

SRS:- Sounding Reference Signal gNB

Two types of Reference Signal are there in UL which gives information about the channel quality:-

1. DMRS :- Demodulation Reference Signal
2. SRS :- Sounding Reference Signal

With the help of above Two RS, gNB takes smart decisions for resource allocation for uplink transmission, link adaptation and to decode transmitted data from UE.

SRS is a UL reference signal which is transmitted by UE to Base station. SRS gives information about the combined effect of multipath fading, scattering, Doppler and power loss of transmitted signal. Hence Base Station estimates the channel quality using this reference signal and manages further resource scheduling, Beam management, and power control of signal. So SRS provides information to gNB about the channel **over full bandwidth** and using this information gNB takes decision for resource allocation which has better channel quality comparing to other Bandwidth regions.

One reference signal (DMRS) is always associated with each channel (PUCCH/PUSCH), which provides information about the radio channel then why this separate reference signal is required?

Answer:-

- DMRS provides information about the frequency region which is being used by PUSCH/PUCCH specifically.
- If gNB assigns resources over full bandwidth region for a UE then there is no choice left for UE to select specific frequency region Hence SRS is optional. BUT DMRS will always be transmitted with PUSCH/PUCCH for coherent demodulation and channel estimation.

Difference between 4G LTE SRS and 5G NR SRS (Sounding Reference Signal):

S. No.	4G - LTE	5G - NR
1	Max SRS Symbols is one $N_{sym}^{SRS} = 1$	Max SRS Symbols can be 1,2 or 4 $N_{sym}^{SRS} \in \{1,2,4\}$ OR In the Time Domain, SRS Resources Spans Over 1,2 or 4 consecutive symbols. (No. of symbols are more than LTE so NR has better sounding capacity comparing to LTE)
2	SRS is transmitted at the last symbol of the slot	Symbol number for SRS transmission depends on l_o OR l_{offset} , where l_o is the time domain starting position OR SRS will always be transmitted in the last six symbols of the slot.
3	LTE has two kinds of SRS 1. Common SRS / Cell-Specific SRS 2. Dedicated SRS / UE Specific SRS	Always configured as UE Specific only
4.	Since $K_{TC} = 2$ so, SRS is transmitted always on alternate REs	SRS transmission is flexible. It depends on transmission comb K_{TC} value [$K_{TC} = 2$ or 4]
5	Max number of cyclic shifts can be 8 $n_{cs} \in \{0, 1, 2, 3, \dots, 7\}$ Hence, max 8 UEs can transmit SRS simultaneously using one antenna port	5G NR has additional flexibility of SRS transmission. So if $K_{TC} = 4$, then Max number of cyclic shifts can be 12. $n_{cs} \in \{0, 1, 2, 3, \dots, 11\}$ Hence, max 12 UEs can transmit SRS simultaneously using one antenna port
6.	Frequency Hopping Mechanism is same in LTE and 5G NR.	

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