Transforming into 5G mapping

A brief view from a 5G network supplier

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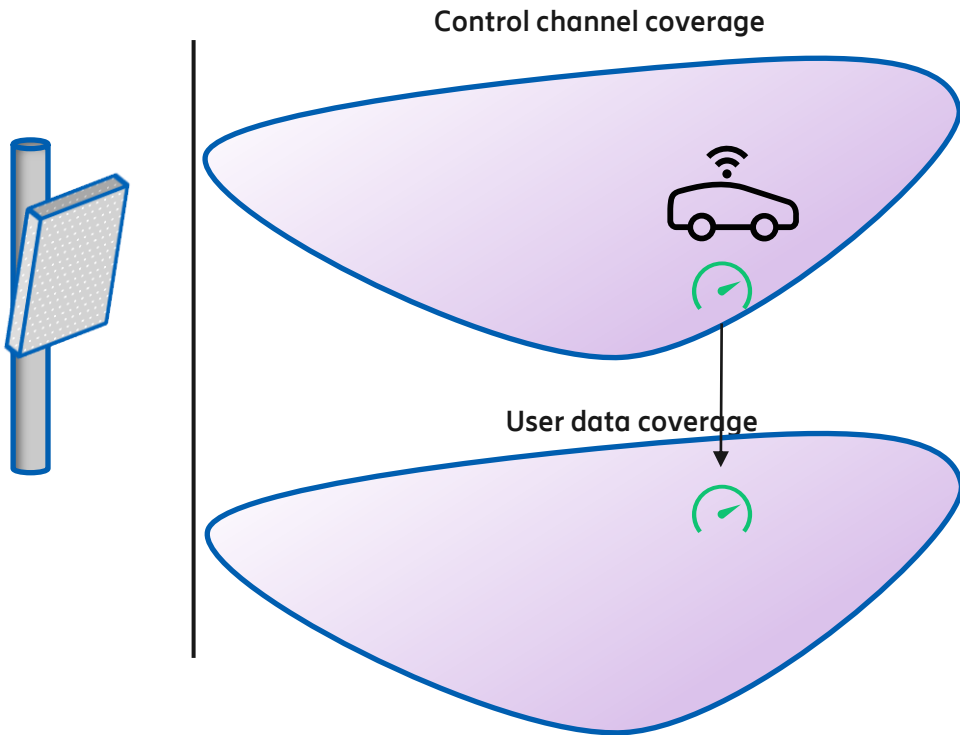
Background – Significance of RSRP
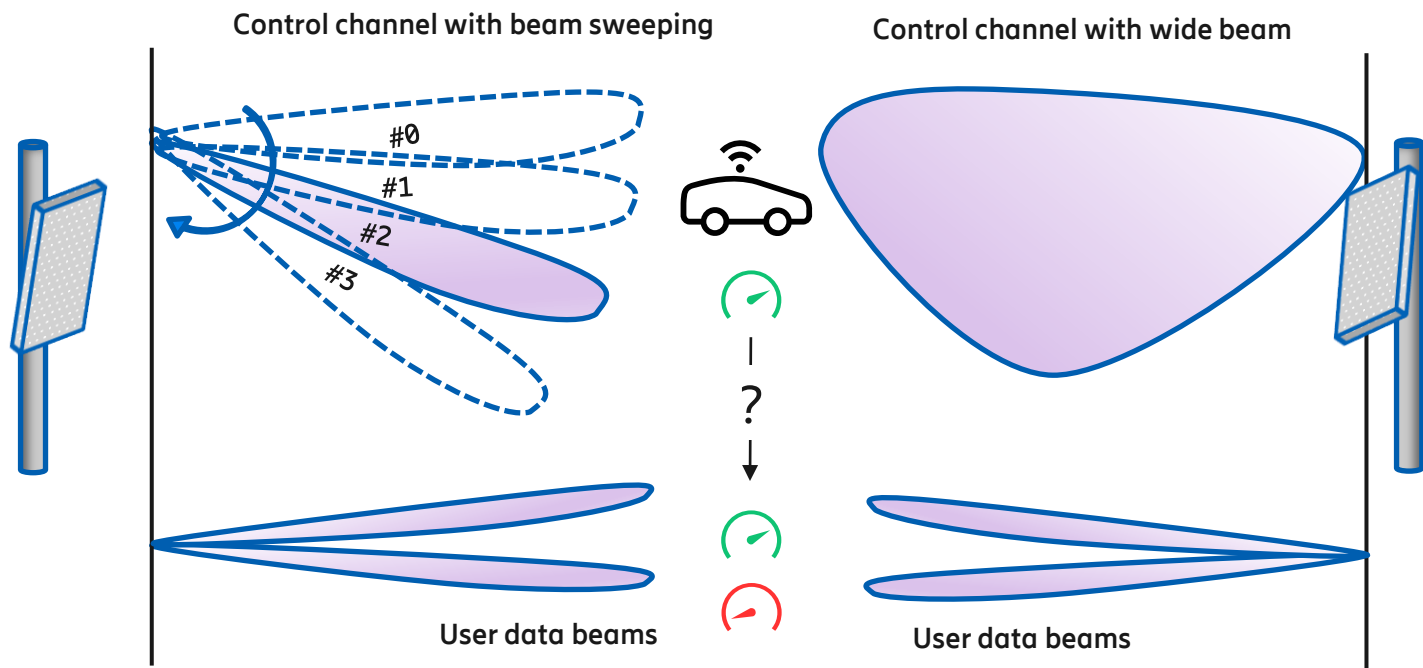
Comparison between 4G and 5G

4G
A unified approach

Control channel coverage

User data coverage

Control Channel coverage correlates with user data
coverage for all kind of implementations

5G
Two main approaches

Control channel with beam sweeping

#0
#1
#2
#3

User data beams

Control channel with wide beam
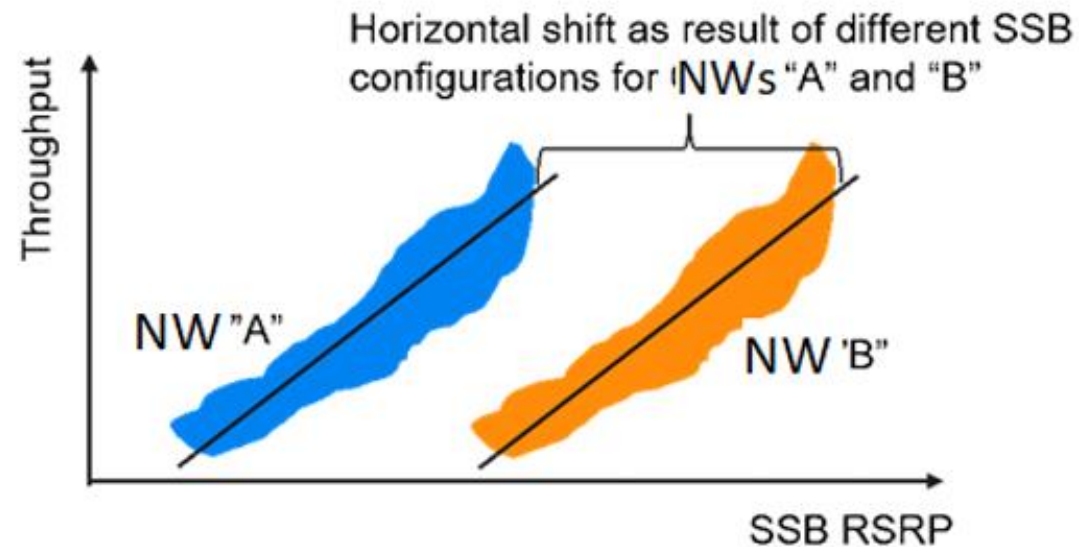
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User data beams

Control Channel coverage correlation with user data
depends on type of implementation

Practical issues of SS-RSRP in NR

Different signatures depending on approach

Horizontal shift as result of different SSB configurations for NWs "A" and "B"

Throughput

NW "A"

NW "B"

SSB RSRP

➤ Network A uses SSB wide beam

➤ Network B uses SSB beam sweeping

- Since both networks use different configurations for SSB, the relation between <u>user throughput</u> and <u>SS-RSRP</u> will have a shift (taking equal network characteristics).

  - **Measuring a higher signal strength does not mean higher user throughput.**

Field measurements

Multiple SSB beams

Network "A" static test results			
Reference Point	Reference Signal Received Power (dBm)	Downlink Throughput (Mbps)	Uplink Throughput (Mbps)
Point 1	-81	495	5
Point 2	-84	234	11
Point 3	-70	341	12
Point 4	-80	726	23
Point 5	-83	464	2
Point 6	-69	702	37
Point 7	-62	644	26
Point 8	-75	722	26
Point 9	-89	519	14
Point 10	-85	135	27
Point 11	-78	565	6
Point 12	-71	626	20
Point 13	-61	652	56
Point 14	-62	798	38
Point 15	-51	667	56
Average	-73 ⬆	553 ⬇	24 ⬇

Single SSB beam

Network "B" static test results			
Reference Point	Reference Signal Received Power (dBm)	Downlink Throughput (Mbps)	Uplink Throughput (Mbps)
Point 1	-85	514	65
Point 2	-84	725	60
Point 3	-82	499	68
Point 4	-92	510	59
Point 5	-84	506	68
Point 6	-76	617	82
Point 7	-92	472	15
Point 8	-106	445	20
Point 9	-91	388	36
Point 10	-91	715	51
Point 11	-87	929	60
Point 12	-79	650	68
Point 13	-74	1024	73
Point 14	-73	890	75
Point 15	-69	454	74
Average	-84 ⬇	623 ⬆	58 ⬆

Medium RSRP range, same static locations. RSRP and Performance are not related

Coverage metrics alternatives

# Decoupling IDLE and CONNECTED concepts

— **IDLE mode coverage**
  — It can be defined as the capability of a User Equipment to **access** the mobile network. Either for initiating a data session, a MOC, an MTC or any other services.
  — A certain SS-RSRP **is necessary** for accessing 5G system, but it is **not sufficient**. Initial access involves **UL** transmissions which are **often more limiting** than SS-RSRP.
  — It is **problematic** to use SSB Power as a unified metric **across different countries, vendors and operators**

alternative metrics under study

➢Normalized RSRP
➢Pathloss

To complement with other methods

➢Crowdsourcing
➢DT / Network Scanner
➢PM Counters / MDT

— CONNECTED mode coverage
  — It can be defined as the capability of a User Equipment to be delivered by a network with certain quality of service.
  — We can refer to a minimum coverage which will be mapped to a predetermined minimum expectation in terms of DL/UL bitrate.
  — Correlation with SSB Power is low and, if not normalized, even misleading.

alternative metrics under study
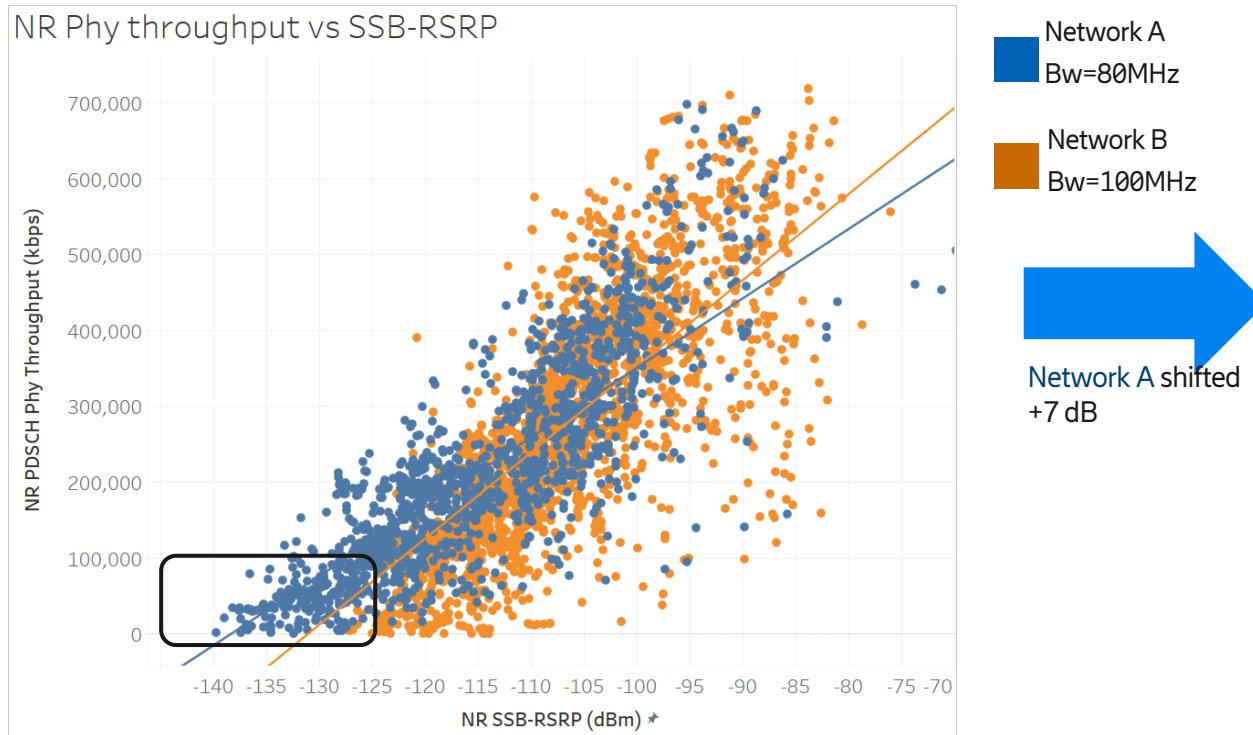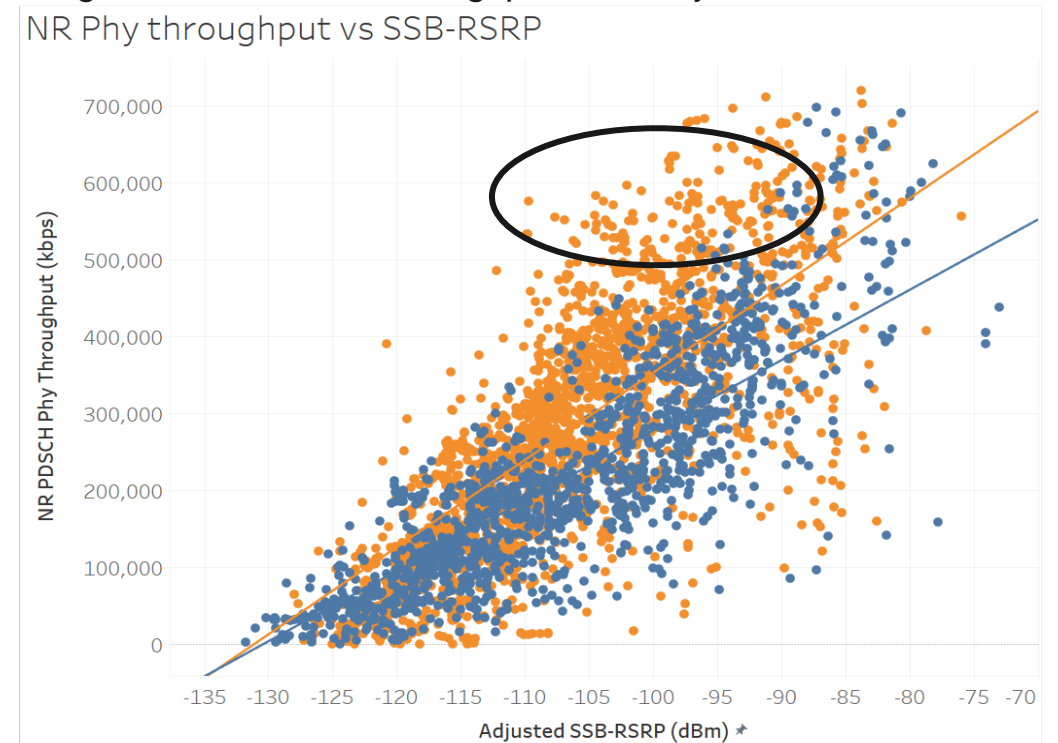
➢PDSCH SINR
➢CQI*RANK
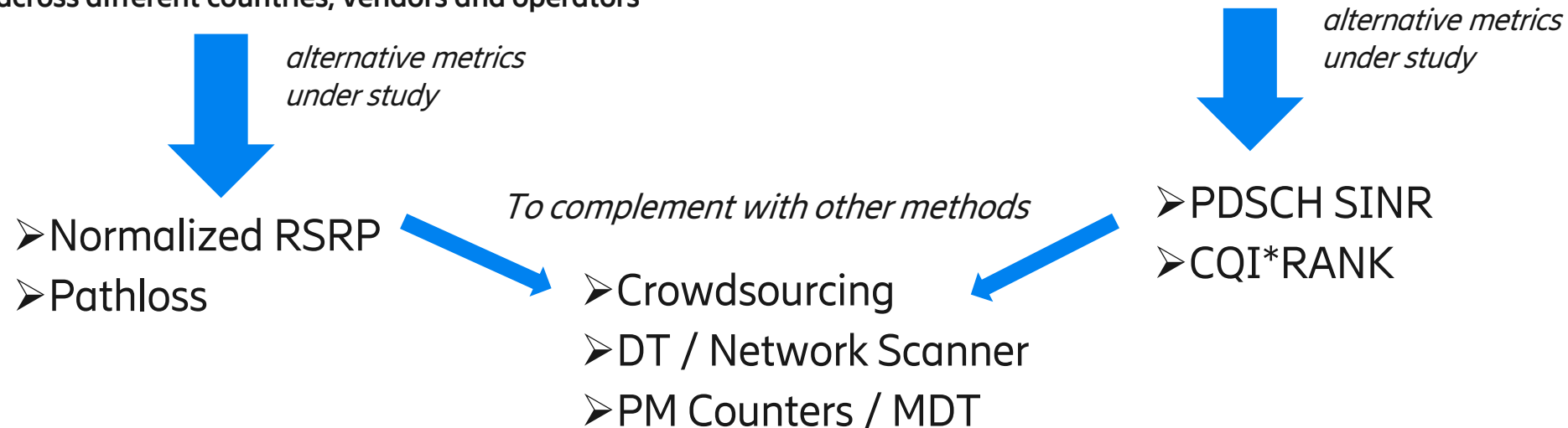
Normalized RSRP

- All pure SS-RSRP related gains can be accounted for to get a **Normalized RSRP**

- **Network B** clearly shows a higher RSRP. Plotting RSRP vs Throughput without correcting RSRP will make us draw wrong conclusions.

- After **Network A** is shifted +7dB both RSRP ranges become equivalent and throughput comparison is possible. Normalizing also per PRB would additionally give information on throughput efficiency
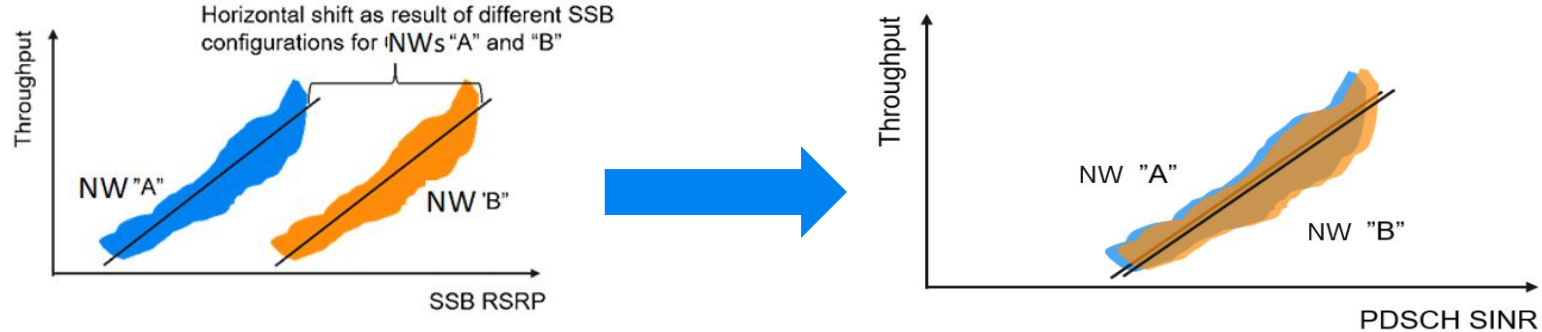

Network A shifted +7 dB

- Challenge: calculating the normalization shift.

PDSCH SINR

- **PDSCH SINR** is the most powerful metric to predict Connected Mode performance (Downlink Throughput). It is focused on traffic channel signal to noise ratio, getting away from the pilot signal strength.

- In LTE, PDSCH SINR was not a magnitude to be reported by UE measurement report. In NR, 3GPP allows to report it (together with RSRP and RSRQ).

- Challenge: in practice only some chipsets are designed to report this magnitude. There is an alternative under study for those chipset not supporting this report: CQI*Rank.

Practical measurement methods

Several active and passive methods are also under study to complement 5G coverage metrics, including:

— Crowdsourcing
— PM Counters
— Drive Test
— Network scanner
— MDT (Minimization of drive tests: 3GPP feature for remote data collection)