**[104-e-NR-5G\_V2X-02]: Clarification on the S-SSB slot**

* **SY-4: Determination of slots including S-SSB transmission**
* **SY-6: Restriction of S-SSB slot**
* **Corrections for SY-1 Correction on SL-BCH, SY-2 Corrections/clarifications on S-SSB and SL-SSID can be discussed in the CR preparation.**

**till 1/28, with potential CRs till 2/2 – Teng (CATT)**

For the discussion on Rel-16 SL SYNC in this meeting, companies are encouraged to follow the steps:

* 1/25-1/26: 1st round to discuss the technical details.
* 1/26-1/27: 2nd round to discuss the proposal/potential TPs based on the discussion and contributions.
* 1/27-1/28: Conclusion for consensus.
* Till 2/2: All CRs discussion/checking.

**Issue SY 4 Determination of slots including S-SSB transmission**

Based on current specification description in TS 38.331 and 38.213, the value of the interval parameter $N\_{interval}^{S-SSB}$ is provided by *sl-timeInterval*, i.e., *sl-TimeInterval-r16* in IE *SL-SyncConfig-r16 in* TS 38.331. If *sl-TimeInterval-r16* is configured with value 0, it means there would be no interval between neighboring sidelink SSBs and  S-SSBs which transmit in the same slot corresponding to the value of $N\_{offset}^{S-SSB}$. But based on RAN1’s agreement, it is not intended to transmit multiple S-SSBs in a slot, which have no obvious difference with transmitting one S-SSB in a slot since the multiple S-SSBs are same and the Tx power is restricted by the max power in a slot. So it is should be avoided.

RAN2 has not agreed the corresponding CR during last meeting, but the issue is still there from the system design perspective. This issue can be admitted by companies in RAN1. A solution can be discussed/solved and reflected in RAN1 spec, or RAN1 can send LS to RAN2 for spec change request/triggering RAN2’s discussion again.

**Round 1 comments 1/25-1/26**

**Q1: Do you think this issue exists in current specification? (Yes/No)**

**Q2: If Yes, do you think this issue can be solved in RAN1 spec or RAN2 spec? How to solve it/potential TPs?**

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| **Company** | **Q1****(Y/N)** | **Q2****(R1/R2)** | **TPs recommendation / Views** |
| LGE | Y | R1 | Ok with ZTE/Sanechips’ text proposal below.$N\_{interval}^{S-SSB}$ is a slot interval between S-SS/PSBCH blocks, which is equal to , where,  is provided by *sl-timeInterval* |
| NTT DOCOMO | Y | R2 (or R1) | Multiple S-SSBs within a slot is impossible since one S-SSB uses all symbols of a slot. 0 is removed from sl-timeInterval if possible; otherwise, prohibition of 0 can be added in the corresponding field description.Update of RAN1 spec is also fine for us. |
| ZTE,Sanechips | Y | R1 | The following TP in the clause 16.1 in 38.213:

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| 16.1 Synchronization procedures......------------------- < Unchanged parts are omitted > --------------------------A UE is provided, by *sl-NumSSB-WithinPeriod*, a number $N\_{period}^{S-SSB}$ of S-SS/PSBCH blocks in a period of 16 frames. The UE assumes that a transmission of the S-SS/PSBCH blocks in the period is with a periodicity of 16 frames. The UE determines indexes of slots that include S-SS/PSBCH block as $N\_{offset}^{S-SSB}$+$N\_{interval}^{S-SSB}⋅i\_{S-SSB}$, where- index 0 corresponds to a first slot in a frame with SFN satisfying $(SFN mod 16)=0$- $i\_{S-SSB}$ is a S-SS/PSBCH block index within the number of S-SS/PSBCH blocks in the period, with $0\leq i\_{S-SSB}\leq N\_{period}^{S-SSB}-1$- $N\_{offset}^{S-SSB}$ is a slot offset from a start of the period to the first slot including S-SS/PSBCH block, provided by *sl-TimeOffsetSSB*- $N\_{interval}^{S-SSB}$ is a slot interval between S-SS/PSBCH blocks, which is equal to , where,  is provided by *sl-timeInterval*------------------- < Unchanged parts are omitted > --------------------------...... |

 |
| NEC | N/not sure |  | RRC parameters are cited below for reference.

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| ***sl-NumSSB-WithinPeriod***Indicates the number of sidelink SSB transmissions within one sidelink SSB period. The applicable values are related to the subcarrier spacing and frequency as follows:FR1, SCS = 15 kHz: 1, 2FR1, SCS = 30 kHz: 1, 2, 4FR1, SCS = 60 kHz: 1, 2, 4, 8FR2, SCS = 60 kHz: 1, 2, 4, 8, 16, 32FR2, SCS = 120 kHz: 1, 2, 4, 8, 16, 32, 64 |
| ***sl-TimeOffsetSSB***Indicates the slot offset from the start of sidelink SSB period to the first sidelink SSB. |
| ***sl-TimeInterval***Indicates the slot interval between neighboring sidelink SSBs. This value is applicable when there are more than one sidelink SSBs within one sidelink SSB period. |

We understand that multiple SSBs within one slot in not expected but we may need more clarification. ***sl-TimeInterval*** indicates the slot **interval** between neighbouring SSBs, from our understanding, value 1 will be the smallest valid value. Then value 0 means SSB overlap and this error case can be avoided by proper higher layer configuration.Follow the same logical, in case of 15KHz, there are only 160 slots within 160ms period. High layer will also avoid to configure *sl-TimeInterval*with value 639 which is within the current value range (0…639). As a consequence, we don't have to change the value range (0…639) of *sl-TimeInterval* for 15kHz. Situation are same in 30kHz case.So, we think high layer can avoid to configure value 0 follow the same issues exist in value 639 for 15kHz and 30 kHz. |
| Ericsson | Y | R1 (or R2) | We are OK with the text proposal indicated by ZTE. Additionally, it could be possible to modify the R2 specification modifying the values of sl-TimeInterval-r16 to INTEGER (1..640)  |
| Huawei/HiSilicon | No need to change | N/A | We don’t think this issue needs to be corrected at this stage at least for RAN1. * First the value ‘0’ can be avoided by the network configuration. So even it is within the RRC parameter list, no harm at all.
* Second, since the periodicity is 160ms for all SCS, the time interval values which are larger than 160 or 320 will be meaningless for 15kHz or 30kHz SCS respectively as well. But we can rely on the network to do the right configuration for these cases.
* Third, if 639 is eventually changed to 640 for the time interval, even for 60kHz SCS, the largest interval between two adjacent S-SSB will be 638 (assume two S-SSBs are configured), the value 639 and 640 will be invalid as well. RAN1 have no necessity to correct all these invalid cases.

And furthermore, although in Rel-16 the value ‘0’ may not be used, while the value ‘0’ it may be used for future. For example, multiple S-SSBs can be transmitted in the same slot with different antenna ports by different direction or beam.  |
| vivo | N |  | We share the same view as NEC and Huawei that this is an error case and a smart gNB can avoid configuring wrong sl-TimeInterval values. In this regard, this TP is not necessary.  |
| Apple | Y | R2 | The value of 0 is not used since there is no case of transmitting multiple S-SSB in the same slot (at least in Rel-16). This is not like the other values which may be used in some SCS settings. Hence, we think the issue should be fixed. Comparing to modifying RAN1 specification, we prefer to modify it in RAN2 specification. Simply remove the value 0 from “sl-timeInterval”, or restrict the usage of value 0. If we only modify RAN1 specification, the confusion still exists in RAN2, since “sl-timeInterval” is defined as “indicating the slot interval between neighboring sidelink SSBs” in RAN2, which should not support the value of 0.  |
| Sharp | N |  | We share the views from NEC, Huawei and vivo. No change is necessary. |
| Samsung | Y | R2 | We share the view with Apple. |
| OPPO | Y | R2 | We tend to agree with Apple, the value 0 cannot be used under any condition, which is different from some other values which cannot be used in some SCS configurations. We believe this issue can be addressed in either RAN1 or RAN2 specification, however, for the readability of specifications, we suggest to remove “0” from the value range of sl-timeInterval in the RAN2 specificaion.  |
| Qualcomm | Y | Simpler in RAN1 | In my understanding, a slot interval of 0 between S-SS/PSBCH blocks means that the blocks are in consecutive slots, not that they’re in the same slot. The issue is then in how $N\_{interval}^{S-SSB}$ is used in the equation, not in its description. It’s clearer to directly update the equation, otherwise the spec could remain ambiguous.The UE determines indexes of slots that include S-SS/PSBCH block as $N\_{offset}^{S-SSB}+\left(N\_{interval}^{S-SSB}+1\right).i\_{S-SSB}$ |
| Intel | Y |  | Prefer to restrict usage of 0 value rather than to shift the entire indexing. |
| Nokia | Y | RAN2 | We would prefer to handle this in RAN2 and modify the value range of sl-TimeInterval-r16 to preclude 0 (i.e. INTEGER (1..640)).  |

***Observations on the 1st round of discussion:***

* Totally 14 companies replied on this issue by providing their views/TPs.
	+ 10 companies: Yes.
		- 4 companies RAN2
		- 4 companies RAN1
		- 2 companies RAN1 or RAN2
	+ 4 companies: No/not sure.

**[FL]**

* To the comment that gNB can configure that value “0” will never be used for any case. This is different from the case that some values are not used for SCS 15KHz. Each value in the set of {1, …, 639} will have a chance to be configured for different SCS, even some of them may not be used for 15KHz, it can be configured for 60/120KHz. This is also the smart gNB should do for flexibility. However, the value “0” will never be configured/used for any case, because it can lead to a problem that one slot may configured with more than one S-SSB. It is true that a smart gNB can configure to avoid using value “0”, but we list a wrong number (i.e. 0) in the RRC parameters list, which is not supposed to be.
* For concept of slot interval, the interval between slot *n* and slot *n+1*is 1, if my understanding is correct. This is also similar when we discuss the PSFCH periodicity with 0/1/2/4, where 0 means no PSFCH resource is configured. Therefore, interval value of 0 means in the same slot.
* To the comment that either RAN1 or RAN2 to solve this issue. Based on our discussion and analysis, a correction in RAN2 specification can essentially solve this problem. Even RAN1 change the equation in our specification, the wrong value “0” still exists in RAN2 specification. However, RAN2 had a discussion on this correction during last meeting but nothing agreed to be changed in their specification. If we decide to change it in RAN2 spec, LS should be sent to RAN2 to trigger the discussion/correction again.
* I would like to list the two options below for further check, which one is more efficient/reasonable.

**Round 2 comments 1/26-1/27**

***FL proposal:***

* ***Down select from the two options below to solve the issue of S-SSB slot transmission:***
	+ ***Option 1: Send LS to RAN2, sl-TimeIterval-r16 in TS 38.331 is changed to (1 … 640).***
	+ ***Option 2: Adopt the following TP in TS 38.213.***

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| -------------------------- Start of Text Proposal for TS 38.213 --------------------------16.1 Synchronization procedures------------------- < Unchanged parts are omitted > --------------------------A UE is provided, by *sl-NumSSB-WithinPeriod*, a number $N\_{period}^{S-SSB}$ of S-SS/PSBCH blocks in a period of 16 frames. The UE assumes that a transmission of the S-SS/PSBCH blocks in the period is with a periodicity of 16 frames. The UE determines indexes of slots that include S-SS/PSBCH block as $N\_{offset}^{S-SSB}$+$N\_{interval}^{S-SSB}⋅i\_{S-SSB}$, where- index 0 corresponds to a first slot in a frame with SFN satisfying $(SFN mod 16)=0$- $i\_{S-SSB}$ is a S-SS/PSBCH block index within the number of S-SS/PSBCH blocks in the period, with $0\leq i\_{S-SSB}\leq N\_{period}^{S-SSB}-1$- $N\_{offset}^{S-SSB}$ is a slot offset from a start of the period to the first slot including S-SS/PSBCH block, provided by *sl-TimeOffsetSSB*- $N\_{interval}^{S-SSB}$ is a slot interval between S-SS/PSBCH blocks, which is equal to $N\_{interval}^{'S-SSB}+1$, where $N\_{interval}^{'S-SSB}$ is provided by *sl-timeInterval.*------------------- < Unchanged parts are omitted > ---------------------------------------------------- End of Text Proposal for TS 38.213 -------------------------- |

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| **Company** | **TPs recommendation / Views** |
| Qualcomm | Addressing the FL’s reply,For concept of slot interval, the interval between slot *n* and slot *n+1*is 1, if my understanding is correct. This is also similar when we discuss the PSFCH periodicity with 0/1/2/4, where 0 means no PSFCH resource is configured. Therefore, interval value of 0 means in the same slotThe wording related to PSFCH uses “period”, not the interval between two slots. In the PSFCH case, it is correct to say that a period of 0 means PSFCH is disabled.If we go with Option 1, the description of both $N\_{interval}^{S-SSB}$ and *sl-timeInterval* would still need to be updated because they longer represents the gap between the two slots. e.g. the value of 1 wouldn’t correspond to a 1 slot gap, but 0 slot gap between the SSB slots.If we go with Option 2, the same also applies about the description of $N\_{interval}^{S-SSB}$ and *sl-timeInterval*Directly capturing the “+1” in the equation doesn’t require any other changes:The UE determines indexes of slots that include S-SS/PSBCH block as $N\_{offset}^{S-SSB}$+$(N\_{interval}^{S-SSB}+1)⋅i\_{S-SSB}$, whereIn our view, there really is no need to send this to RAN2 when it can be solved simply in RAN1 and with multiple methods. |
| ZTE,Sanechips | Option 2. Similar view as QC, we prefer not to add work load of both WGs.  |
| NEC | We tend to agree Teng's interpretation on interval that interval of 0 and 1 is 1. Otherwise, if we set interval between 0 and 1 as 0, then what’s the numbering for interval between 0 and 0? Anyhow, If we interpret interval between 0 and 1 as 1, the range should be [1,639]; if we interpret interval between 0 and 1 as 0, the range should be [0,638]. Both ranges contains 639 elements, while the current range [0,639] contains 640 elements, which we think is not the original intention considering we're designing only the valid intervals.One method as we preferred, keep current [0,639] and expect high layer's smart configuration and do nothing in RAN1 and RAN2.If majority want to fix it, then as an alternative, change the RRC value to [0,638] in RAN2 and apply "+1" in RAN1 OR change RRC value to [1,639] in RAN2.  |
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**Issue SY 6 Restriction of S-SSB slot**

An agreement in RAN1#101-e meeting is missed in the latest TS 38.213. The agreement is copied as follows.

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| RAN1#101-eAgreements:* S-SSB transmission/reception slots are in cell-specific UL resources in Uu.
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**Round 1 comments 1/25-1/26**

**Q1: Do you think the agreement above is missed in current specification? (Yes/No)**

**Q2: If Yes, do you have recommendation on the TPs? If No, please input your views.**

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| --- | --- | --- |
| **Company** | **Q1****(Y/N)** | **TPs recommendation / Views** |
| LGE | Y | OK with Docomo’s text proposal below.A S-SS/PSBCH block can be transmitted/received in a slot of which all OFDM symbols are semi-statically configured as UL as per the higher layer parameter *tdd-UL-DL-ConfigurationCommon-r16* of the serving cell if providedor *sl-TDD-Configuration-r16* if provided or *sl-TDD-Config-r16* of the received PSBCH if provided. |
| NTT DOCOMO | Y | TP in our contribution (R1-2101582).Any other clarification is fine for us if it describes the above agreement. |
| ZTE,Sanechips | Y | the following finetuning based on DCM's contribution to the clause 16.1 in 38.213:

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| 16.1 Synchronization procedures......---------------------------- < Unchanged parts are omitted > ----------------------------A UE is provided, by *numSSBwithinPeriod-SL*, a number $N\_{period}^{S-SSB}$ of S-SS/PSBCH blocks in a period of 16 frames. The UE assumes that a transmission of the S-SS/PSBCH blocks in the period is with a periodicity of 16 frames. The UE determines indexes of slots that include S-SS/PSBCH block as $N\_{offset}^{S-SSB}$+$N\_{interval}^{S-SSB}⋅i\_{S-SSB}$, where- index 0 corresponds to a first slot in a frame with SFN satisfying $(SFN mod 16)=0$- $i\_{S-SSB}$ is a S-SS/PSBCH block index within the number of S-SS/PSBCH blocks in the period, with $0\leq i\_{S-SSB}\leq N\_{period}^{S-SSB}-1$- $N\_{offset}^{S-SSB}$ is a slot offset from a start of the period to the first slot including S-SS/PSBCH block, provided by *timeOffsetSSB-SL*- $N\_{interval}^{S-SSB}$ is a slot interval between S-SS/PSBCH blocks, provided by *timeIntervalSSB-SL* The UE does not expect the set of symbols of the slot configured for S-SSB transmission and reception to be indicated in a cell-specific way as downlink/flexible by *TDD-UL-DL-ConfigCommon* which is configured or by *sl-TDD-Configuration* which is pre-configured, or by *sl-TDD-Config* which is indicated in the received PSBCH payload.---------------------------- < Unchanged parts are omitted > ----------------------------...... |

 |
| NEC | Y | DCM's proposal is ok. |
| Ericsson | Y | The text provided by DCM looks fine. |
| Huawei/HiSilicon | Y | The dedicated ITS band case also need to be captured. At this case, the suggested TP will need to be updated as:16.1 Synchronization procedures......---------------------------- < Unchanged parts are omitted > ----------------------------A UE is provided, by *numSSBwithinPeriod-SL*, a number $N\_{period}^{S-SSB}$ of S-SS/PSBCH blocks in a period of 16 frames. The UE assumes that a transmission of the S-SS/PSBCH blocks in the period is with a periodicity of 16 frames. The UE determines indexes of slots that include S-SS/PSBCH block as $N\_{offset}^{S-SSB}$+$N\_{interval}^{S-SSB}⋅i\_{S-SSB}$, where- index 0 corresponds to a first slot in a frame with SFN satisfying $(SFN mod 16)=0$- $i\_{S-SSB}$ is a S-SS/PSBCH block index within the number of S-SS/PSBCH blocks in the period, with $0\leq i\_{S-SSB}\leq N\_{period}^{S-SSB}-1$- $N\_{offset}^{S-SSB}$ is a slot offset from a start of the period to the first slot including S-SS/PSBCH block, provided by *timeOffsetSSB-SL*- $N\_{interval}^{S-SSB}$ is a slot interval between S-SS/PSBCH blocks, provided by *timeIntervalSSB-SL* A S-SS/PSBCH block can be transmitted/received in a slot of which all OFDM symbols are semi-statically configured as UL as per the higher layer parameter *tdd-UL-DL-ConfigurationCommon* of the serving cell if providedor *sl-TDD-Configuration* if provided or *sl-TDD-Config* of the received PSBCH if provided or if *tdd-UL-DL-ConfigurationCommon* and *sl-TDD-Configuration* are not provided for a spectrum indicated with only PC5 interface in Table 5.2E.1-1 in [TS 38.101-1].---------------------------- < Unchanged parts are omitted > ---------------------------- |
| vivo | Y | Generally fine with the spirit of TP proposed by Docomo. But it seems the TP does not cover the case of SL performed on a UL carrier of the FDD spectrum, where the slots are full UL but no tdd-UL-DL-ConfigurationCommon is provided for the serving cell. I made some changes (highlighted in yellow) on top of Docomo’s proposal.Besides, I am not pretty sure why ‘tdd-UL-DL-ConfigurationCommon-r16’ is used? I guess the ‘-r16’ should be removed?A S-SS/PSBCH block can be transmitted/received in a slot of which all OFDM symbols are semi-statically configured as UL as per the higher layer parameter *tdd-UL-DL-ConfigurationCommon-r16* of the serving cell if providedor *sl-TDD-Configuration-r16* if provided or *sl-TDD-Config-r16* of the received PSBCH if provided, or in a slot of a UL carrier of the paired spectrum. |
| Apple | Y | Fine with the proposal from DCM.  |
| Samsung | Y | DCM’s TP can be a starting point. We can discuss details in the 2nd round discussion. |
| OPPO | Y | We agree with vivo that the agreement is not only related to unpaired spectrum, but also paired spectrum, however, in our view it has nothing to do with ITS spectrum, to address the concern from Huawei, we suggest to directly spell out that this is for paired/unpaired spectrum in specification. Furthermore, “can be” in the sentence “A S-SS/PSBCH block can be transmitted/received…” should be replaced with “is”, to align with the agreement. In a word, we suggest the following(on top of vivo’s version):For unpaired spectrum, a S-SS/PSBCH block is transmitted/received in a slot of which all OFDM symbols are semi-statically configured as UL as per the higher layer parameter *tdd-UL-DL-ConfigurationCommon-r16* of the serving cell if providedor *sl-TDD-Configuration-r16* if provided or *sl-TDD-Config-r16* of the received PSBCH if provided. For paired spectrum, a S-SS/PSBCH block is transmitted/received in a slot of a UL carrier ~~of the paired spectrum~~.  |
| Qualcomm | Y |  |
| Intel | Y | Agree to implement the missing agreement |
| Nokia | Y | We would also prefer to use the DCM TP as a starting point for further discussion. |

***Observations on the 1st round of discussion:***

* Totally 13 companies replied on this issue by providing their views/TPs.
	+ 13 companies agree to capture the missing agreement into TS 38.213.
	+ 6 companies would like to further discuss the wording of the TP based on the draft TP from DOCOMO in R1-2101582.

**[FL]**

* It is agreed to have a TP to capture the missing agreements by all companies.
* The wording can be refined based on the second round of discussion. I use the updated TP wording from OPPO’s comment as a starting point, also with a minor change by me.
* To one of the comments from vivo, I also checked TS 38.331, the parameter *tdd-UL-DL-ConfigurationCommon* is without “-r16”.

**Round 2 comments 1/26-1/27**

***FL proposal:***

* ***Adopt the following TP in TS 38.213***

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| -------------------------- Start of Text Proposal for TS 38.213 --------------------------16.1 Synchronization procedures--------------------------<Unchanged parts omitted>--------------------------A UE is provided, by *sl-NumSSB-WithinPeriod*, a number $N\_{period}^{S-SSB}$ of S-SS/PSBCH blocks in a period of 16 frames. The UE assumes that a transmission of the S-SS/PSBCH blocks in the period is with a periodicity of 16 frames. The UE determines indexes of slots that include S-SS/PSBCH block as $N\_{offset}^{S-SSB}$+$N\_{interval}^{S-SSB}⋅i\_{S-SSB}$, where- index 0 corresponds to a first slot in a frame with SFN satisfying $(SFN mod 16)=0$- $i\_{S-SSB}$ is a S-SS/PSBCH block index within the number of S-SS/PSBCH blocks in the period, with $0\leq i\_{S-SSB}\leq N\_{period}^{S-SSB}-1$- $N\_{offset}^{S-SSB}$ is a slot offset from a start of the period to the first slot including S-SS/PSBCH block, provided by *sl-TimeOffsetSSB*- $N\_{interval}^{S-SSB}$ is a slot interval between S-SS/PSBCH blocks, provided by *sl-timeInterval*For unpaired spectrum, a S-SS/PSBCH block can be transmitted/received in a slot of which all OFDM symbols are semi-statically configured as UL as per the higher layer parameter *tdd-UL-DL-ConfigurationCommon-r16* of the serving cell if providedor *sl-TDD-Configuration-r16* if provided or *sl-TDD-Config-r16* of the received PSBCH if provided. For paired spectrum, a S-SS/PSBCH block can be transmitted/received in a slot of an UL carrier.--------------------------<Unchanged parts omitted>---------------------------------------------------- End of Text Proposal for TS 38.213 -------------------------- |

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| **Company** | **TPs recommendation / Views** |
| Qualcomm | I don’t follow the suggestion from OPPO that specifying paired/unpaired spectrum would exempt the ITS band from the restriction. Isn’t the ITS band unpaired spectrum? |
| ZTE,Sanechips | OK |
| NEC | OK |
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