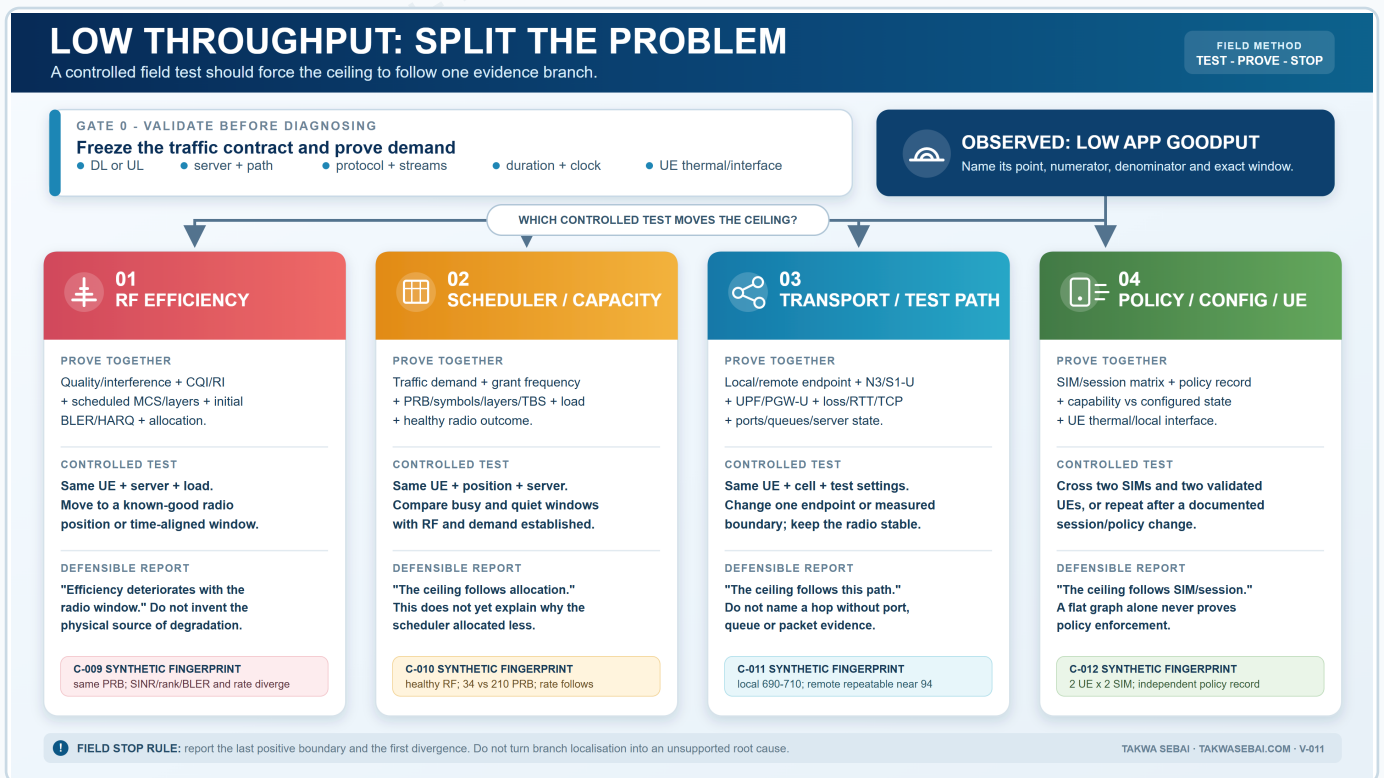


5G NR LOW THROUGHPUT

A Field Triage Playbook

Freeze the test. Split the path. Find the first divergence. Stop where proof stops.



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Original field resource

BEFORE THE FIRST TEST

Use the playbook without exposing operational evidence

The method is practical only when authorisation, confidentiality and conclusion limits remain visible.

THIS GUIDE IS FOR

- Authorised 5G NR troubleshooting
- Declared synthetic exercises
- Reproducible comparisons
- Evidence handoffs that stop before speculation

NEVER COLLECT HERE

- Subscriber, site or device identifiers
- Customer traces or restricted screenshots
- Credentials, IP addresses or ticket references
- A completed workbook from another person

EVIDENCE RULE

Low throughput is a symptom at one measurement point. It is not a root cause and it is not one counter. Every conclusion must name the last positive boundary, the first divergence and what remains unproven.

SYNTHETIC-CONTENT DECLARATION

V-011 contains four training fingerprints labelled C-009 to C-012. They are original synthetic examples, not customer results, benchmarks or universal thresholds.

WHAT IS NOT CLAIMED

No demand, conversion rate, price, testimonial, before/after field result or physical root cause is asserted in this public sample.

FIELD SEQUENCE

The first ten minutes decide whether the rest of the investigation is usable

Do not open every dashboard. Freeze the comparison, prove demand and remove obvious test ceilings first.

01 - FREEZE

Record:

- DL or UL
- endpoint and path
- TCP/UDP and streams
- warm-up and measured interval
- payload boundary
- UE state and clock

02 - PROVE DEMAND

Ask:

- Was data waiting?
- Was the source saturated?
- For UL, do SR/BSR show demand?
- Did the network schedule little because little traffic was offered?

03 - REMOVE CEILINGS

Repeat:

- same test, same location
- known-good endpoint or path
- after thermal, power, VPN and local-interface checks

Change one useful variable only.

FIELD STOP RULE

If the result moves when only the server or path changes, report that the ceiling follows the changed path. Do not name a router, port or cable without interface evidence.

Minimum notes before escalation

Field	Record before the first trace
Test window	Start, steady interval, stop, timezone and clock offset
Known-good	The successful comparison using the same contract
Changed variable	Position, load window, endpoint, SIM or UE - only one
Evidence boundary	Last positive point and first observed divergence

CONTROLLED COMPARISON

A throughput number is usable only when its test contract is known

Two results are not comparable when endpoint, path, duration, payload or terminal state changed unnoticed.

Field	Record	Why it matters
Direction	DL, UL or simultaneous	Different scheduling, buffers and power evidence
Endpoint	Anonymised ID, location, ownership	The endpoint can be the ceiling
Path	Edge, operator, internet, VPN	A path change alters more than the radio
Protocol	TCP, UDP or application-specific	Loss and congestion behaviour differ
Streams	Parallel session count	One stream may not fill the path
Intervals	Warm-up, measured, stop	Short tests can measure ramp-up
Payload	App, IP, PDCP, RLC or another layer	Headers and recovery change the number
UE state	Software, thermal, power, interface	The terminal can throttle
Clock	Timezone and offset	Misaligned windows create false correlations
Demand	Proof that data was waiting	No demand can look like no scheduling

COMPARABLE

Same UE, location, endpoint, path, protocol, streams, duration and time base. One discriminating variable changes.

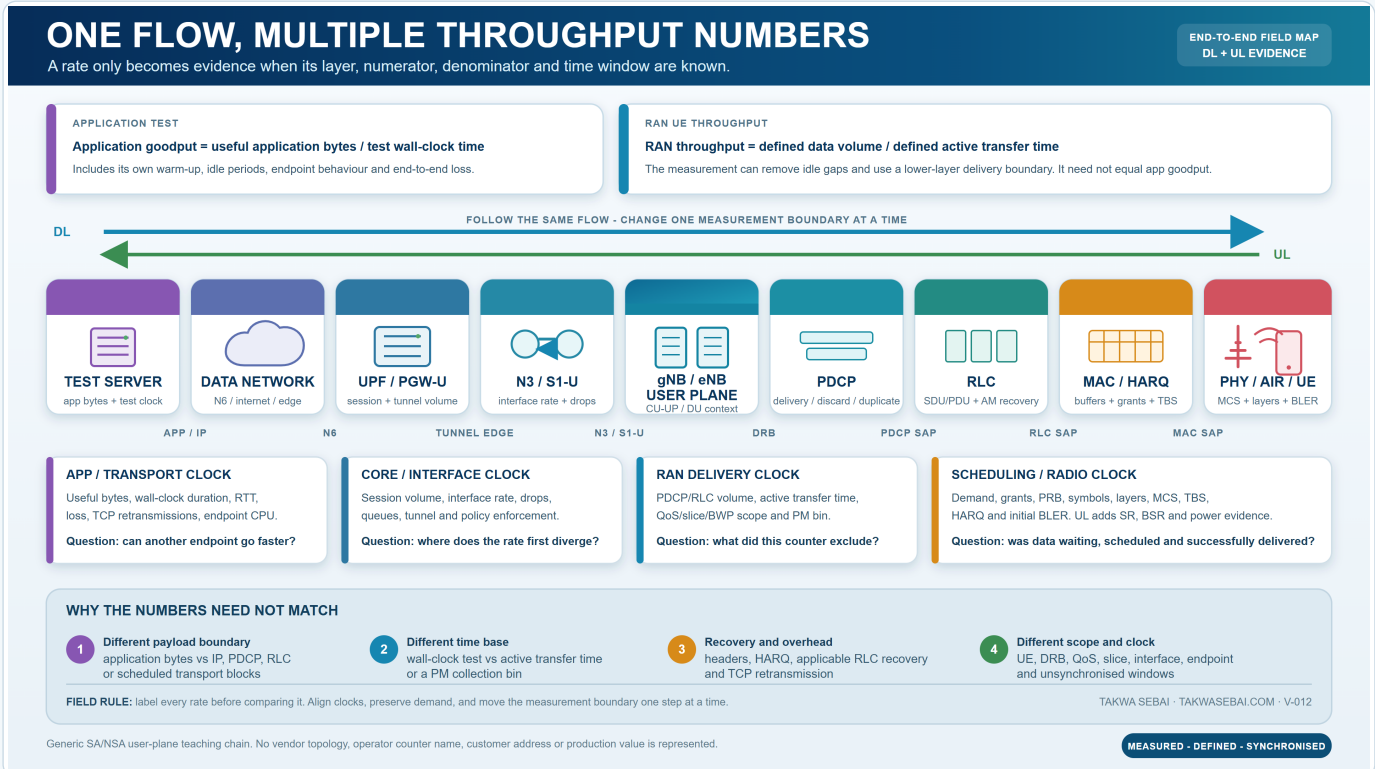
NOT COMPARABLE

Remote single-stream ten-second test versus local multi-stream sixty-second test, with unknown UE temperature and unaligned counters.

V-012

One flow can produce several legitimate throughput numbers

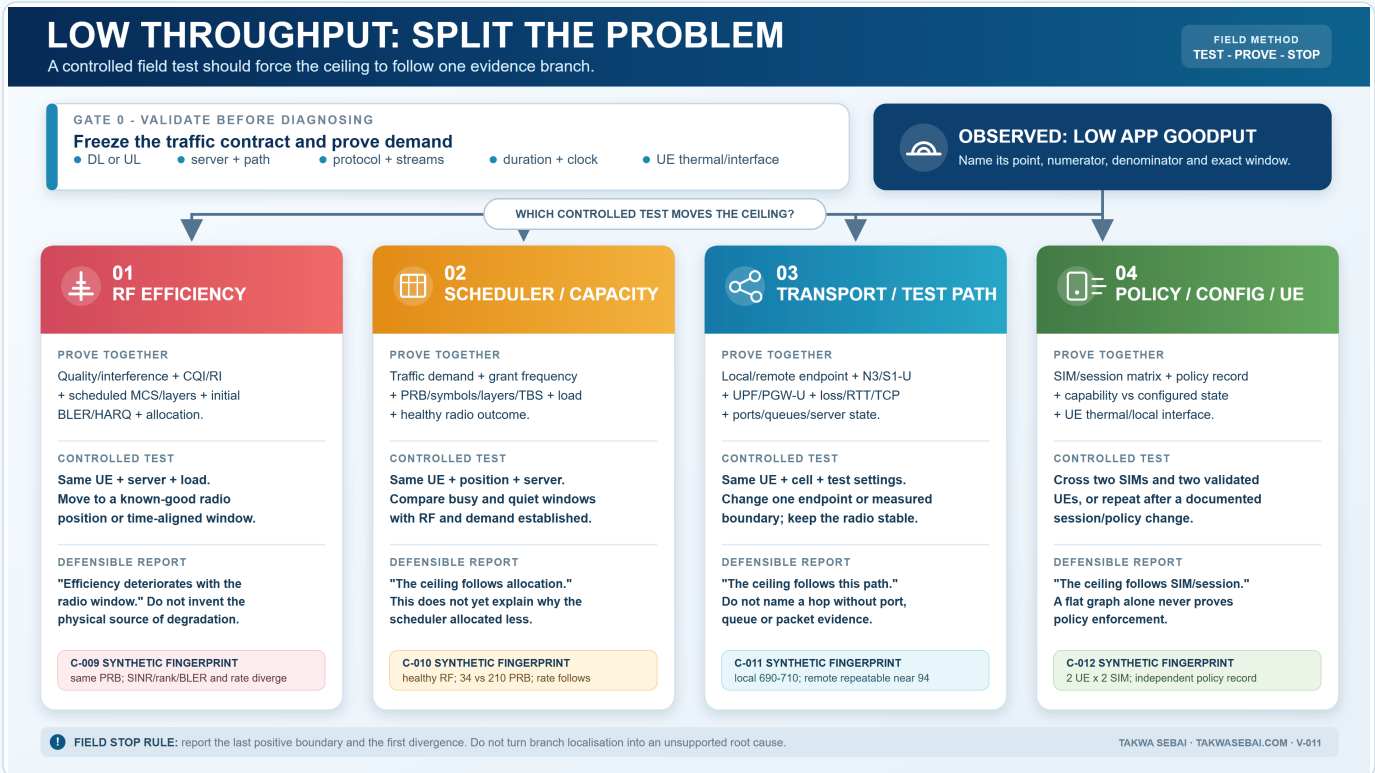
Label every rate by layer, payload boundary, denominator and exact time window before comparing it.



V-011

Force the ceiling to follow one evidence branch

Validate the test first. Then run the controlled comparison with the highest power to remove branches.



The four fingerprints shown inside V-011 are synthetic training patterns. They are not customer evidence, vendor thresholds or promised performance.

Branch	Discriminating move	Defensible output
RF efficiency	Known-good radio window, same path	Efficiency follows the radio window
Scheduler / capacity	Busy versus quiet, RF and demand held	Ceiling follows allocation
Transport / path	Change one endpoint or boundary	Ceiling follows the selected path
Policy / config / UE	Cross SIM, session or validated UE	Ceiling follows subscription or terminal

DO NOT MERGE TWO QUESTIONS

Radio efficiency and scheduler allocation can limit the same result in different ways

Measure how successfully scheduled resources carried data separately from how many resources the UE received.

RADIO EFFICIENCY

Read together:

- SS-RSRP or CSI-RS with the correct prefix
- RSRQ and SINR context
- CQI and RI
- scheduled MCS and layers
- initial BLER, CRC and HARQ
- PRB and scheduled symbols
- UL power evidence where relevant

ALLOCATION

Read together:

- proof of DL or UL demand
- grant frequency
- PRB, symbols, slots and TBS
- layers and realised BWP
- active-UE and load context
- QoS and admission state
- control-channel evidence when available

CRITICAL DISTINCTION

MCS alone is not throughput. The observed rate also depends on scheduled resources, symbols, layers, slots, transport-block size, successful delivery and the measurement boundary.

Observation	What it can support	What remains open
High allocation + poor outcome	Radio-efficiency branch	Physical RF source
Low allocation + healthy outcome	Allocation-limited interval	Why the scheduler allocated less
Strong level + few grants	Level is not the ceiling	Demand, load, QoS, control or policy
UL data + small grants	UL allocation branch	Power, scheduler, policy or capability

MOVE ONE BOUNDARY

Challenge the endpoint and transport path without changing the radio comparison

A controlled endpoint change can localise the next investigation beyond the radio, but it cannot name the exact hop.

01 - SAME UE AND CELL

Hold position, radio state, direction, protocol, streams and duration.

02 - LOCAL KNOWN-GOOD ENDPOINT

Establish whether the radio and immediate path can deliver more.

03 - REMOTE ENDPOINT OR BOUNDARY

Change only the selected endpoint or measured interface.

04 - ALIGN INTERFACE EVIDENCE

Compare N3/S1-U, UPF/PGW-U, N6, loss, RTT, queues and endpoint state.

05 - WRITE THE BOUNDARY

Report where the rate first diverges, not an unsupported device name.

DEFENSIBLE

"The ceiling follows the selected path beyond the radio in this controlled comparison."

UNSUPPORTED

"The remote router is limited to 100 Mbit/s" without port, queue, topology or endpoint evidence.

CROSS THE RIGHT VARIABLE

A two-SIM / two-UE matrix localises the branch without inventing policy

Keep radio, endpoint, path, software and thermal state comparable. Add an independent record before naming enforcement.

	Validated UE-A	Validated UE-B
Consented test SIM-X	Observed rate / state	Observed rate / state
Consented test SIM-Y	Observed rate / state	Observed rate / state

POLICY / SESSION EVIDENCE

- subscription and session policy
- UE-AMBR or Session-AMBR when applicable
- QoS Flow and DRB mapping
- slice and DNN context
- enforcement record
- controlled policy change where authorised

UE / CONFIGURATION EVIDENCE

- supported band combinations
- feature set and maximum layers
- actual CA or MR-DC state
- configured and active BWP
- modem software and thermal state
- USB, Ethernet or Wi-Fi ceiling

STOP RULE

A flat plateau alone does not prove shaping. Capability support does not prove that the network configured or scheduled the capability during the test.

Defensible wording: "The ceiling follows the subscription, session or terminal in the controlled matrix. Independent policy or configuration evidence is still required to name the mechanism."

WRITE THE HANDOFF BEFORE THE ROOT CAUSE

Last positive. First divergence. Next discriminating test.

These three statements expose the evidence boundary and prevent a branch classification from becoming an invented physical cause.

LAST POSITIVE

The last boundary where expected volume, state or delivery is established in the controlled comparison.

FIRST DIVERGENCE

The next synchronised boundary where observed volume, state or timing no longer matches the known-good comparison.

Hypothesis	Evidence that supports it	Test that can reject it	Limit
RF efficiency		Same path, known-good radio window	Do not name physical RF source
Allocation		Same setup, controlled load window	Do not infer scheduler reason
Transport / path		Move one endpoint or boundary	Do not name exact hop
Policy / session		SIM/UE matrix plus independent record	Plateau alone is insufficient
UE / config		Same SIM in validated UE	Capability is not realised state

YOUR THREE-SENTENCE EVIDENCE BOUNDARY

1. Last positive: _____
2. First divergence: _____
3. Next test: _____

REPRODUCIBLE OUTPUT

A useful handoff lets another engineer replay the evidence path

Record the test contract, comparison and conclusion limit. Keep sensitive identifiers outside the public or shared template.

1 - SYMPTOM AND DIRECTION

DL / UL, measurement point, exact window

2 - FROZEN TEST CONTRACT

Endpoint, path, protocol, streams, duration, payload and UE state

3 - DEMAND PROOF

What shows data was available during the interval?

4 - KNOWN-GOOD COMPARISON

Same contract; one controlled variable changed

5 - LAST POSITIVE

Last boundary where expected state or volume is established

6 - FIRST DIVERGENCE

First synchronised boundary where the comparison breaks

7 - BRANCH CLASSIFICATION

RF / allocation / path / policy-config-UE

8 - EXCLUDED HYPOTHESES

What evidence rejects or weakens each branch?

9 - CONCLUSION LIMIT

What has not been proved?

10 - NEXT DISCRIMINATING TEST

One action with a clear rejection condition

FINAL STATEMENT

Observed: _____
 Supported classification: _____
 Not proved: _____
 Post-check contract: _____

CONTINUE THE EVIDENCE PATH

Use the compact playbook as a field entry point

The full guide explains the radio and protocol context. The workbook provides a fillable evidence workflow.

87-PAGE ENGLISH FIELD GUIDE

5G NR From Site to Trace
Numerology, BWP, SSB, PDCCH, measurements, mobility and low throughput.

24-PAGE FILLABLE BETA

5G NR Troubleshooting Evidence Workbook
Case intake, evidence inventory, branch worksheets, conclusion boundary and handoff.

Technical references

TS 38.214 V18.9.0 - physical layer procedures for data

TS 38.321 V18.9.0 - MAC protocol

TS 38.322 V18.2.0 - RLC protocol

TS 38.323 V18.5.0 - PDCP protocol

TS 28.552 V18.12.0 - 5G performance measurements

TS 28.554 V18.9.0 - 5G end-to-end KPIs

TS 23.501 V18.12.0 - 5G system architecture

TS 38.306 V18.9.0 - UE radio capabilities

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