz), 20 (1920 kHz), 10 (3840 kHz) |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Table 8. SLS Parameter Set 2

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter Set 2** | **Deployment Scenario** | **UE distribution** | **Channel Model** |
| **Value** | **Indoor Office:**  Scenario A) InH open office model:  Office box 120m x 50 m, 12 BS per operator, 2 operator, BS height at 3m (ceiling), UE height 1m, ISD = 20m, BS randomly deployed within 10m x 10m virtual box    Optional:  Scenario B) small InH open office model:  Office box 20m x 20 m, 1 BS per operator, 2 operator, BS height at 3m (ceiling), UE height 1m, BS randomly deployed within 10m x 10m virtual box    Optional:  Scenario C) InH open office model:  Office box 120m x 50 m, 12 BS per operator, 1 operator, BS height at 3m (ceiling), UE height 1m, BS fixed position, ISD = 20m    Optional:  Scenario D) InH open office model:  Office box 120m x 50 m, 6 BS per operator, 2 operator, BS height at 3m (ceiling), UE height 1m, BS fixed position, ISD = 40m    Optional:  Scenario E) InH open office model:  Office box 120m x 80 m, 3 BS per operator, 2 operator, BS height at 3m (ceiling), UE height 1m, BS fixed position, a=20m, b=40m, c=20m, and d=40m  **Dense Urban:**  Scenario F) Dense Urban with 1 layer  Hexagonal grid, single layer, 3 sectors per site, 19 sites locations, BS height 10m, UE height 1.5m, ISD = 150m    Optional:  Scenario G) Dense Urban with 2 layers  Macro layer (sub 7GHz):  Hexagonal grid, single layer, 3 sectors per site, 19 sites locations  BS height 25m, UE height 1.5m, ISD = 200m, fixed BS position  Micro layer (above 52.6 GHz):  BS height 10m, UE height 1.5m, 2 operator, 1 BS per hexgrid per operator, random position within macro hexagonal grid per operator, minimum distance between TRP and UE: 10m,    **Indoor Factor Hall:**  Optional:  Indoor factory with Dense cluster & low BS (InF-DL)  Grid, 300m x 150m x 10m factor hall  ISD 50m, BS height 1.5m, UE height 1.5m, Typical clutter size 2m, Clutter height 6m, Clutter density 20%  Optional:  Indoor factory with sparse clutter & High BS (InF-SH)  Grid, 300m x 150m x 10m factor hall  ISD 50m, BS height 8m, UE height 1.5m, Typical clutter size 10m, Clutter height 2m, Clutter density 60% | Average of 10 UE per BS    For InH open office: 100% indoor UEs  For Dense urban: 100% outdoor UEs  For InF: 100% indoor UEs | InH open office:  InH – office channel & PL model from TR38.901    Dense Urban:  UMi street canyon channel & PL model from TR38.901    Indoor factor:  InF channel & PL model from TR38.901 |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Table 9. SLS Parameter Set 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter Set 3** | **Mobility** | **BS Antenna Configuration (Mg,Ng,M,N,P)** | **BS Antenna Pattern** | **BS Antenna element gain** | **UE Antenna Configuration (Mg,Ng,M,N,P)** | **UE Antenna Pattern** | **UE Antenna element gain** |
| **Value** | 3 Km/hr | (1,1,8,16,2) with (0.5 dv, 0.5 dH)    Optional:  (1,1,4,4,2), (1,1,8,4,2), (1,1,8,8,2), (1,1,16,16,2), (1,1,32,8,2) | Antenna power pattern given in Table 7.3-1 of TR38.901  (with exception of antenna element gain) | 5 dBi | (1,1,2,4,2) with (0.5 dv, 0.5 dH)    Optional:  (1,1,1,2,2), (1,1,2,2,2), (1,1,4,4,2) | Antenna power pattern given in Table 7.3-1 of TR38.901  (with exception of antenna element gain) | 0 dBi    Optional:  5dBi |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

Table 10. SLS Parameter Set 4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter Set 4** | **BS Power Limitation** | **UE Power Limitation** | **BS NF** | **UE NF** | **Transmission Rank** |
| **Value** | 40 dBm EIRP  Maximum TxP adjusted to meet EIRP limits | 25 dBm EIRP with 21 dBm max TxP    Optional:  40dBm EIRP with 21 dBm max TxP | 7 dB | 13 dB    Optional:  10 dB | Rank adaptative transmission between Rank 1 and 2 |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Table 11. SLS Parameter Set 5

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter Set 5** | **PDCCH Overhead** | **DMRS Overhead** | **CSI-RS Overhead** | **SRS Overhead** | **Other Overhead** |
| **Value** | 2 Symbol per slot | 1 Symbol per slot | - | - | - |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Table 12. SLS Parameter Set 6

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter Set 6** | **TDD DL/UL Ratio** | **CSI feedback** | **Additive Rx EVM** | **Traffic Model** | **UE Receiver** | **Cell selection criteria** | **DL/UL Traffic Ratio** |
| **Value** | - | Ideal feedback | - | FTP Model 3 (0.5MByte file)    Optional:  Full buffer,  FTP Model 1 (27Mbyte file)  FTP Model 3 (27Mbyte file) | MMSE-IRC | Random select from strongest RSRP with 1 dB HO Margin | 50% DL, 50% UL    Optional:  100% DL, 0% UL,  80% DL, 20% UL  0% DL, 100% UL |
| **[Company Name here]** | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] | [enter comments here] |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

## 2.3 High-level Issues for Supporting NR from 52.6 GHz to 71 GHz SI

Based on submitted contributions, we provide a summary of high-level abstracted issues for supporting NR from 52.6 GHz to 71 GHz. Please note the summary is not an exhaustive list.

1. Candidate numerology (SCS, and CP length) to be supported by RAN1 specification.
   * Discussions may include how RAN1 should conclude on determination of the candidate numerologies
   * Discussion may also include identification of any coupling with other system parameters, such as bandwidth (number of PRB), FFT size, etc
2. Candidate bandwidths (or range of bandwidth) to be supported by RAN1 specification and related considerations (e.g. maximum FFT size)
   * Discussions may include how RAN1 should conclude on determination of the candidate bandwidths
3. Identification of regulatory aspects to consider in channel access (and interference mitigation techniques) for 60GHz unlicensed NR operation
   * Some examples could be CCA sensitivity levels, time unit for measurement and back-off counters, access categories, channel bandwidth occupancy, etc.
4. Supported LBT modes of operation (e.g. omni-directional LBT, directional LBT, receiver-aided LBT, no-LBT, etc)
   * Discussion may include how RAN1 should conclude on LBT mode of operations and identification of various consideration aspects (in the decision-making process)
   * Discussions may also include whether to always mandate LBT operations or not

Other issues discussed in submitted contributions are (not an exhaustive list):

* Investigation of directional LBT
* Investigation of receiver-aided LBT
* Shared COT mechanisms
* Beam sweeping issues for SS/PBCH blocks
* Beam failure detection issues
* Potential enhancements to increase the channel access opportunities
* Energy detection threshold calculation to account for instance for the directivity of LBT, or LBT channel bandwidth
* OCB constraints and related specification impact
* FBE operations
* SSB and CORESET#0 multiplexing

**Discussion Summary:**

Companies are encouraged to provide comments on

* Identification of high-level issues/considerations
  + Including whether the above listed 4 issues above is ok
  + Including any changes and modifications to the high-level issue description
* For each high-level issue/consideration provide further comment on what RAN1 should make conclusions and agreements on.

|  |  |
| --- | --- |
| Company Name | Comments/Views |
|  |  |
|  |  |
|  |  |
|  |  |

# Conclusion of the Email Discussion [101-e-NR-52\_71\_GHz]

**Summary of email discussion outcome:**

* xxx

# Reference

1. R1-2004703, “Summary of discussions on supporting NR from 52.6 GHz to 71 GHz,” Moderator (Intel Corporation)