

Connectivity You Can Count On

A response to Ofcom - with independent evidence from a live UK rail corridor and a proposal for the missing measurement infrastructure.

PREPARED BY

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digis²

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SECTION 1

1. Executive Summary

Ofcom's 'Connectivity you can count on' (3 June 2026) reframes UK mobile policy from coverage to reliable real-world experience. We support the shift, and we go further: measurement-led regulation needs continuous, application-aware, independently published evidence at corridor and venue level. Snapshots diagnose; continuous instrumentation regulates. The UK is the lowest-ranked G7 economy on mobile performance — 33 of 38 in the OECD — and on-train is the weakest segment, during our Eurostar trips from London to Paris, we used to notice a sharp contrast in mobile network performance: service in the UK was typically poor, but once we crossed into France, connection speeds immediately improved to a reliable and acceptable level.

The missing infrastructure is a continuous, independent rail-connectivity observatory. This response proposes one, backed by primary evidence from a UK corridor and by a delivered multi-operator reference case in another market.

We recognise Ofcom will form its own view. This submission is substantive input evidence, not prescription, and is a supplement to the consultation response submitted by Digis Squared.

1.1 At a glance

Beyond the network floor. Ofcom's three thresholds (≥ 5 Mbit/s download, ≥ 1.5 Mbit/s upload, ≤ 50 ms latency) are the right floor. Passengers experience apps, not thresholds. Voice, video conferencing (Teams, Zoom), streaming, messaging and financial transactions each have their own quality bar published by vendors and standards bodies - and those bars must be reported alongside the network floor.

Why rail, why now. EE meets Good Performance on 42% of on-train tests nationally; Three/O2/Vodafone on 17–21%. The VodafoneThree merger has just closed with rural and densification commitments that need independent verification. VMO2's Starlink Direct-to-Cell went live February 2026; Vodafone-AST SpaceMobile trials in summer 2026. The evidence gap is widening at exactly the moment new services need measurement against real experience.

Continuous, not campaign. Crowdsourced data identifies. Drive-test campaigns diagnose. Neither alone delivers the always-on, independent evidence Ofcom's ambition requires. The missing infrastructure is a continuous rail-connectivity observatory.

SECTION 2

2. Problem statement - the gap Ofcom has identified, and what remains

2.1 What Ofcom's evidence establishes

Ofcom's June 2026 discussion paper and its commissioned measurement studies establish the shape of the problem clearly:

- **On-train:** Nationally, in the Streetwave measurement study, on-train Good Performance was met by EE on 42% of tests, Three on 21%, O2 on 20% and Vodafone on 17%. No operator approaches the 90% benchmark.
- **Route variance:** Route variance is enormous - pass rates ranged from 4% on cross-country lines to 82% on short London commuter routes. National averages conceal local failure.
- **Latency-driven failure:** Latency, not throughput, is the dominant reason tests fail the Good Performance threshold. This shifts the engineering focus from 'more spectrum' to signal quality, handover, congestion and backhaul.
- **Indoor and busy areas:** Indoor and busy-area performance (from the GMCA 'Beyond Coverage' study, June 2026, and the Co-op Live case cited by Ofcom) shows peak-hour degradation of up to 50 percentage points and confirms that buildings designed with connectivity in mind perform materially better than those relying on the outdoor network; capacity, not coverage, is the binding constraint.
- **Rural:** Rural areas remain materially behind - Mobile Matters 2025 shows 5G's share of connections at 29.5% urban vs. 18.8% rural.

2.2 International context — the gap the UK has to close

Ofcom notes the UK is the lowest-ranked G7 economy on mobile performance and 33 of 38 in the OECD. Rail-leader economies have moved further than the UK on independent continuous monitoring:

- **Japan:** Japan — JR East publishes on-train connectivity metrics as part of Shinkansen and Tokyo-area service quality reporting; MIC (Ministry of Internal Affairs and Communications) publishes independent measurement benchmarks quarterly. Outcome: Japan consistently ranks in the OECD top decile for mobile QoS; industry consolidation of measurement methodology reduced measurement dispute cost across MNOs.
- **South Korea:** South Korea — MSIT (Ministry of Science and ICT) publishes an annual independent measurement campaign of mobile QoS; operator league tables are public. Outcome: since MSIT's 2020 methodology overhaul, Korean urban Good Performance equivalence rose from ~78% to ~92% by 2024 — measurement-driven competitive pressure.
- **Switzerland:** Switzerland — SBB publishes rail-corridor connectivity data alongside timetable performance; ComCom supplements with independent

measurement. Outcome: Swiss rail passengers can see per-line quality before booking; SBB uses the data as an operator-negotiation instrument.

- **Germany:** Germany — Deutsche Bahn's Konnect programme and Bundesnetzagentur's Funkloch-App combine continuous on-train measurement with crowdsourced coverage reporting. Outcome: independent evidence supported €500m+ of targeted trackside investment 2022-2025 aligned to measured gaps.

These models are the pattern the UK now needs — not as an academic exercise, but because Ofcom's ≥9-in-10 ambition cannot be tracked without them.

2.3 The passenger voice - Ofcom's own consumer research and adjacent evidence

Ofcom published a consumer research report alongside the discussion paper (June 2026, based on qualitative fieldwork with mainstream and vulnerable users across all four nations). Its findings are consistent with our own operational experience:

- Mobile connectivity is now integral to everyday life; reliance is highest when Wi-Fi is unavailable — precisely the on-train and rural contexts where connectivity most often fails.
- Network quality issues are strongly location-linked; passengers describe them by route and venue, not by operator KPI.
- Business travellers, remote workers, older users and users with disabilities describe the greatest impact from poor rail connectivity — safety, wayfinding, keeping in touch and continued work all depend on it.

The wider consumer-body picture reinforces this. Which? has consistently identified mobile network quality as a leading dissatisfaction driver among broadband and mobile customers. Citizens Advice highlights digital connectivity as an inclusion issue for households without home broadband — a group disproportionately represented among rail commuters on lower incomes. London TravelWatch and Transport Focus regularly identify on-train mobile connectivity as one of the top complaints from long-distance rail passengers. The evidence base points consistently in the same direction; what has been missing is the measurement instrument to translate consumer sentiment into industry accountability.

2.4 The economic cost of poor rail connectivity

UK rail carries approximately 1.5 billion passenger journeys per year (Office of Rail and Road, 2024/25), may be more as of now. Business travellers and remote workers represent a material and growing share of intercity journeys. A dropped Teams call on a London-Bristol -for example- business journey costs both the caller and the recipient's time; multiplied across passengers, corridors and journeys, the productivity loss is significant — before considering safety, well-being and the reputational cost to rail as the modal-shift alternative to road and air.

Cost of doing nothing — an indicative sizing

Assume intercity and regional journeys are ~30% of 1.5 bn total, giving ~450 m journeys/year with meaningful business use.

Assume ~20% carry a knowledge worker attempting remote work en-route (Teams call, doc load, transactional app), giving ~90 m business-relevant journeys/year.

At an average of 15 productive minutes lost per affected journey to poor connectivity, and an average UK knowledge-worker labour rate of ~£30/hour, the productivity loss is around £15 per affected journey — approximately £1.35 billion per year, before any allowance for missed sales, incident escalation, safety-service disruption or brand impact.

Even at half this figure, the annual cost of poor rail connectivity is materially greater than the total programme cost of a national observatory covering all 24 Streetwave-measured lines.

Investing in independent, continuous measurement is the enabling first step to unlock this value. Without measurement, MNOs, TOCs and government cannot know where to invest; with it, the same money delivers materially more passenger experience per pound.

2.5 Why the current three metrics miss the passenger experience

Ofcom's Good Performance metric — ≥ 5 Mbit/s download, ≥ 1.5 Mbit/s upload, ≤ 50 ms latency — is defensible as a floor. Its limitation is that it assumes all applications have the same needs. They do not:

- A Teams or Zoom call needs one-way latency below 80 ms, jitter below 30 ms and MOS ≥ 3.6 ; download throughput is largely irrelevant if these fail.
- Video streaming (YouTube, iPlayer, Netflix) tolerates variable throughput but is intolerant of stalls and startup delay; peak throughput matters less than sustained buffer level.
- Banking and wallet apps need auth round-trip below 1.5 seconds at $\geq 99.5\%$ reliability; a network passing all three Ofcom thresholds can still fail these transactions if it has jitter tails.
- Messaging (WhatsApp, SMS, iMessage) needs high delivery success on modest bandwidth; low-throughput coverage in rural segments is often sufficient.

An application-aware quality regime reports both the network floor and the app-class KQIs that map to what passengers feel.

2.6 Why one-off snapshots are not enough

The Streetwave study and Beyond Coverage report are excellent snapshot evidence. They cannot, on their own, deliver an ongoing regulatory instrument: neither operator investment nor consumer choice can be effectively driven by a study published on a yearly cadence. Only continuous, independent measurement — published at the frequency of change on the ground — can serve as the regulatory dial Ofcom's ambition requires.

2.7 Market context and the investment environment

Performance ultimately depends on the investment environment. The UK market has changed materially in the last 24 months and any credible response has to sit within that context:

- **Merger dynamics:** The VodafoneThree merger has closed, creating a denser network and consequential competitive pressure on EE, VMO2 and MVNOs. VodafoneThree's Network Commitment (rural, densification) is a regulated undertaking that needs independent verification per corridor — precisely what this framework enables. Our view on market dynamics: the merger is likely net-positive for network quality where the Commitment lands, but there is a legitimate concern that market concentration reduces price competition; independent measurement is the right instrument for the CMA and Ofcom to test whether the trade-off is playing out as anticipated.
- **MVNO growth:** MVNO growth and new market entrants (Sky Mobile, Lyca, iD Mobile, iD, giffgaff and specialist propositions) have expanded consumer choice and driven price pressure. Independent measurement should apply to hosts on equal terms so consumers can compare like-for-like.
- **Planning environment:** Planning and site-access friction remain the principal barriers to densification in busy areas. Local-authority planning refusal rates and timescales vary widely; Ofcom's own analysis shows the spread. Standardising the framework and publishing outcomes would create healthy pressure to converge.
- **Spectrum:** Spectrum in mid-band, mmWave and newly 3GPP defined FR3 Spectrum, plus new NTN spectrum via the D2D licence variations, is the raw material for the next investment cycle. Sharing frameworks work well where demand exists; they do not resolve rural economics on their own.
- **Cross-government:** Ofcom sits alongside DSIT's Wireless Infrastructure Strategy, DfT's rail-connectivity work, and Great British Railways' upcoming establishment. The connectivity conversation is now cross-departmental; the measurement framework must be too.

A robust regulatory response has to acknowledge that performance is a product of investment, competition and public-sector coordination — not a lever Ofcom can pull alone. The NOC in Section 9 is designed to be a shared instrument for exactly that ecosystem.

SECTION 3

3. Connectivity You Can Count On, on the train

3.1 The three principles

- **Independence:** No network to defend; no vendor allegiance; no operator loyalty. Independence is the precondition for regulator-facing evidence, and we hard-code it in governance.
- **Application-aware:** Report Ofcom's three metrics AND the service-class KQIs passengers actually feel - voice, video conf, streaming, messaging, transactional, safety.
- **Continuous:** Measurement is not a project; it is an operating discipline. What isn't measured continuously cannot be assured continuously.

3.2 What this vision demands operationally

Four capabilities would be needed to make the vision real:

Capability	What it delivers
Real-time testing	Autonomous measurement across all technologies (2G–5G SA, NTN, WiFi, IoT). Multiple kit variants. AI-analysed reports in 15 minutes. Static, portable or backpack; no engineer required on site.
Analytics engine	Data fusion and AI root-cause analysis. Ingests active tests, crowdsourced QoE, cell/site/spectrum data, TOC route metadata. Produces geospatial QoE maps, vulnerable-spot rankings, predictive analytics and per-segment RCA.
AI enabled planning	AI-native network planning. Radio, transmission, transport and core in one Digital Twin. Automatic Cell Planning; PCI/RSI collision resolution; site-addition, site-consolidation and NTN-augmentation modelling. Documented 68%→94% lift in production.
Cognitive Operations capability	Cognitive operations and assurance. Vendor-agnostic, multi-technology, multi-domain. Threshold-based alarming; automated diagnostics; SOC-style incident detection and playbook execution.

3.4 Sustainability

Rail is the low-carbon transport option; better on-train connectivity helps drive modal shift from road and air. The measurement layer itself runs on efficient IoT-class hardware — silent, wall-mount, low-power — so the observatory's own footprint is negligible.

3.5 Where connectivity is going — 2028–2030 outlook

A measurement framework built today needs to be usable in 2030. The technology and policy landscape is moving faster than Ofcom's typical review cycle:

- **Satellite D2D:** NTN normalisation — direct-to-device satellite moves from messaging class (2025-26) to consumer data class (2027-28) as AST SpaceMobile's constellation completes and Starlink's D2C data services expand. NTN becomes a regular tab on the coverage map, not a special case.

- **5G SA default:** 5G Standalone becomes default — enabling network slicing per service class, per operator. The service-class KQIs in Section 4 become directly enforceable rather than statistically inferred.
- **FRMCS:** FRMCS rolls out — passenger connectivity and rail signalling converge on shared 5G infrastructure through the late 2020s. The measurement instrument must serve both use cases without confusing them.
- **CAM:** Connected and automated mobility matures — road corridors join rail as continuously measured environments; the NOC pattern extends naturally to a UK Corridor Observatory.
- **Metric evolution:** Ofcom's Good Performance thresholds themselves will need to rise — today's ≥ 5 Mbit/s floor will look modest by 2030 as ambient-video, XR and always-on AI applications become mainstream.

3.6 Digital inclusion — who benefits most

Poor rail connectivity disproportionately affects the groups least able to work around it:

- **Commuters:** Long-distance commuters, who lose productive hours per week when Teams and Zoom fail on-train; disproportionately concentrated on West Coast, East Coast, Great Western and cross-country lines.
- **Remote workers:** Remote and hybrid workers who rely on rail for regular office trips and treat travel time as work time; often the same demographic as the previous group.
- **Digitally excluded households:** Passengers without home broadband — a group over-represented on longer-distance rural rail journeys — for whom mobile is their only reliable connectivity.
- **Vulnerable users:** Older passengers and passengers with disabilities, for whom on-train connectivity supports wayfinding, safety and accessibility apps; failures have real welfare cost.
- **Safety-dependent:** Passengers relying on emergency services or safety-critical apps (medical, personal alarm).

A response framed only around business travellers would understate the case.

SECTION 4

4. What 'good' should mean — service-class taxonomy and industry standards

OFCOM section2 Q1

What are your views on the use of the Map Your Mobile good performance metric, and how should the measure evolve over time?

OFCOM section2 Q2

What are your views on the usefulness of (a) the 90% figure as a benchmark applicable across geographies and based on crowdsourced data, and (b) whether the 90% benchmark is realistic and sufficiently ambitious?

Ofcom's three metrics are the network floor. This section proposes the service-class taxonomy and named industry standards that must be reported alongside — grounded in what the app vendors themselves publish.

4.1 Service classes

Class	Examples	What passengers experience
Voice	Voice/VoLTE/VoNR; emergency calls	Setup completes; call holds; audio is intelligible; no drop
Video conferencing	Microsoft Teams, Zoom, Google Meet, WebEx	Video does not freeze; audio does not cut; screen share works
Video streaming	YouTube, iPlayer, Netflix, Amazon Prime	Starts quickly; does not stall; resolution acceptable
Social & feeds	Facebook, Instagram, X, TikTok	Feeds load; images and videos render; posts succeed
Messaging	WhatsApp, iMessage, SMS	Messages send; delivery is confirmed; time-to-deliver acceptable
Navigation	Apple Maps, Google Maps, Waze	Tiles load; route re-calculation works; ETA updates
Transactional	Banking, payments, ticketing	Auth succeeds; transactions confirm; failures are recoverable
Safety-critical	999 / 112, rail-crew comms, safety alerting	Always available regardless of app-level QoE

4.2 Industry standards we benchmark against

Standard	What it defines / requires
Ofcom Good Performance	≥ 5 Mbit/s DL, ≥ 1.5 Mbit/s UL, ≤ 50 ms latency — the network floor
3GPP VoLTE MOS	MOS ≥ 3.6 for acceptable voice quality; packet loss $< 1\%$; jitter < 30 ms
ITU-T G.1010	End-user multimedia QoS classes — delay, jitter and loss targets per application class
Microsoft Teams	Round-trip latency < 80 ms (optimum), < 100 ms (acceptable); packet loss $< 1\%$; jitter < 30 ms
Zoom	Bandwidth 1.5 Mbps UL/DL for 1080p; latency < 100 ms; jitter < 40 ms; loss $< 2\%$
Google Meet / WebEx	Similar to Teams / Zoom; publish minimum-bandwidth and latency requirements
YouTube / Netflix / iPlayer	Startup < 5 s; stall rate $< 1\%$ of session duration; adaptive resolution ≥ 720 p sustained
GSMA IR.94	Video-calling / conversational-video service requirements for MNOs

4.3 Safety-critical services — the non-negotiable floor

Emergency-services voice (999/112), rail-crew safety-critical communications and passenger safety alerting must be reliable regardless of app-level QoE. Safety belongs as a distinct service class with its own availability requirement, not folded into passenger applications. FRMCS (Future Railway Mobile Communication System) — the 5G-based successor to GSM-R — will bring passenger and signalling networks into much closer proximity than today; independent measurement is a prerequisite for confidence in that convergence.

4.4 How this maps to what passengers feel

A passenger does not think 'my SINR is 8 dB' — they think 'my Teams call froze' or 'the payment failed'. The service-class taxonomy above translates operator-side KPIs into what passengers actually experience. It gives Ofcom, MNOs, TOCs and consumers a common language, and it is the intellectual foundation for the multi-dimensional benchmarking (radar) view we present in Section 5.

SECTION 5

5. Evidence base — London ⇄ Bristol case study

OFCOM section6 Q1

What do you think are the biggest barriers, technical and commercial, to achieving better mobile performance on trains? Which are most significant, and why?

This section presents our primary measurement evidence on the London ⇄ Bristol corridor. The intent is not to replace Ofcom's national study but to add independent, deep, per-second, per-operator, per-service-class evidence on one live intercity route — the kind of evidence the NOC in Section 9 would generate continuously across the network. Together with the RCA in Section 6, this section directly addresses Ofcom's question on the biggest technical and commercial barriers to on-train performance.

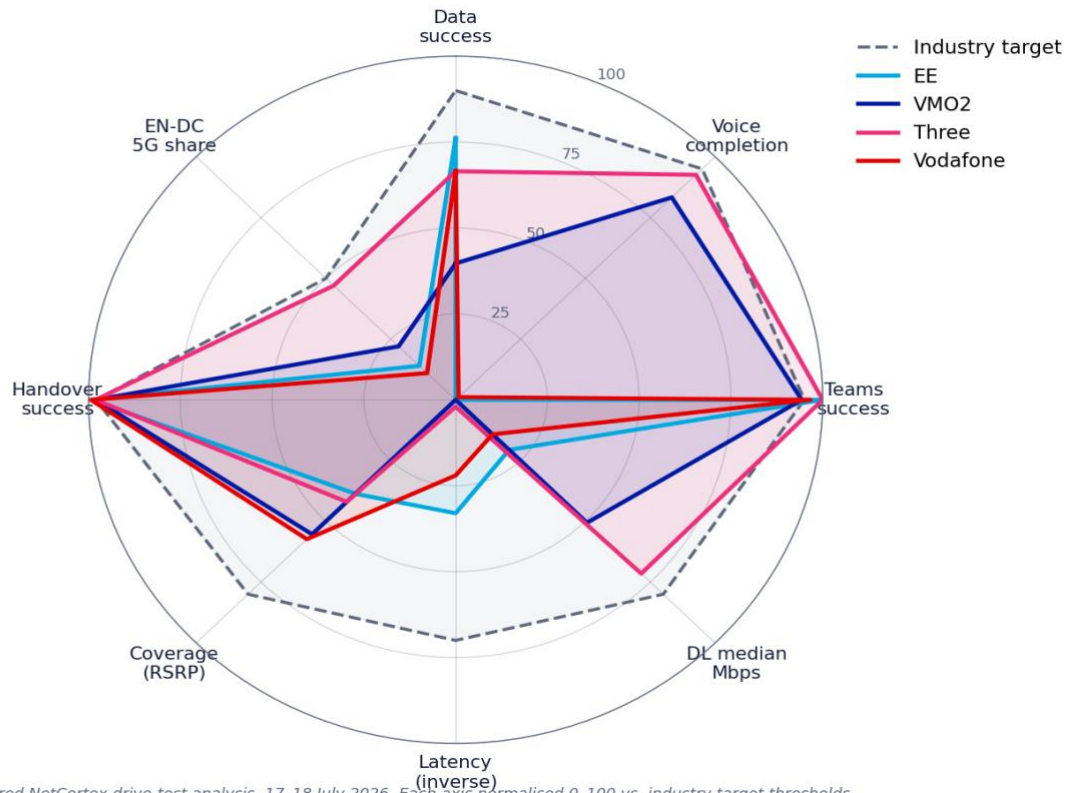
5.1 Methodology

- **Route:** London ⇄ Bristol (M4 corridor · 508 GPS track points · bidirectional).
- **Test days:** 17 July 2026 and 18 July 2026.
- **Scenarios:** Data-only · Data + Teams · Teams-alone · Voice. Same scripts, same route, per operator.
- **Operators:** EE · VMO2 (O2) · Three · Vodafone - 4 SIMs, four independent test kits, identical driver script and timing.
- **Volume:** 16 campaigns (4 operators × 4 scenarios). 2,902 valid scripted activities, 99,194 one-hertz radio and application samples.
- **Analysis:** per-sample re-read, no interpolation. Radar-view normalisation against industry-standard target polygon. Using NetCortex/ OctoMind (see section 11).

5.2 Radar view — 4 operators vs. industry-standard target

The clearest single view of the corridor's current state:

London ⇌ Bristol — 4-operator radar vs. industry-standard target

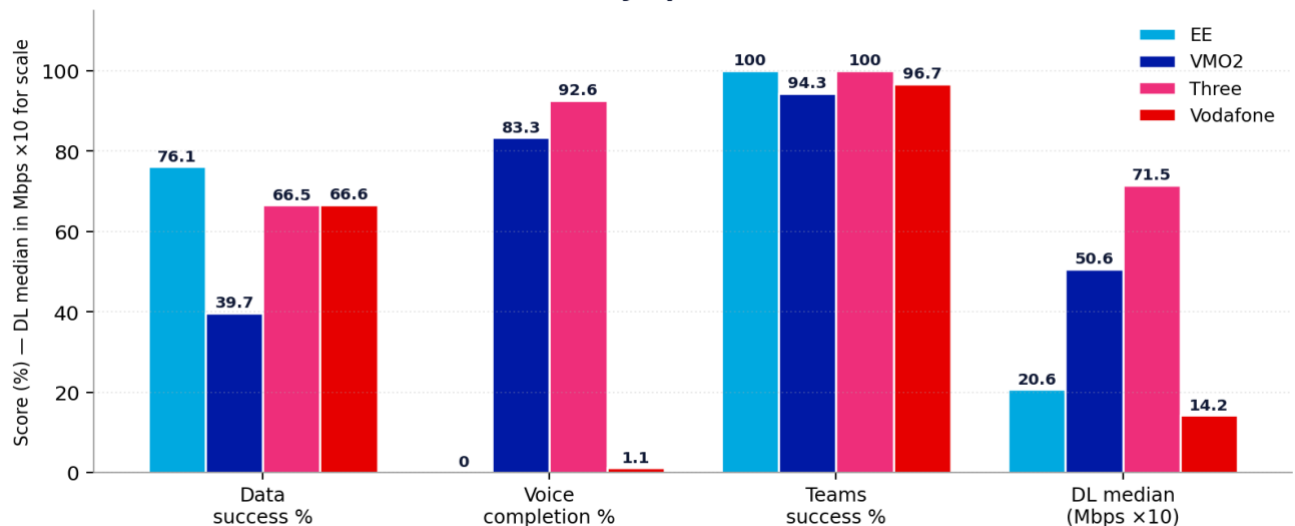


Source: Digis Squared NetCortex drive-test analysis, 17-18 July 2026. Each axis normalised 0-100 vs. industry target thresholds.

Figure 1 — London ⇌ Bristol, 4 operators overlaid on the industry-standard target polygon (dashed). No operator meets the target on every axis; each has a distinct failure profile.

5.3 Headline KPIs — the numbers underneath the radar

London ⇌ Bristol — headline KPIs by operator



Source: Digis Squared NetCortex drive-test analysis, 17-18 July 2026. 785+716+745+656 = 2,902 scripted activities.

Figure 2 — Headline KPIs per operator across data, voice, Teams and downlink speed. DL median shown x10 for scale on the same chart.

Full-set KPI table:

KPI	EE	VMO2	Three	Vodafone
Campaign activities	785	656	745	716
Data success (%)	76.1	39.7	66.5	66.6
Data + Teams success (%)	29.0	22.9	34.3	33.8
Teams success (%)	100	94.3	100	96.7
Voice completion (%)	0.0	83.3	92.6	1.1
DL median (Mbps)	2.06	5.06	7.15	1.42
DL peak (Mbps)	30.8	5.7	42.8	43.8
Ping RTT median (ms)	67	243	98	78
RSRP p50 (dBm)	-108.4	-103.4	-107.4	-102.8
SINR p50 (dB)	10.0	8.8	8.3	9.9
EN-DC share on data (%)	14	22	47	11
Weak-coverage time (%)	43	30	35	28
Handover success (%)	99.3	98.1	98.1	99.4

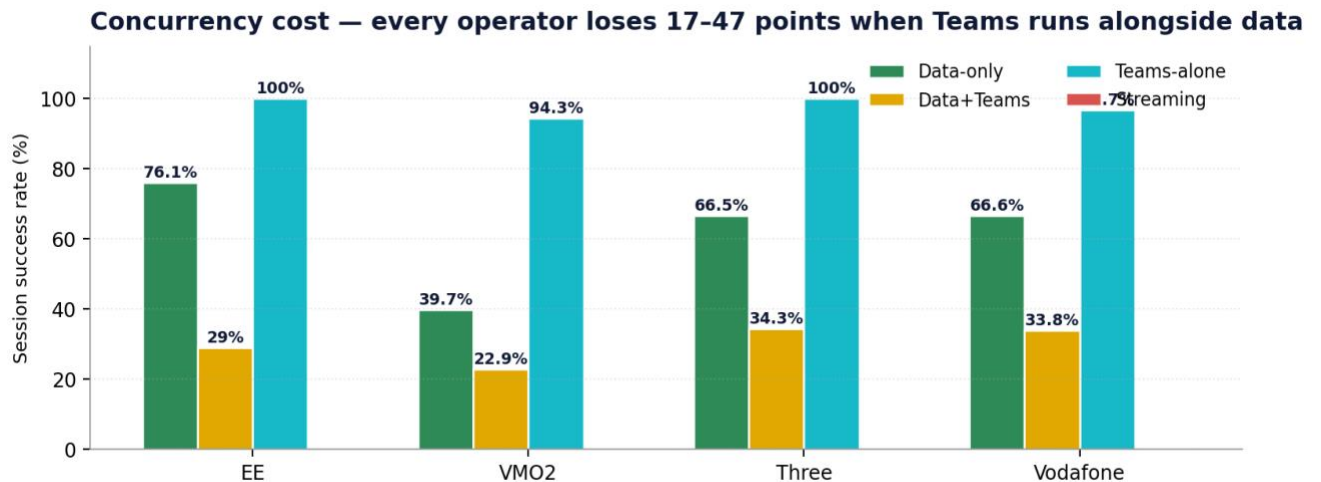
Three paradoxes hidden in the numbers

Strongest signal, weakest conversion. Vodafone has the corridor's best RSRP (-102.8 dBm) and least weak-coverage time (28%), yet the worst DL median and second worst 1.1% voice completion. Signal quality and service delivery have decoupled — the problem is not coverage.

Two voice collapses, two different causes. EE (0/81 completion) fails at setup on healthy radio — a core/IMS/provisioning problem- this was intentionally done to proof the capability of catching core issues- and Vodafone (1/90) fails on a marginal, interfered layer with 39.7% RACH failure and no fallback path. One symptom, two different fixes.

Concurrency wrecks everyone. Every operator loses 17–47 percentage points when Teams runs alongside data. Streaming hits 0% for all four. Concurrency is what real passenger usage looks like (not an outlier).

5.4 Cross-scenario view — concurrency



Source: Digis Squared NetCortex drive-test analysis, London → Bristol, 17-18 July 2026.

Figure 3 — Data-only vs. data+Teams vs. Teams-alone vs. streaming, per operator. The Ofcom-three passing scenarios do not survive concurrent load.

This is the empirical validation of Section 4's argument. When a passenger multitasks the way passengers actually do, data plus a Teams call, every operator's success rate collapses. When they try to stream video, all four operators fail. Ofcom's three-metric floor did not detect any of this.

5.5 Corridor Coverage CDF

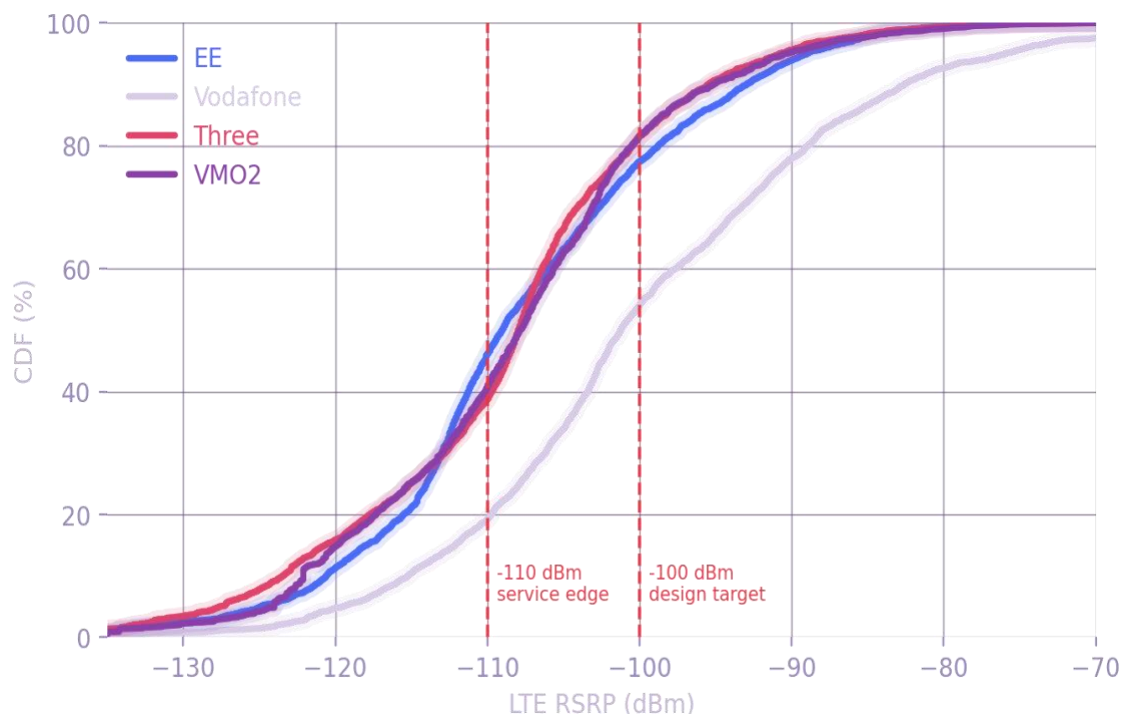


Figure 4 — London to Bristol RSRP CDF.

5.6 On-board Wi-Fi observations and position

Digis Squared's measurement campaign did not carry a distinct on-board Wi-Fi test cadence, so we defer to Ofcom's national finding that on-board Wi-Fi meets the Good Performance threshold on approximately 1% of tests. On this corridor, Wi-Fi

throughput observed during the drive was consistently below the 5 Mbit/s Ofcom threshold and would not have influenced any of the passenger-facing KPI results.

Our position on on-board Wi-Fi. On-board Wi-Fi should be treated as a complement to mobile connectivity, not a substitute. The Streetwave 1%-pass finding indicates current on-board Wi-Fi delivers minimal passenger benefit at meaningful cost. Three actions would improve outcomes: (a) TOCs and DfT should specify Wi-Fi performance to the same Good Performance standard as mobile so it is judged on outcomes, not availability; (b) South Western Railway's trackside mmWave trial should be independently benchmarked before wider adoption is considered — the results are of interest across the industry; (c) where Wi-Fi cost cannot deliver Good Performance, TOCs should focus that investment on on-board mobile-signal amplification (repeaters, RIS panels) that lifts all four MNOs plus D2D satellite, rather than a single captive network. The NOC framework (detailed in section 9) would report Wi-Fi alongside mobile using the same yardstick.

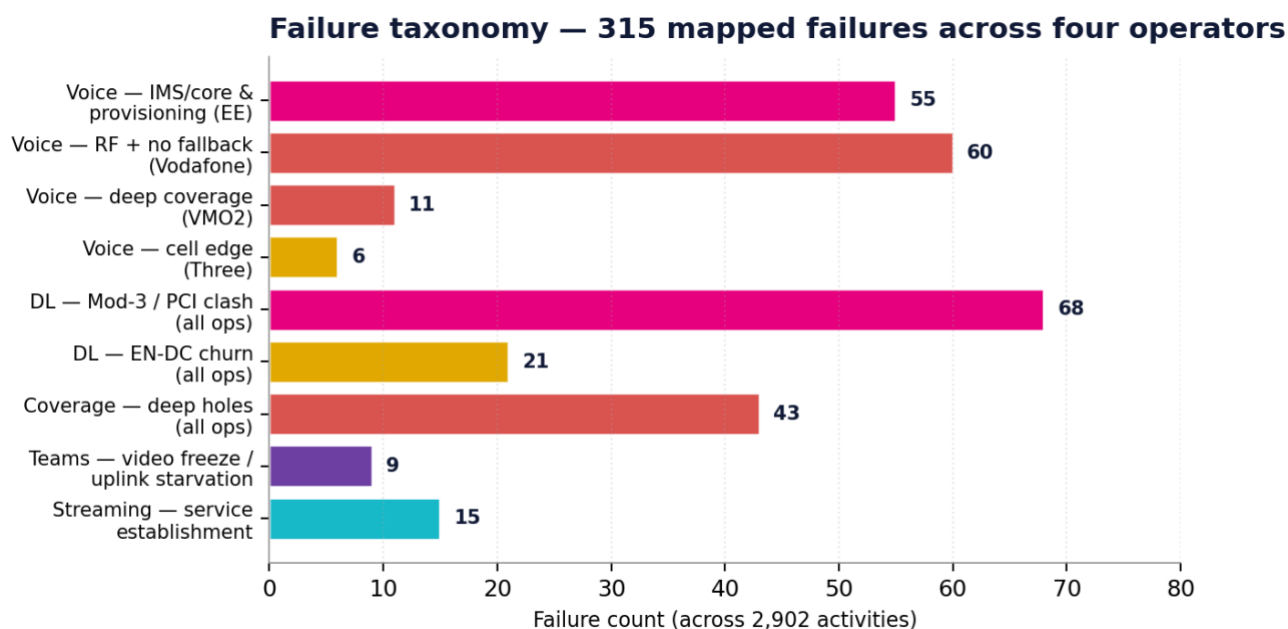
5.7 What the evidence establishes

- The Good Performance metric alone would rate this corridor as broadly functional. However, Application-level KQIs (voice, Teams-with-data, streaming) tell a materially different story.
- There is no single 'best' operator. Three leads composite score (82.5/100) on data speed and voice; EE leads data reliability; Vodafone leads on signal and handover but converts poorly; VMO2 has structural coverage holes.
- The dominant failure mechanism is a corridor-wide PCI Mod-3 reuse defect that erodes SINR 5-8 dB and corrupts control-channel setup and handover - visible in every operator's failure clusters.
- Two structural fixes (corridor PCI re-plan and provisioning audits for EE and Vodafone) would remove the majority of failure volume across all operators - this is not a single-operator problem.

SECTION 6

6. Gaps identified and root causes

The RCA using Digis Squared's NetCortex of the London-Bristol campaign produced 20 detailed records across the four operators. The consolidated failure taxonomy is below.



Source: Digis Squared NetCortex RCA of London ⇌ Bristol drive test, 17–18 July 2026.

Figure 5 — Failure taxonomy across 2,902 activities. Root causes cluster into six families; the corridor-wide Mod-3/PCI clash is the shared multiplier behind coverage, voice and Teams failures.

6.1 Latency-driven failures

Consistent with Ofcom's national finding. Latency is the dominant threshold-breach reason across the corridor. The RCA shows the root cause is not raw distance but signal quality: cells operating close to the edge, with control-channel corruption from PCI reuse, produce latency spikes that fail voice setup and video-conferencing sessions even when throughput is nominally acceptable.

6.2 Coverage and capacity gaps

VMO2 has three drop reports below -122 dBm with attach rejections and forced GSM fallback — deep coverage voids that generate the majority of its voice failures. EE has 43% weak-coverage time on this corridor — the highest of the four — and 16 drop clusters with mean trigger -114.4 dBm. Vodafone reaches minima below -120 dBm on 11 of 17 drop reports. Coverage remains a real constraint; efficiency is another.

6.3 Handover behaviour

Handover success itself remains high across all operators (98.1–99.4%). The issue is what happens around handover: EN-DC (5G-leg) add/release churn, SCG addition on weak LTE anchors that release shortly after, and mid-transfer collapse when an SCG

add lands on a cell with active PCI collision. Handover as a discrete event works; handover in context degrades service.

6.4 Application-specific failures

The RCA identifies patterns invisible to Ofcom's three metrics:

- **Teams freeze-under-success:** EE Teams sessions marked 'Success' but with 36 embedded video freezes (359 seconds cumulative) under 100% Mod-3 clash — the network reports success while the passenger sees a frozen call.
- **Streaming — no bearer:** All four operators' streaming sessions failed at service establishment — no user-plane bearer opened — even on cleanest radio. This is an application/APN configuration issue, not a radio issue.
- **Good-RF, no-throughput:** Two Vodafone downloads collapsed at 0.03 Mbps despite excellent RSRP/SINR and zero clash tokens — server / DNS suspects, off-network. Radio spend would not fix them.

6.5 The dominant multiplier — corridor-wide PCI / Mod-3 clash

Across all four operators, the coverage Digital Twin flags Mod-3 clash in 80–100% of drop reports and PCI clash in 70–100%. Geometry screens (overshoot, cross-sector, side-lobe, back-lobe, serving-not-closest) are clean. The corridor's cells are physically well-placed — but their identity assignment produces persistent co-channel interference that erodes SINR 5-8 dB in the exact segments where failures cluster. A corridor-wide PCI re-plan is the highest-leverage single intervention available on this route and would benefit every operator.

SECTION 7

7. Recommendations to meet industry requirements on the tested corridor

The 8-step action plan below consolidates the NetCortex RCA. It maps onto the four-quadrant fix taxonomy — soft optimisation, hard physical actions e.g. re-azimuth or mechanical tilting, Smart CAPEX, NTN augmentation — described earlier. Each action carries a specific diagnosis, specific change and expected impact.

7.1 Prioritised remediation table

#	Action	Diagnosis	Expected impact
P1	Corridor-wide PCI / Mod-3 re-plan (all operators)	Clash tokens on 34–100% of samples in every failure cluster; geometry screens clean.	SINR recovery of several dB in weak areas; removes the shared failure multiplier
P2	EE — IMS/VoLTE core triage + SIM provisioning audit	55/81 setup failures under nominal RF; RACH/HO layers clean.	Addresses the dominant mode (68%) of the 81-call wipe-out
P3	Vodafone — PRACH / uplink reliability + provisioning check	220/554 RACH failures (39.7%), 29 RLF, 36 re-establishments; 30 pristine-RF signalling failures.	Stable bearer acquisition for VoLTE setup
P4	VMO2 — close deep coverage holes + HO/RACH tuning	3 drop reports below -122 dBm with attach rejects and GSM fallback; POF RSRP to -134 dBm.	Removes the deep-hole majority (11/15) of voice failures
P5	Three — cell-edge capacity + EN-DC stabilisation	11/18 DL failures coverage-limited at -105 to -110 dBm; NR-leg toggling collapsed 99 → <1 Mbps.	Sustains the speed lead without the edge-failure tail
P6	Gate SCG addition on LTE anchor quality (EE · VMO2 · Vodafone)	NSA SCG additions attempted below -100/-105 dBm anchors fail or release across 21 drop reports.	Prevents EN-DC churn from amplifying weak-anchor drops
P7	Vodafone — enable a voice fallback path	Zero RAT transitions across 90 attempts; the single connected call was a GSM fallback.	A safety net while P1/P3 land
P8	Restore full export profile for Teams / streaming (all)	No serving-cell rows and no RTC/OTT KPI tokens in several exports.	Turns the next campaign's QoE analysis from inference into measurement

7.2 Modelled cumulative uplift

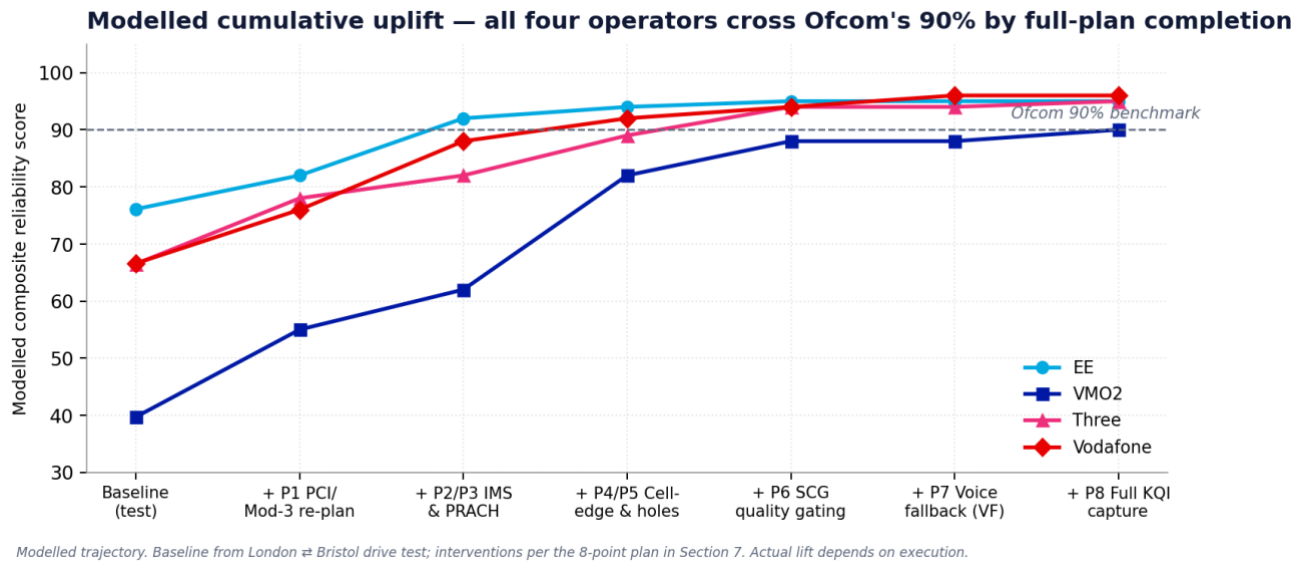


Figure 6 — Modelled cumulative reliability lift as each intervention lands. All four operators cross Ofcom's 90% benchmark by full-plan completion. Baseline is the July 2026 drive-test measurement; interventions per the 8-point plan above.

7.3 Impact-vs-effort matrix

Recommendations — impact vs. effort

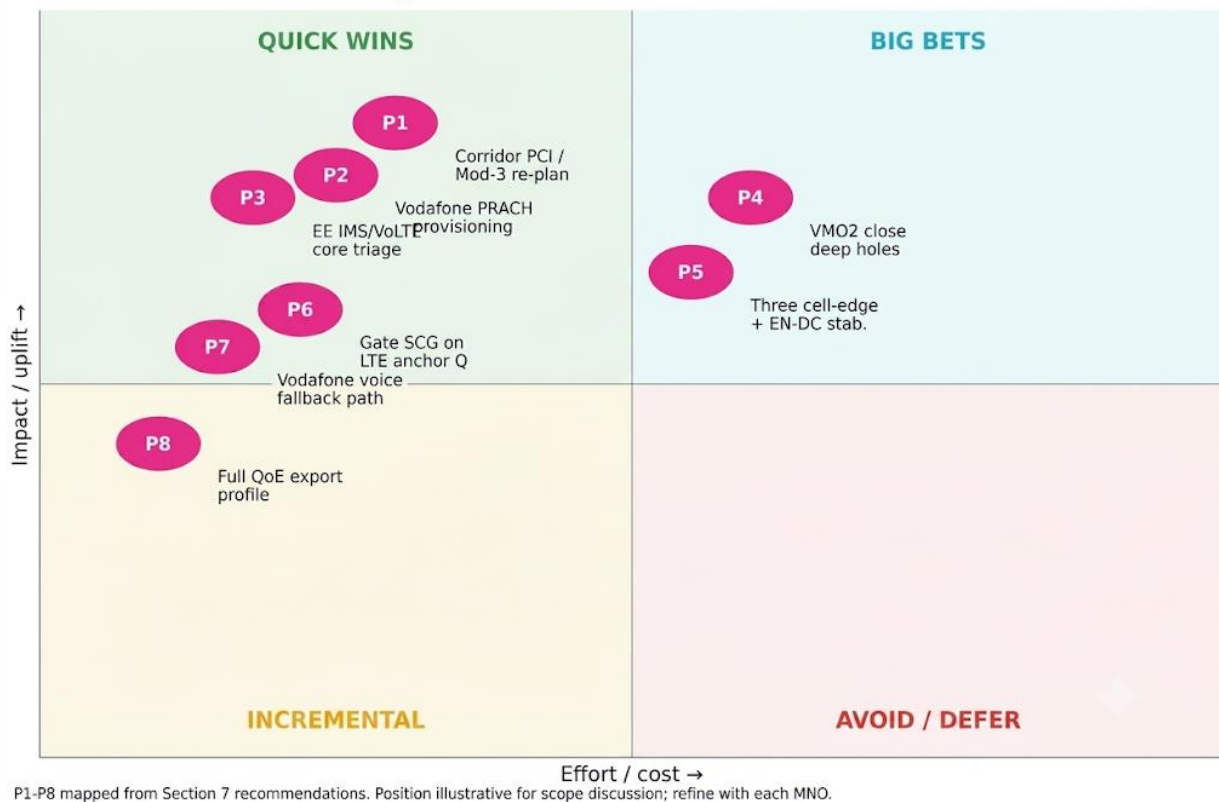


Figure 7 — Impact-vs-effort placement of the 8 recommendations. Quick wins (P2, P7, P8) can start immediately; big bets (P4, P5) need capital and time; corridor PCI (P1) is the single highest-leverage move.

SECTION 8

8. Views on Ofcom's other focus areas: busy areas, indoor and rural

This section gives our substantive views on the other three: busy areas, indoor shared places and rural. We draw on Ofcom's own case studies as well our operational experience in comparable multi-operator venues. Primary evidence for these three focus areas is exactly what the UK Rail Connectivity NOC framework in Section 9 would extend to venues and geographies - with the same methodology, the same independence and the same reporting cadence.

8.1 Busy areas (Ofcom section 4)

OFCOM section4 Q1

What do you think are the biggest barriers to achieving better mobile performance in town and city centres, and why?

The urban challenge is not coverage — Ofcom's own GMCA 'Beyond Coverage' evidence shows outdoor coverage in Greater Manchester is broadly good. The binding constraints are capacity and consistency under load. Peak-time degradation of up to 50 percentage points was observed indoors in the same study; the same pattern applies outdoors during rush hour and event peaks.

Two structural barriers dominate: (a) densification friction — planning-refusal variance between local authorities, site-access negotiation costs, and street-furniture availability; and (b) the split investment case — no single MNO captures the full value of an urban site, so investment is under-provided relative to social value. Both barriers are structural and neither is a technology gap.

- **Planning:** Local authority planning refusal rates and timescales vary widely across the UK; Ofcom's own analysis shows the spread. Standardising expectations and publishing outcomes would create pressure to converge on best practice.
- **Street furniture:** Street furniture as a densification enabler — councils that publish their asset register and charging framework enable materially faster small-cell rollout.
- **Data enablement:** Ofcom's Digital Connectivity Portal and the wider DSIT Wireless Infrastructure Strategy should be strengthened with granular local performance data — which the NOC framework can supply.

Suggested Improvements: per-street QoE analytics and Smart CAPEX modelling identify where densification lands the greatest experience lift per pound. Local authorities become planning decision-makers with evidence, not assertion.

8.2 Indoor shared places (Ofcom section 5)

OFCOM section 5 Q1

What do you think are the biggest barriers to achieving better mobile performance indoors, and why?

The Ofcom paper cites both the GMCA study and the Co-op Live case. Both confirm the same pattern: buildings designed or upgraded with connectivity in mind perform materially better than those relying on the outdoor network. The barriers are principally commercial and coordination-related, not technical.

- **Split incentive:** The commercial case for individual MNOs to build dedicated indoor infrastructure at every venue is weak; the case for a neutral-host model is strong but requires demand aggregation.
- **Building-side capability:** Building owners often lack the technical knowledge to specify indoor connectivity requirements at design stage; retrofit costs materially more than in-design.
- **Reporting gap:** There is no standard indoor quality-reporting framework — landlords, MNOs and consumers all lack a common language.

These are based on experience of running real-time Network Assurance inside high-density, multi-operator venue, benchmarking coverage, throughput and digital-service experience 24x7. The same model transposes directly to UK stations, hospitals, shopping centres, stadiums and large offices. The Rail Connectivity NOC framework extends naturally into a Venue Connectivity Observatory using the same platform.

Recommendation to Ofcom: work with DCMS to publish an indoor connectivity design standard for new build and major refurbishment, with independent measurement as the assurance mechanism.

Effectiveness of Neutral-host models. For busy indoor venues and station platforms, neutral-host infrastructure is the right structural answer. It resolves the split-incentive problem, delivers better indoor quality than any single-MNO investment can economically justify, and enables demand aggregation. Ofcom should actively encourage neutral-host adoption via (a) a standard performance-reporting framework so venue operators can compare providers, and (b) endorsement of independent measurement as the neutral-host assurance instrument.

Example case study: [Multi-operator Network assurance at one of the world's most demanding venues!](#)

8.3 Rural (Ofcom section 7)

OFCOM section 7 Q1

What do you think are the biggest barriers to achieving better mobile performance in rural locations, and why?

Rural connectivity carries two distinct problems that the paper tends to blur:

- **Genuine not-spots:** Genuine not-spots: geographies with no economic case for terrestrial coverage. The Shared Rural Network programme addresses these; the remaining gaps are progressively harder and progressively more suited to satellite direct-to-device (VMO2-Starlink live since Feb 2026; Vodafone-AST trials summer 2026).
- **Populated rural:** Populated rural areas: villages, small towns and rural business parks where terrestrial coverage exists but performance is materially below urban norms. This is where VodafoneThree merger commitments matter most — and where independent verification is currently absent.

Members of the industry are, in our experience, sceptical about spectrum sharing as a rural solution: unused spectrum in rural areas is generally unused because deployment there is uneconomic, and sharing does not change the economics. The credible levers are: full delivery of the VodafoneThree Network Commitment, targeted use of D2D satellite in genuine not-spots, neutral-host arrangements in populated rural, and smarter use of existing assets (masts, backhaul, spectrum).

Solutions for Improvement: independent verification of VodafoneThree merger delivery via the NOC framework (Section 9.16); NTN augmentation testing (Section 9.3) on the same yardstick as terrestrial; and INOS Watcher deployment at rural rail stations and village-centre locations to make performance visible in the geographies Ofcom cares most about.

8.4 Common thread across all four focus areas

Each of Ofcom's four focus areas has different technical characteristics but the same fundamental gap: continuous, independent, application-aware measurement is absent. The proposal in Section 9 is designed for rail because rail is our current evidence base — but the platform is deliberately general. A UK Connectivity Observatory built on the same foundations would serve buses, roads, hospitals, stadiums, shopping centres, stations, business parks and rural community hubs. Rail is Phase 1 because that is where the data is; the design is portable.

SECTION 9

9. The revolutionary proposal - a UK Rail Connectivity NOC

OFCOM section6 Q2

Do you agree with the proposal to work with government to support improvements in train connectivity?

OFCOM section6 Q3

What information would you find useful for Ofcom to provide further insights on in relation to connectivity on trains?

The NOC in one page

The below section references **Digis Squared solutions** which are listed in Section 11.

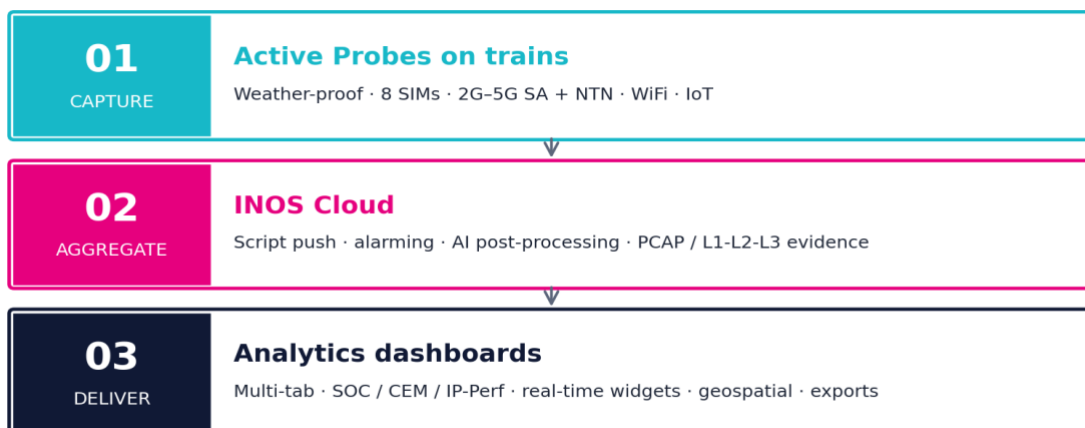
What. A UK Rail Connectivity NOC — one **INOS Watcher** per rail line (up to 8 SIMs each: all four UK MNOs plus O2 Satellite, Vodafone-AST). Weather-proof, wall-mounted, silent, always-on, GDPR-clean by design.

How. Three-layer platform (Capture → Aggregate → Deliver) built on **INOS Cloud** + **ConnectSphere**, with AI-driven RCA (**NetCortex**), planning (**OctoMind**) and assurance (**KATANA**).

Phased. Phase 1 — London ⇄ Bristol + 2 comparator lines (0–12 months). Phase 2 — 5 lines including one per devolved nation. Phase 3 — the 24 Streetwave-measured lines. Phase 4 — the whole UK network.

Answers Ofcom section 6, Q2. Yes, we agree with working with government — we propose the vehicle to make that partnership deliverable. This section details the concept, architecture, capabilities, governance, potential funding and roll-out.

The Rail Connectivity NOC — three layers, one platform, one accountable partner



AI is the connective tissue at every layer — AI-driven RCA (analytics), AI-native planning, cognitive-ops assurance, predictive KQI in dashboards.

Figure 8 — The NOC at a glance. Three layers, one platform. Read the detail below or jump to Appendix E for architecture and business case.

The London-Bristol evidence in Sections 5–7, and Ofcom's own national studies, both point to the same conclusion: the UK needs continuous, independent, application-aware measurement infrastructure for rail. The FRMCS replacement of GSM-R (Section 9.10) is a once-in-a-generation opportunity to bring signalling and passenger connectivity into aligned investment planning; the NOC is the measurement layer that makes that alignment accountable.

9.1 Concept — one INOS Watcher per rail line

The INOS Watcher is a weather-proof, wall-mounted, silent, always-on stationary probe from the INOS product family. It supports up to 8 SIMs per unit — enough to cover all four UK MNOs plus O2 Satellite, Vodafone-AST SpaceMobile and spare capacity in a single unit. Multi-technology: 2G, 3G, 4G, 5G NSA/SA, VoLTE, VoNR, VoWiFi, WiFi, IoT and CAT-M. Cloud-controlled and remote-scriptable; scripts push, kits run, data uploads — no engineer needed on site.

Deployed on-train (or at station platforms and depots), Watchers turn a rail corridor from an intermittently-tested route into a continuously-measured one — with the same methodology every day, at the same cadence, for every operator.

9.2 Three-layer architecture — Capture, Aggregate, Deliver

- **Capture:** INOS Watcher. 24×7 stationary probe. Multi-SIM, multi-technology. Runs the full test catalogue (Section 9.3) continuously.
- **Aggregate:** INOS Cloud. Script design and push, kit control, threshold-based alarming, NXI post-processing, ARP auto-reports, raw data / PCAP / L1-L2-L3 evidence storage.
- **Deliver:** ConnectSphere. Multi-tab dashboards for SOC, CEM, IP-Perf and Core-Radio views. Real-time widgets, per-team tailoring, live geographic probe map.

9.3 Test catalogue — what the Watcher measures continuously

- **Network layer:** attach and registration, PS/CS, mobility, coverage and quality, roaming, RSRP/RSRQ/SINR.
- **Speed & IP:** DL/UL over HTTP, HTTPS and FTP; Ping; TWAMP (gaming and latency simulation); Ookla speed test.
- **Voice:** VoLTE, VoNR, VoWiFi with POLQA / PEVQ MOS scoring.
- **OTT applications:** WhatsApp, Facebook, Instagram, YouTube, Teams, Zoom, Snapchat, X/Twitter, Twitch, browsing, DNS, CDN cache-hit.
- **VAS:** SMS, MMS, USSD.
- **Video QoE:** real-time QoE of adaptive video streaming.

9.4 Reporting cadence and aggregation model

Time buckets: 1 min, 15 min, 1 h, 4 h, daily, weekly, monthly, overall. Function aggregations: min, max, median, average, sum, standard deviation. Nested aggregations: per-kit, per-handset, per-APN/gateway, per-geography, per-service-class summary. Automated reports (ARP) delivered to each stakeholder on their own

cadence — SOC (real-time), MNO operations (hourly / daily), regulator (monthly / quarterly).

9.5 Dashboarding — ConnectSphere with AI insights

Multi-tab platform tailored per team. Real-time widgets and live geographic probe map. Session-level detail table. Multi-operator side-by-side view (same conditions, four operators, one screen). Full history and CSV / KML / API export. AI insights surfaced inline — predictive KQI forecasts for the next journey; auto-generated RCA narrative for each incident; natural-language query bar for on-the-fly investigation.

9.6 Alarming — SLA-grade, per-line, per-service

A dedicated alarming subsystem, not just push notifications:

- **Multi-KPI:** Per-KPI thresholds — DL, UL, latency, jitter, loss, MOS, Teams call quality, YouTube stall rate, WhatsApp delivery — each with warn / alarm / SLA-breach bands.
- **Fully scoped:** Per-line, per-direction, per-operator, per-service scoping — an alarm on 'Teams MOS below 3.2 on London ⇌ Bristol westbound for O2' is routable to exactly the accountable engineer.
- **Noise-reduced:** Duration and hysteresis gating (must breach for ≥5 min across ≥3 samples) to eliminate flap; cross-segment correlation groups adjacent alarms into one incident.
- **Predictive:** AI-driven anomaly alerts on top of thresholds — the model learns each line's baseline per hour of day, per operator, per bearer, and alerts when today's pattern deviates significantly, before a threshold is breached.
- **Escalation:** Severity 1 (SLA breach) → Ofcom / GBR / TOC / MNO exec channel, incident room stood up. Severity 2 (alarm) → on-call engineer at accountable MNO, 15-minute ack SLA. Severity 3 (warning) → SOC watch team, daily digest. Severity 4 → recorded, no notification.
- **Channels:** Multi-channel delivery — WhatsApp, Email, Web push, Mobile push, SMS, ticketing-system integration (ServiceNow / Jira / Remedy), SIEM feed for MNO SOC's, public status page.
- **Audit trail:** Every alarm, acknowledgement, escalation and resolution timestamped and retained — supports SLA reporting, incident review and regulator audit.

9.7 Benefits to MNOs — why operators should welcome this

The NOC is an accelerator for MNOs, not a stick. Operators receive as much value as the regulator does:

- **Complaint pre-emption:** detect degradations before the passenger tweets or complains.
- **Trusted evidence:** Independent evidence for SLA and regulator submissions — the same data every party trusts.

- **Fair benchmarking:** Like-for-like multi-operator benchmarking on the same train, same conditions, same time — impossible with each MNO's own kit.
- **Deep RCA:** Raw data, PCAP and L1/L2/L3 available for deep RCA — feeds directly into MNO engineering workflows.
- **OPEX reduction:** Reduces expensive drive-test campaigns — the Watcher runs 24×7 for the cost of a handful of drive-test days.
- **Shared cost:** Shared-cost model with the other MNOs and TOCs reduces per-operator burden versus going it alone.
- **Regulatory shield:** Pre-tested proof-points for commitments and D2D satellite claims.
- **Agility:** Cloud-pushed re-configuration of test scripts — new KPIs live in hours, not weeks.

9.8 Why this is the missing infrastructure

Ofcom's stated ambition, ≥9-in-10 attempts delivering Good Performance, cannot be assured with periodic drive tests and crowdsourced telemetry alone. Drive tests are episodic; crowdsourced data is sparse on rail. The NOC is the continuous, independent instrument that turns Ofcom's ambition from a slogan into a reported metric with a clear owner.

9.9 Precedent — regulated observatories in other sectors

Sector	Body	What it does
Aviation	Eurocontrol Performance Review Body	Independent measurement of ATM performance across Europe; published metrics inform policy and investment
Energy	Ofgem Data Portal	Regulator-published operational data on network performance, demand and consumer outcomes
Water	Discover Water	Industry-and-regulator collaboration publishing consumer-facing performance indicators
<i>Rail (proposed here)</i>	<i>UK Rail Connectivity NOC</i>	<i>The same model applied to on-train mobile connectivity: independent, continuous, public</i>

9.10 Technical context — FRMCS and rail-comms convergence

GSM-R is being replaced by the Future Railway Mobile Communication System (FRMCS) on 5G-based infrastructure. Signalling and passenger connectivity converge on the same underlying spectrum, sites and vendors. Ofcom's rail work programme cannot treat them as independent. The NOC provides the passenger-side measurement layer that complements — and cross-informs — FRMCS deployment.

9.11 Data protection and privacy — pre-answer the objection

The INOS Watcher runs its own test SIMs and generates its own test traffic. It does not capture passenger devices, packets or identifiers. There is no PII in the data pipeline. The NOC is GDPR-clean by design.

9.12 Governance and independence

Suggested governance framework:

- **Data ownership:** Data owned by an independent entity accountable to Ofcom.
- **Publication rules:** Publication cadence and thresholds fixed by charter.
- **Audit:** Audit rights for Ofcom, TOCs and MNOs on the methodology and raw data.

9.13 Counterparty and delivery model

Ofcom cannot deliver on-train access unilaterally. The delivery consortium would involve:

Party	Role in the NOC
Ofcom	Regulatory sponsor; commissioning authority; ultimate data consumer
DfT	Transport policy sponsor; funding co-signatory
Great British Railways / TOCs	Access to rolling stock and stations; operational co-ordination
MNOs (all four)	Data-sharing on cell configuration; use of published outputs; benefits per Section 9.7

9.14 Potential Funding model

A potential hybrid model could be: Ofcom underwrites Phase 1 as regulator-commissioned instrument; MNOs contribute an industry levy in Phase 2 in recognition of the operator benefits in Section 9.7; DfT co-funds Phases 3 and 4 as part of rail-passenger investment. Total programme cost is small compared with typical rail infrastructure spend - the observatory's cost of measurement is a fraction of the cost of poorly-targeted network investment it prevents.

9.15 Phased rollout (suggested)

- **Phase 1 (0–12 months):** London ⇄ Bristol (the corridor we have measured) plus one commuter and one cross-country comparator. 3 Watchers, 8 SIMs each. Public quarterly reporting.
- **Phase 2 (12–24 months):** Next 3–5 highest-impact lines from Ofcom's 2026 study, deliberately including at least one line in each of Scotland, Wales and Northern Ireland to serve all four UK nations from an early phase.
- **Phase 3 (24–36 months):** All 24 originally measured lines.
- **Phase 4 (36+ months):** Full UK network, with FRMCS-aligned deployment paths where signalling migrations align.

9.16 Time-sensitive use case — verifying VodafoneThree merger commitments

The VodafoneThree merger closed with rural and network-densification commitments overseen by Ofcom and the CMA. Independent verification of delivery — line by line, month by month — is a natural fit for the NOC. Rail corridors intersect exactly the rural and hard-to-serve geographies where the merger's commitments matter most. The NOC would give Ofcom and the CMA a continuous, independent instrument for compliance monitoring, rather than the periodic reporting the current framework relies on.

9.17 Business case sketch

We are happy to work with Ofcom for an initial Business case sketch for this proposal.

SECTION 10

10. Policy asks to Ofcom

Concrete actions Ofcom can take to move from ambition to implementation. We acknowledge that several of these asks require cross-Whitehall coordination (DCMS, DfT, Treasury) and ministerial engagement — they are within Ofcom's convening power but not solely within Ofcom's unilateral authority. Where that is the case, we frame the ask as one Ofcom can lead rather than deliver alone.

#	Ask	What it enables
1	Endorse per-segment, per-service-class reporting	Formalise per-corridor, per-direction, per-service-class reporting as a supplement to the 90% area benchmark
2	Endorse the NOC framework	Public support for an independent UK Rail Connectivity NOC in the 2026/27 work programme
3	Convene the counterparty framework	Convene Ofcom + DfT + Great British Railways + TOCs + MNOs so on-train access is unblocked
4	Underwrite Phase 1	Regulator-underwritten or industry-levy funding for the pilot on London ⇌ Bristol plus two comparators
5	Include NOC outputs in Map Your Mobile	NOC-supplied evidence powering the next-generation consumer comparison layer
6	Independent verification of D2D satellite services	Formal role for the NOC in independently verifying VMO2-Starlink and Vodafone-AST performance claims on rail
7	Align the NOC framework with existing government initiatives	Explicit cross-reference to DSIT's Wireless Infrastructure Strategy, Project Gigabit's rural connectivity work and DfT's rail-connectivity programme, so the measurement framework serves the wider policy landscape not just Ofcom's evidence base

10.1 Consumer empowerment mechanisms enabled by NOC data

Independent, published, per-line quality data is the enabler for concrete consumer-facing tools. In the 12-24 months after NOC Phase 1 goes live, the following mechanisms become possible — each anchored in NOC outputs:

- **Route forecast:** Before you book — route-quality forecast: passengers see per-operator, per-app quality forecasts for their planned journey, alongside timetable and price, on Map Your Mobile-next-generation and TOC booking pages.
- **Switching:** Switching decision-support: consumers considering a switch see which operator performs best on the routes and venues they actually use, not headline national averages.

- **Complaints:** Complaint escalation with evidence: when a passenger complaint is logged, the accountable MNO can be shown the NOC data for that segment at that time — turning disputed complaints into evidenced ones.
- **Redress:** Redress mechanism: repeated SLA breaches on advertised routes create a documented basis for consumer redress via Ofcom's ADR schemes — an option that does not exist today.
- **Public dashboard:** Public dashboard: a consumer-facing website (adjacent to Discover Water or Which? style) showing per-line quality alongside per-operator scoring. Free at point of use, publicly auditable.

SECTION 11

11. About Digis Squared

11.1 Who we are

Digis Squared is an independent, vendor-agnostic network assurance and engineering company. Headquartered in London, with offices in Cairo, Dubai, Luanda and Riyadh. We help regulators and operators measure, benchmark and improve the quality that mobile consumers actually receive.

A regulator's central need is independent visibility: the Authority's own source of truth on service quality, coverage and consumer experience, generated outside the networks it oversees and strong enough to support enforcement. That standards-based, vendor-agnostic, independent measurement is our core business.

11.2 Presence



11.3 Portfolio

Four flagship AI-native platforms, working end-to-end from measurement to assurance:

- **INOS:** Autonomous measurement across all technologies. Seven kit variants (Watcher · Edge · Air · Rugged · Lite · Compact · Gauge) on one cloud platform.
- **NetCortex:** Vendor-agnostic AI-driven data fusion and RCA analytical platform.
- **OctoMind:** AI-native planning across Radio, Transmission, Transport and Core; Digital Twin simulation.
- **KATANA:** Vendor-agnostic cognitive operations, assurance and SOC platform.

APPENDICES

Appendices

A. Methodology detail — London ⇄ Bristol drive test

16 campaigns (4 operators × 4 scenarios) across 17–18 July 2026. Route: M4 corridor, 508 GPS track points. Scenarios: Data-only, Data+Teams, Teams-alone, Voice. Same scripts and driver timing per operator. 785 (EE) + 656 (VMO2) + 745 (Three) + 716 (Vodafone) = 2,902 valid scripted activities. 99,194 one-hertz radio and application samples. Analysis by NetCortex Digital Twin — per-sample re-read, no interpolation. Voice campaigns judged on completion and failure reason; HTTP downloads marked 'partial' re-validated at ≥10 Mbps..

B. Answers to Ofcom's discussion questions

Ofcom's discussion paper contains numbered questions in Annex A2 organised around Sections 2 to 7. Our response above answers them by section; a compact Q&A mapping is:

Ofcom paper section	Our response section	Short direct answer
Section 2: Good metric & 90% benchmark	This response Section 4 and Section 3.3	Support the 3 thresholds as the network floor; add service-class KQIs and per-segment reporting to complete the picture
Section 3: Consumer information / Map Your Mobile	Section 9.5 and Policy Ask 5	NOC-supplied per-corridor per-app data as the next-generation Map Your Mobile evidence base
Section 4: Busy areas (urban)	Section 2 (evidence recap), Section 4 (KQIs)	Endorse a NOC-equivalent Venue Observatory using the same INOS Watcher platform
Section 5: Indoor shared places	Section 4 (KQIs), Reference case Al-Masjid al-Haram	In-building measurement is a solved capability for us — the Al-Masjid al-Haram deployment is direct precedent
Section 6: Trains	Sections 5, 6, 7, 9 (the core of this response)	London ⇄ Bristol evidence; 8-point action plan; UK Rail Connectivity NOC proposal
Section 7: Rural	Sections 2.4, 8.15 (Phase 2), 8.16	Rail corridors intersect rural geography; NOC is the natural instrument for VodafoneThree merger commitment verification