**3GPP TSG RAN WG1 #102-e R1-200xxxx**

**e-Meeting, August 17th – 28th, 2020**

**Agenda item:** 6.2.4

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Summary of [102-e-LTE\_TerrBcast-01]

**Document for:** Discussion and Decision

# Issue #1: Corrections for TS 36.300

In x5424 two TPs are included to add the new CPs and reference signals to TS 36.300:

***TP1.1****: {TS 36.300 Section 5.1.1}*

|  |
| --- |
| 5.1.1 Basic transmission scheme based on OFDM The downlink transmission scheme is based on conventional OFDM using a cyclic prefix. The OFDM sub-carrier spacing is *Δf* = 15 kHz. 12 consecutive sub-carriers during one slot correspond to one downlink *resource block*. In the frequency domain, the number of resource blocks, NRB, can range from NRB-min = 6 to NRB-max = 110 per CC or per Cell in case of CA or DC.  In addition, there are also four reduced sub-carrier spacings, *Δflow* = 7.5 kHz, *Δflow1* = 2.5 kHz, *Δflow2* = 1.25 kHz and *Δflow3* ≈ 0.37 kHz for both MBMS-dedicated cell and MBMS/Unicast-mixed cell.  In the case of 15 kHz sub-carrier spacing there are two cyclic-prefix lengths, corresponding to seven and six OFDM symbols per slot respectively.  - Normal cyclic prefix: TCP = 160×Ts (OFDM symbol #0) , TCP = 144×Ts (OFDM symbol #1 to #6)  - Extended cyclic prefix: TCP-e = 512×Ts (OFDM symbol #0 to OFDM symbol #5)  where Ts = 1/ (2048 × Δf)  In case of 7.5 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low = 1024×Ts, corresponding to 3 OFDM symbols per slot.  In case of 2.5 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low1 = 3072×Ts, corresponding to 1 OFDM symbol per slot.  In case of 1.25 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low2 = 6144×Ts, corresponding to 1 OFDM symbol per subframe.  In case of 0.37 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low3 = 9216×Ts, corresponding to 1 OFDM symbol per 3ms slot.  In case of FDD, operation with half duplex from UE point of view is supported.  <---------------------------Other parts are omitted -------------------------------> |

***TP1.2****: {TS 36.300 Section 5.1.4}*

|  |
| --- |
| 5.1.4 Downlink Reference signal and synchronization signals The downlink cell-specific reference signals consist of known reference symbols inserted in the first and third last OFDM symbol of each slot for antenna port 0 and 1. There is one cell-specific reference signal transmitted per downlink antenna port. The number of downlink antenna ports for the transmission of cell-specific reference signals equals 1, 2, or 4.  Physical layer provides 504 unique cell identities using Synchronization signals and resynchronization signals.  The downlink MBSFN reference signals consist of known reference symbols inserted every other sub-carrier in the 3rd, 7th and 11th OFDM symbol of sub-frame in case of 15kHz sub-carrier spacing and extended cyclic prefix; every four subcarriers in the 2nd, 4th and 6th symbol of sub-frame in case of 7.5kHz sub-carrier spacing; every four subcarriers in the single symbol of slot in case of 2.5kHz sub-carrier spacing; every six subcarriers in the single symbol of subframe in case of 1.25kHz sub-carrier spacing; and every twelve subcarriers for MBSFN reference signal pattern type 1 or every six subcarriers for MBSFN reference signal pattern type 2 in the single symbol of 3ms slot in case of 0.37kHz sub-carrier spacing.  In addition to cell-specific reference signals and MBSFN reference signals, the physical layer supports UE-specific reference signals, positioning reference signals, CSI reference signals, and discovery signals.  A UE may assume presence of the discovery signals consisting of cell-specific reference signals, primary and secondary synchronization signals, configurable resynchronization signals, and configurable CSI reference signals.  <---------------------------Other parts are omitted -------------------------------> |

The two TPs above can be taken as a starting point for the update of TS 36.300. **Companies are encouraged to provide input on TP 1.1 and 1.2:**

|  |  |
| --- | --- |
| Company | Input |
| Qualcomm | The TP looks OK to us |
| ZTE | We support this TP. And if the TP is agreed, then RAN1 needs send an LS to RAN2 to ask RAN2 update the specification accordingly. |
| BBC | We support this TP. We suggest some minor editorial changes to TP1 as follows highlighted in yellow:  ***TP1.1-v1****: {TS 36.300 Section 5.1.1}*   |  | | --- | | 5.1.1 Basic transmission scheme based on OFDM The downlink transmission scheme is based on conventional OFDM using a cyclic prefix. The OFDM sub-carrier spacing is *Δf* = 15 kHz. 12 consecutive sub-carriers during one slot correspond to one downlink *resource block*. In the frequency domain, the number of resource blocks, NRB, can range from NRB-min = 6 to NRB-max = 110 per CC or per Cell in case of CA or DC.  In addition, there are also four reduced sub-carrier spacings, *Δflow* = 7.5 kHz, *Δflow1* = 2.5 kHz, *Δflow2* = 1.25 kHz and *Δflow3* ≈ 0.37 kHz for both MBMS-dedicated cell and MBMS/Unicast-mixed cell.  In the case of 15 kHz sub-carrier spacing there are two cyclic-prefix lengths, corresponding to seven and six OFDM symbols per slot respectively.  - Normal cyclic prefix: TCP = 160×Ts (OFDM symbol #0) , TCP = 144×Ts (OFDM symbol #1 to #6)  - Extended cyclic prefix: TCP-e = 512×Ts (OFDM symbol #0 to OFDM symbol #5)  where Ts = 1/ (2048 × Δf)  In the case of 7.5 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low = 1024×Ts, corresponding to 3 OFDM symbols per slot.  In the case of 2.5 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low1 = 3072×Ts, corresponding to 1 OFDM symbol per slot.  In the case of 1.25 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low2 = 6144×Ts, corresponding to 1 OFDM symbol per subframe.  In the case of 0.37 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low3 = 9216×Ts, corresponding to 1 OFDM symbol per 3ms slot.  In the case of FDD, operation with half duplex from UE point of view is supported.  <---------------------------Other parts are omitted -------------------------------> | |
| Huawei, HiSilicon | The TP with update per BBC’s suggested changes looks ok to us. |

# Conclusion

In view of the input above, the following is proposed for agreement:

**Proposal:** **Endorse (from RAN1 perspective) the following TP to TS 36.300, and include it in an LS to RAN2:**

|  |
| --- |
| 5.1.1 Basic transmission scheme based on OFDM  The downlink transmission scheme is based on conventional OFDM using a cyclic prefix. The OFDM sub-carrier spacing is *Δf* = 15 kHz. 12 consecutive sub-carriers during one slot correspond to one downlink *resource block*. In the frequency domain, the number of resource blocks, NRB, can range from NRB-min = 6 to NRB-max = 110 per CC or per Cell in case of CA or DC.  In addition, there are also four reduced sub-carrier spacings, *Δflow* = 7.5 kHz, *Δflow1* = 2.5 kHz, *Δflow2* = 1.25 kHz and *Δflow3* ≈ 0.37 kHz for both MBMS-dedicated cell and MBMS/Unicast-mixed cell.  In the case of 15 kHz sub-carrier spacing there are two cyclic-prefix lengths, corresponding to seven and six OFDM symbols per slot respectively.  - Normal cyclic prefix: TCP = 160×Ts (OFDM symbol #0) , TCP = 144×Ts (OFDM symbol #1 to #6)  - Extended cyclic prefix: TCP-e = 512×Ts (OFDM symbol #0 to OFDM symbol #5)  where Ts = 1/ (2048 × Δf)  In the case of 7.5 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low = 1024×Ts, corresponding to 3 OFDM symbols per slot.  In the case of 2.5 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low1 = 3072×Ts, corresponding to 1 OFDM symbol per slot.  In the case of 1.25 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low2 = 6144×Ts, corresponding to 1 OFDM symbol per subframe.  In the case of 0.37 kHz sub-carrier spacing, there is only a single cyclic prefix length TCP-low3 = 9216×Ts, corresponding to 1 OFDM symbol per 3ms slot.  In the case of FDD, operation with half duplex from UE point of view is supported.  <---------------------------Other parts are omitted -------------------------------> |

|  |
| --- |
| 5.1.4 Downlink Reference signal and synchronization signals  The downlink cell-specific reference signals consist of known reference symbols inserted in the first and third last OFDM symbol of each slot for antenna port 0 and 1. There is one cell-specific reference signal transmitted per downlink antenna port. The number of downlink antenna ports for the transmission of cell-specific reference signals equals 1, 2, or 4.  Physical layer provides 504 unique cell identities using Synchronization signals and resynchronization signals.  The downlink MBSFN reference signals consist of known reference symbols inserted every other sub-carrier in the 3rd, 7th and 11th OFDM symbol of sub-frame in case of 15kHz sub-carrier spacing and extended cyclic prefix; every four subcarriers in the 2nd, 4th and 6th symbol of sub-frame in case of 7.5kHz sub-carrier spacing; every four subcarriers in the single symbol of slot in case of 2.5kHz sub-carrier spacing; every six subcarriers in the single symbol of subframe in case of 1.25kHz sub-carrier spacing; and every twelve subcarriers for MBSFN reference signal pattern type 1 or every six subcarriers for MBSFN reference signal pattern type 2 in the single symbol of 3ms slot in case of 0.37kHz sub-carrier spacing.  In addition to cell-specific reference signals and MBSFN reference signals, the physical layer supports UE-specific reference signals, positioning reference signals, CSI reference signals, and discovery signals.  A UE may assume presence of the discovery signals consisting of cell-specific reference signals, primary and secondary synchronization signals, configurable resynchronization signals, and configurable CSI reference signals.  <---------------------------Other parts are omitted -------------------------------> |