

Cleveland Hopkins International Airport (CLE)

Venue Network Intelligence Report

Rev 1, first issue, 2026-09-08

Verizon leads Concourses A and B and the venue gate median. T-Mobile leads Concourse C on the tile basis; the Main Terminal is split between T-Mobile's stronger median and Verizon's higher healthy share. AT&T's 5G median at the gates sits below the healthy line. The record holds no in-building cellular system and a 2024 neutral-host DAS solicitation whose current status this report does not hold. This baseline measures 49 gates, 82 mapped venue points, 25,152 RF tiles, and 14,065 usage tiles over a 12-month window.

Prepared by the Imagine Wireless Network Intelligence Platform

Data window: 2025-08-01 to 2026-07-31 · Issued: 2026-09-08 · Freshness: 39 days (within the 90-day policy)

Primary sources: Ookla Cell Analytics (per-carrier RF tiles; All Networks usage and density tiles) · OpenStreetMap gates, terminal polygons, and tenant points (pinned 2026-09-08)

Reference sources: City of Cleveland procurement portal (RFP NET-11423) · clevelandairport.com · Imagine knowledge graph · public press

CONFIDENTIAL. Prepared for City of Cleveland, Department of Port Control stakeholder review



PHOTO. The terminal complex from the air, October 2025: Main Terminal with Concourses A, B, and C. · Photo: Kevin Payravi, CC BY-SA 4.0, via Wikimedia Commons

Best 5G at the gates	Cleanest signal quality	Critical 5G signal (below -110 dBm)	Venue Wi-Fi offload
Verizon · median -86.1 dBm (T-Mobile -89.1, 3.0 dB behind; n=49 gates)	Verizon · median SINR +16.4 dB	0 of 147 gate-carrier pairs	46.0% of observed MB (n=14,065 tiles)

Contents

- 1. Executive readout
- 2. Venue snapshot and asset inventory
- 3. Carrier findings (3.0 carrier summary · 3.1 Verizon results · 3.2 T-Mobile results · 3.3 AT&T results · 3.4 5G footprint and coverage-band attachment · 3.5 RSRQ, CQI, and optimization priority · 3.6 serving-cell volatility)
- 4. The view by zone (4.1 healthy share and medians · 4.2 coverage class and PCI diversity · 4.3 cross-carrier concordance by gate · 4.4 Concourse C · 4.5 Concourses A and B · 4.6 building-masked view)
- 5. Tenant level (5.1 category RSRP and SINR · 5.2 terminal vs periphery proxy · 5.3 airline clusters · 5.4 retail and food brands · 5.5 lounges)
- 6. Load and density
- 7. Wi-Fi as an augmentation layer
- 8. Private wireless
- 9. Spectrum and service availability
- 10. Carrier-asymmetry atlas
- 11. Federal and operational-critical tenants
- 12. Passenger-impact translation
- 13. Prioritized recommendations
- 14. Post-deployment monitoring criteria and re-measurement plan
- 15. Next layers to add
- 16. Method, thresholds, confidence, and caveats
- Appendix A. Lowest-reading mapped points per carrier ($n \geq 30$ tiles only)
- Appendix B. Strongest-serving band tables per carrier (with footprint share)
- Appendix C. Full gate table

1. Executive readout

Provenance legend: measured values compute from the Ookla exports at build time. Facts marked "cited, not held" come from public records or the Imagine knowledge graph (KG record) and are not held as measurements. Section 16 defines every threshold and basis.

Cleveland Hopkins International Airport is operated by the City of Cleveland, Department of Port Control. The reconciled Airport DAS Master records no distributed antenna system (DAS), no self-owned system, and no neutral host at CLE (KG record, cited, not held). The city released a neutral-host DAS solicitation for the passenger terminal buildings in October 2024 (RFP NET-11423). No award appears in the public record this report holds or in the reconciled Airport DAS Master as of July 28, 2026; the Department of Port Control holds the current status. This report is a baseline of the terminal area as measured in the window. It measures 49 gates, 82 mapped venue points, 25,152 radio-frequency (RF) tiles, and 14,065 usage tiles over the 12-month window ending 2026-07-31.

Verizon: leads Concourses A and B and the venue gate median.

Verizon holds healthy 5G reference signal received power (RSRP) at 49 of 49 gates (100%). Its venue gate median is -86.1 dBm, 3.0 dB ahead of T-Mobile. It is the best 5G carrier at 34 of 49 gates and the best LTE carrier at 46 of 49. Every gate in Concourses A and B reads Verizon as the strongest carrier (13 of 13 and 11 of 11, counts). The record holds no in-building system for any carrier. Verizon's terminal-

vs-periphery proxy is flat (-2.0 dB, section 5.2), which the export cannot resolve between close-in macro coverage and an unrecorded in-building or small-cell asset.

T-Mobile: widest 5G footprint; leads Concourse C on the tile basis; the Main Terminal is split between T-Mobile's stronger median and Verizon's higher healthy share.

T-Mobile's venue gate median is -89.1 dBm, healthy at 49 of 49 gates (100%). It reports 5G on 87% of its on-airport tiles, the widest footprint of the three. On the tile basis it leads Concourse C (median -84.0 vs Verizon -88.5 dBm; healthy 89% vs 76%). In the Main Terminal it holds the stronger median while Verizon holds the higher healthy share (median -81.0 vs -87.0 dBm; healthy 82% vs 86%). It is the best 5G carrier at 15 of 25 Concourse C gates (count). Its terminal-vs-periphery proxy is +0.0 dB, the same ambiguous flat reading.

AT&T: the venue gate median sits below the healthy line.

AT&T's 5G median across 49 gates is -96.3 dBm, 1.3 dB below the -95 dBm healthy threshold and 10.2 dB behind Verizon. Only 10 of 49 gates (20%) are healthy, 39 are at risk, and AT&T is the weakest carrier at 47 of 49 ranked asymmetry gates. AT&T reports 5G on 36% of its on-airport tiles; the other 64% carry only LTE readings (LTE median -96.8 dBm, 17 of 49 gates healthy). AT&T's terminal-vs-periphery proxy is +1.0 dB, periphery-stronger, which matches a macro-spillover signature.

How the order holds

Gate-median order: Verizon, T-Mobile, AT&T. The Verizon-to-T-Mobile margin is 3.0 dB with both carriers healthy at 49 of 49 gates. The margin to AT&T is 10.2 dB from Verizon and 7.2 dB from T-Mobile, and that margin is the material one. Section 16 sets the noise floor: margins under 1 dB are not rankings. The order reproduces from the tile export alone.

Why the baseline matters

The city's neutral-host DAS solicitation (NET-11423, released October 4, 2024, proposals due November 21, 2024 and extended to December 9, 2024 after two addenda (KG record), ten years with a five-year renewal (KG record), cited, not held) asked for a wireless-service-provider-agnostic neutral-host DAS delivering 5G throughout all passenger terminal buildings, with no capital outlay by the airport. No award appears in the public record this report holds or in the reconciled Airport DAS Master as of July 28, 2026; the Department of Port Control holds the current status. The CLEvolution Terminal Modernization Development Program (about \$1.6 billion) adds a relocation clause: the airport may relocate vendor equipment for the modernization program on six months' notice. If the solicitation proceeds, this baseline is the design input and the before reading for section 14. This report does not predict the award.

How to read the order

Every ranking in this report is signal-layer: RSRP and signal-to-interference-plus-noise ratio (SINR) from an Android crowdsource panel. The export contains no throughput or latency, so it measures where signal is. It does not measure whether a call or app fails, and a strong-signal network can still be congested. Nothing in this report is measured indoors; gate and tenant values are tiles within 80 m of a point (section 16).

2. Venue snapshot and asset inventory

Element	Value	Notes
Airport / IATA / ICAO	Cleveland Hopkins International Airport / CLE / KCLE	FAA medium hub; 4,855,943 calendar-year enplanements (KG record, year as recorded in the graph); 10,003,833 two-way passengers in 2025, -1.7% versus 2024 (Crain's Cleveland Business, wkyc). All cited, not held
Operating authority	City of Cleveland, Department of Port Control	Wireless procurement runs through city procurement (RFP NET-11423, cited, not held)
Concourses analyzed	3	A (Frontier Airlines) · B (Delta Air Lines and Southwest Airlines) · C (United Airlines, American Airlines, JetBlue Airways, and Air Canada). Concourse D is

		mapped in OpenStreetMap but closed to passenger service; it is excluded from segmentation.
Zones for tile assignment	4	A · B · C · Main Terminal (nearest gate or tenant point within 500 m)
Gates analyzed	49	A: 13 · B: 11 · C: 25 (OpenStreetMap inventory pinned 2026-09-08; the airport's guide lists 12 in A and 23 in C)
Mapped venue points	82	28 food · 20 retail · 14 transport_admin · 8 services · 4 lounge · 4 admin · 3 other · 1 lodging. Zone attribution: A 12, B 5, C 24, Main Terminal 17, outside zones 24. Google Places (New) + OpenStreetMap capture, pinned 2026-09-08 (Tier B)
Carriers measured	3	Verizon · T-Mobile · AT&T (25,152 RF tiles; 14,065 All Networks usage tiles)
In-building cellular	None recorded	DAS: no · self-owned: no · neutral host: no (Airport DAS Master, reconciled July 28, 2026) (KG record, cited, not held)
Neutral-host DAS procurement	RFP NET-11423, released October 4, 2024	Proposals due November 21, 2024, extended to December 9, 2024 after two addenda (KG record); ten years with a five-year renewal (KG record); scope: a wireless-service-provider-agnostic neutral-host DAS delivering 5G throughout all passenger terminal buildings, with no capital outlay by the airport; no award appears in the public record this report holds or in the reconciled Airport DAS Master as of July 28, 2026; the Department of Port Control holds the current status (cited, not held)
Knowledge-graph coverage	Profile and RFP evidence only	no deployment, vendor, or leadership rows exist for CLE in the knowledge graph (KG record)
Public Wi-Fi	SSID CLE_Public_WiFi	Provider not verified in public sources (cited, not held)
Capital program	CLEvolution Terminal Modernization Development Program (about \$1.6 billion)	Gold Lot, about 1,600 parking spaces, opening spring 2027; \$301 million, 6,000-space parking garage with a ground transportation center and rail station, 2029; \$1.1 billion, 895,000 square foot terminal opening in 2032; Jacobs selected in November 2025 for phase-one program and construction management (cited, not held)



PHOTO. The terminal complex from the air, October 2025. Concourse C runs to the lower left, Concourse A to the upper right, and the closed Concourse D sits beyond the apron. · Photo: Kevin Payravi, CC BY-SA 4.0, via Wikimedia Commons

How to read the measurement

Every cellular number in this report is an aggregate of crowdsourced background scans from consumer Android devices (about 3% of handsets; iOS devices are not sampled), binned by Ookla to map tiles of about 8 m by 11 m, then joined to gate and tenant points. The numbers describe where devices were over a 12-month window. They are not drive-test measurements. Every n counts tiles, and every table carries its n so thin cells are visible.

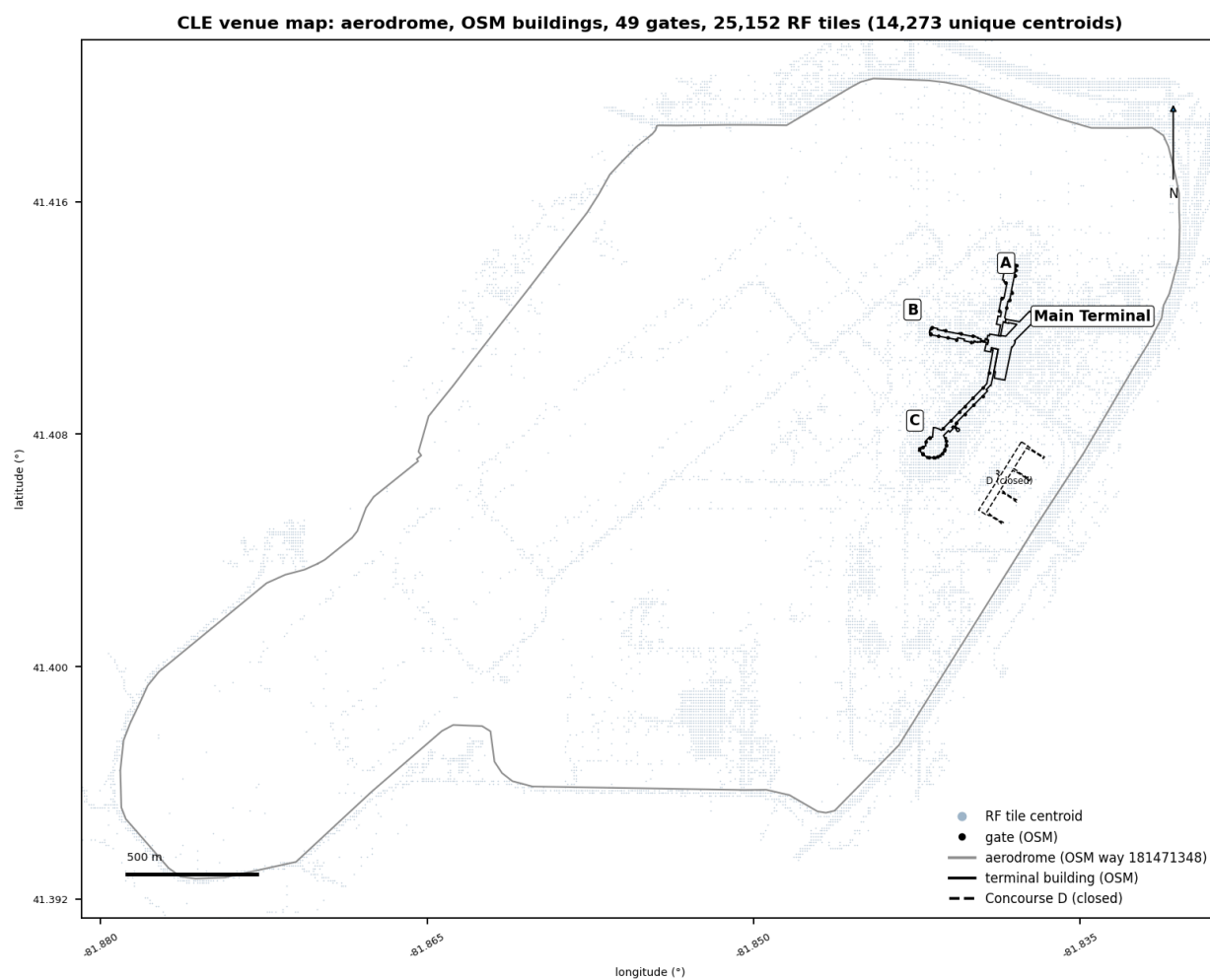


FIG. 1. Venue map: aerodrome outline, OSM terminal buildings, 49 gates, and the 25,152 on-airport RF tile centroids. Concourse D is closed and drawn dashed. North up; scale bar in meters. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

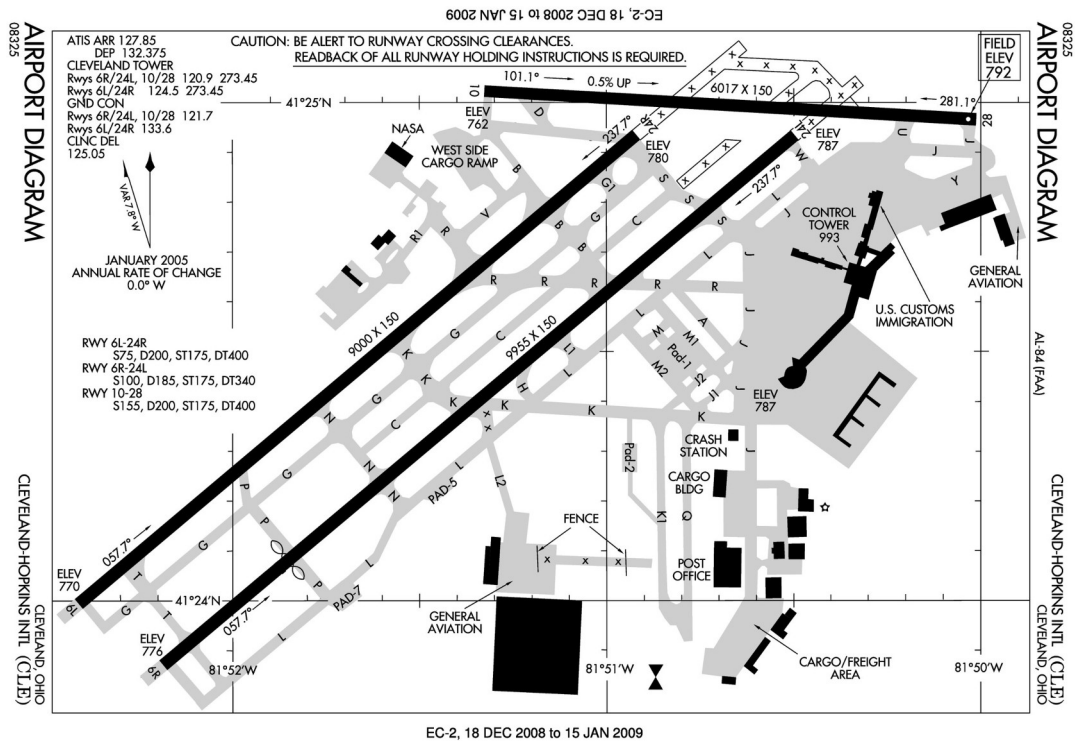


PHOTO. FAA airport diagram for CLE (December 2008 edition), reproduced for orientation. It is the FAA's drawing, not this report's geometry; runway and taxiway labels come from the FAA. · Photo: National Aeronautical Charting Office (NACO), FAA, public domain, via Wikimedia Commons

3. Carrier findings

3.0 Carrier summary

Carrier	5G RSRP median (dBm)	5G SINR median (dB)	LTE RSRP median (dBm)	Healthy 5G gates	n (gates / RF tiles)
Verizon	-86.1	+16.4	-87.5	49 of 49	49 / 8,840
T-Mobile	-89.1	+13.5	-97.4	49 of 49	49 / 8,892
AT&T	-96.3	+14.9	-96.8	10 of 49	49 / 7,420

5G footprint and conditional medians (tile basis). Each 5G median is conditional on the tile reporting a 5G reading; the last column combines presence and level.

Carrier	5G footprint (% of tiles)	5G RSRP median over reporting tiles (dBm)	LTE RSRP median (dBm)	LTE-only tiles (%)	5G present and healthy (% of all tiles)	n (tiles)
Verizon	70%	-87.0	-88.0	28%	55%	8,840
T-Mobile	87%	-87.0	-93.0	12%	71%	8,892
AT&T	36%	-93.0	-94.0	60%	21%	7,420

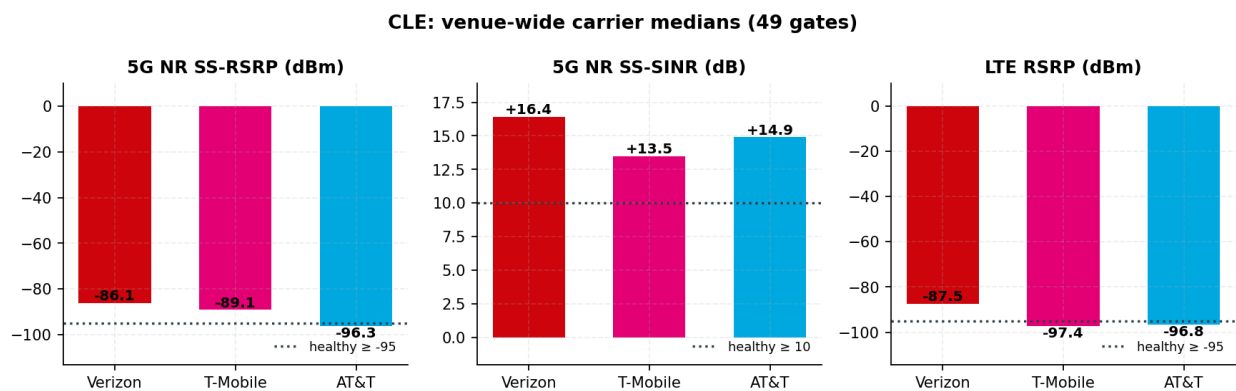


FIG. 2. Venue medians across 49 gates against the locked threshold ladder (section 16). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

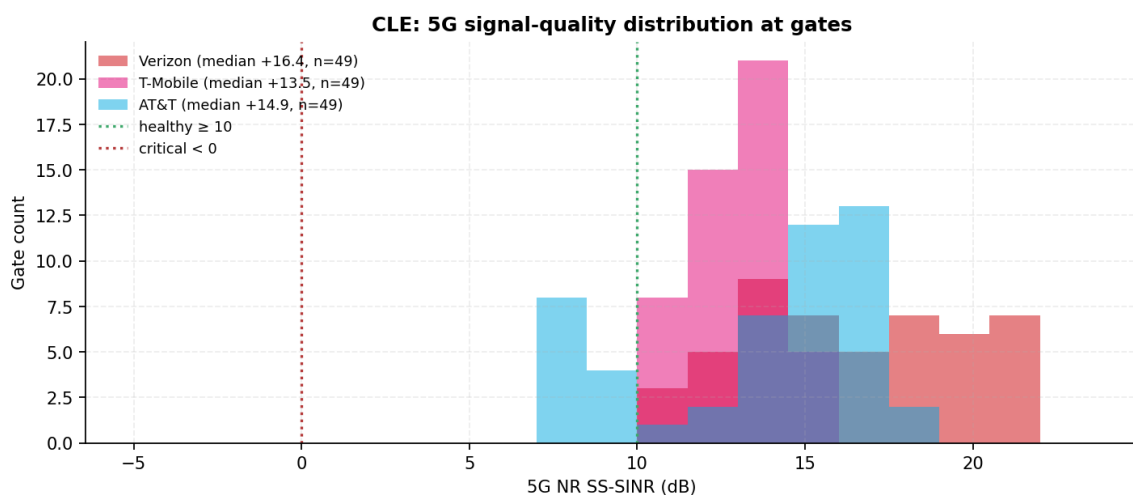


FIG. 3. SINR distribution per carrier at gate level. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

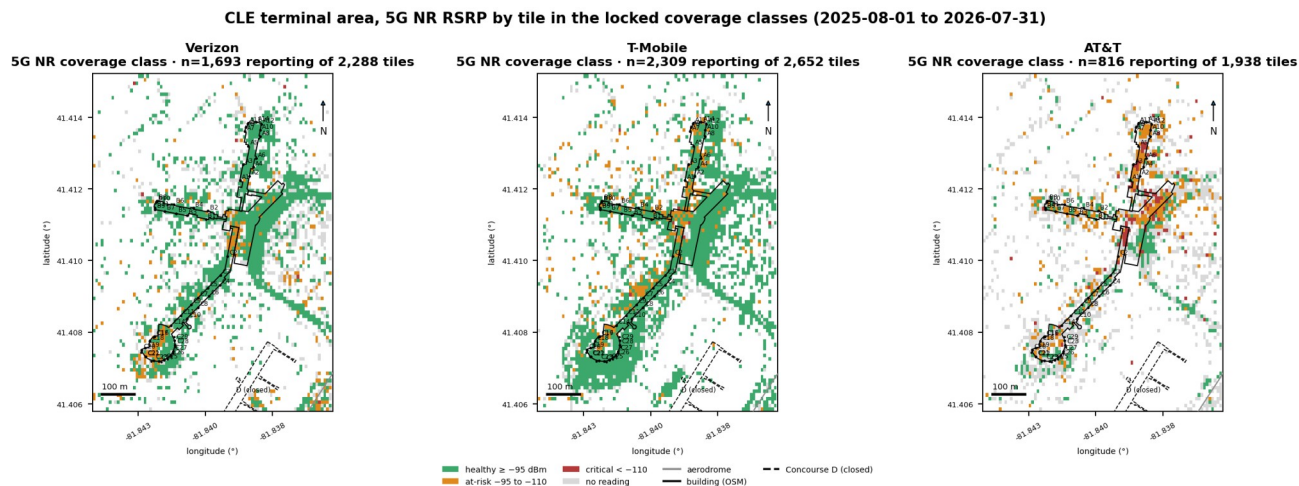


FIG. 4. Terminal-area map of 5G NR RSRP by tile and carrier, colored by the locked coverage class. Grey tiles carry no 5G reading. Each tile is about 8 m by 11 m; n is the tile count per panel. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

3.1 Verizon results

Verizon delivers the strongest 5G at the gates: 49 of 49 gates (100%) in the healthy band. Its venue gate median is -86.1 dBm, 3.0 dB ahead of T-Mobile. It is the best 5G carrier at 34 of 49 gates. Its LTE layer is also the network of record: best LTE at 46 of 49 gates with a healthy venue LTE median of -87.5 dBm. SINR is $+16.4$ dB at the median (49 of 49 gates healthy).

On the tile basis, Verizon is healthy on 91% of Concourse A tiles, 91% of Concourse B tiles, 76% of Concourse C tiles, and 86% of Main Terminal tiles. FIG. 4 shows the pattern: green along Concourses A and B and the apron side of C. In Concourse C and the Main Terminal, T-Mobile's tile medians are higher (section 3.2). The record holds no in-building system for Verizon (KG record, cited, not held). Its terminal-vs-periphery proxy is flat (-2.0 dB, section 5.2), which the export cannot resolve between close-in macro coverage and an unrecorded in-building or small-cell asset. Recommendation 2 asks the Department and each carrier to attest the source of its terminal coverage.



PHOTO. Main Terminal check-in hall (Southwest counters), October 2025. Main Terminal tiles: T-Mobile median -81.0 vs Verizon -87.0 dBm; healthy 82% vs 86%. · Photo: Kevin Payravi, CC BY-SA 4.0, via Wikimedia Commons

Verizon framed finding

Gate-median rank 1 of 3 on 5G and LTE, 3.0 dB ahead of T-Mobile on 5G. Healthy at 100% of gates. This is the parity bar any hosted system must hold for Verizon while it lifts AT&T.

3.2 T-Mobile results

T-Mobile's venue gate median is -89.1 dBm, healthy at 49 of 49 gates (100%), with a SINR median of $+13.5$ dB. It reports 5G on 87% of its on-airport tiles (7,749 of 8,892). Verizon reports 5G on 70% and AT&T on 36%. Its LTE layer is weaker: LTE median -97.4 dBm, healthy at 6 of 49 gates.

On the tile basis T-Mobile leads Concourse C and splits the Main Terminal with Verizon. Concourse C: median -84.0 dBm vs Verizon -88.5 dBm, healthy on 89% of tiles ($n=2,125$) vs 76% ($n=1,510$). Main Terminal: median -81.0 dBm vs Verizon -87.0 dBm, healthy on 82% of tiles ($n=205$) vs 86% ($n=178$). T-Mobile is the best 5G carrier at 15 of 25 Concourse C gates (count). Concourse C is where United, American, JetBlue, and Air Canada board (Tier B).

T-Mobile framed finding

Gate-median rank 2 of 3 on 5G, 3.0 dB behind Verizon; first on 5G reach; leads Concourse C and the Main Terminal on tiles; weakest on LTE. A hosted path would mostly firm up T-Mobile's LTE fallback and its Concourse A and B gates.

3.3 AT&T results

AT&T's 5G median across 49 gates is -96.3 dBm. That is 1.3 dB below the healthy threshold and 10.2 dB behind Verizon. 10 gates are healthy, 39 are at risk, and 0 are critical ($n=49$). AT&T is the weakest carrier at 47 of 49 ranked asymmetry gates (section 10). SINR is $+14.9$ dB at the median.

The 5G footprint explains part of the picture. AT&T reports 5G on 36% of its on-airport tiles (2,663 of 7,420). AT&T tiles with an LTE reading but no 5G reading (60% of its tiles) carry only LTE. The LTE layer is stronger than the 5G layer but still marginal: LTE median -96.8 dBm, healthy at 17 of 49 gates. On the tile basis, AT&T is healthy on 65% of Concourse C tiles, 46% of Concourse A tiles, 43% of Concourse B tiles, and 42% of Main Terminal tiles. On FIG. 4, AT&T's panel is the one where amber and grey dominate the concourse footprints; the building-masked view (section 4.6) quantifies it per building.

AT&T framed finding

Gate-median rank 3 of 3 on 5G, 10.2 dB behind Verizon, with a median below -95 dBm and a 36% 5G footprint. AT&T is the carrier with the most to gain from a hosted in-building path, and the one the section 14 criteria measure first.

3.4 5G footprint and coverage-band attachment

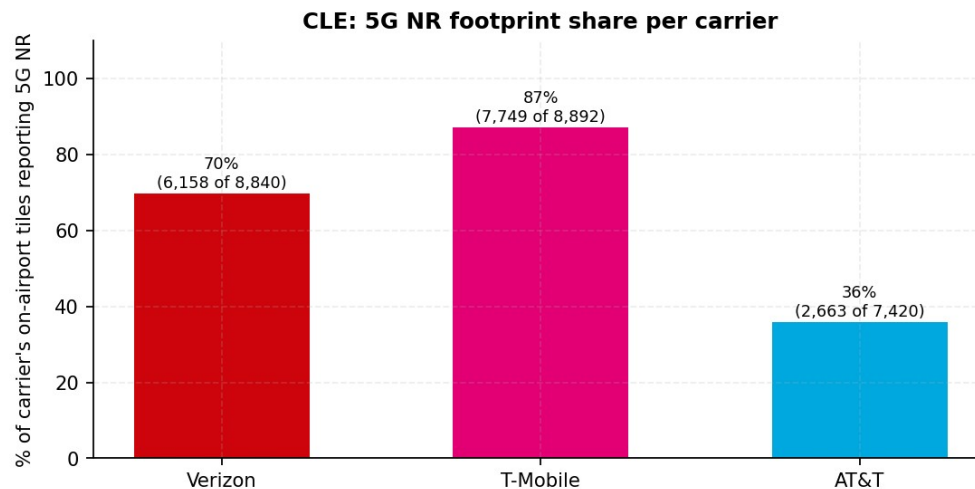


FIG. 5. Share of each carrier's on-airport tiles that report a 5G NR reading (metric 14, 5G footprint). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

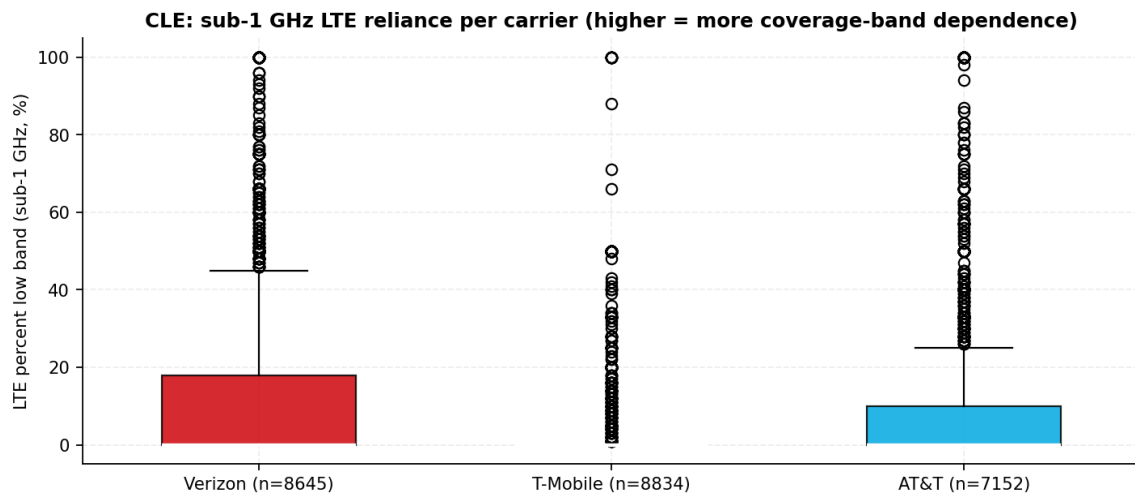


FIG. 6. LTE percent-low-band distribution per carrier. Higher means more attachment to sub-1 GHz coverage bands. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

The percent-low-band statistic describes LTE coverage-band attachment. A tile that attaches to sub-1 GHz spectrum is using a coverage-grade band, which propagation, carrier idle-mode priorities, and site geometry all drive. At CLE the LTE medians are zero for all three carriers. The mean and the share of tiles above zero carry the signal instead. Verizon mean 14.2% (tiles above zero: 32% of n=8,645) · T-Mobile mean 1.0% (tiles above zero: 4% of n=8,834) · AT&T mean 13.4% (tiles above zero: 31% of n=7,152).

The LTE metric does not see 5G low band. On the 5G side, low-band presence is small. Verizon: NR850 on 165 tiles, 5.8% of its 2,838 band-reporting NR tiles. T-Mobile: NR600 on 387 tiles, 5.5% of its 7,049 band-reporting NR tiles. AT&T: NR850 on 3 tiles, 0.6% of its 503 band-reporting NR tiles. Mid-band spectrum carries most tiles for every carrier on both technologies.

3.5 RSRQ, channel quality (CQI), and optimization priority

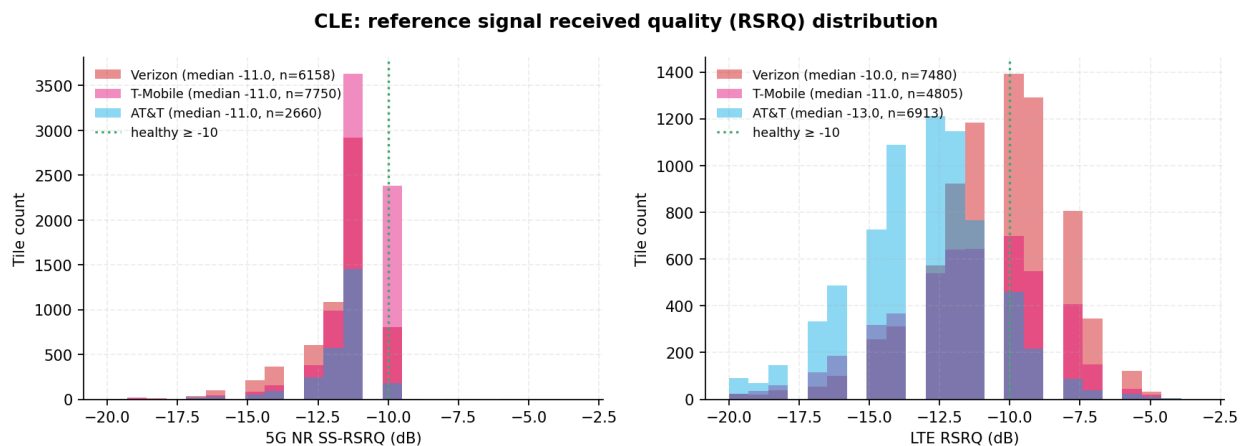


FIG. 7. 5G NR and LTE reference signal received quality (RSRQ) distributions per carrier. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

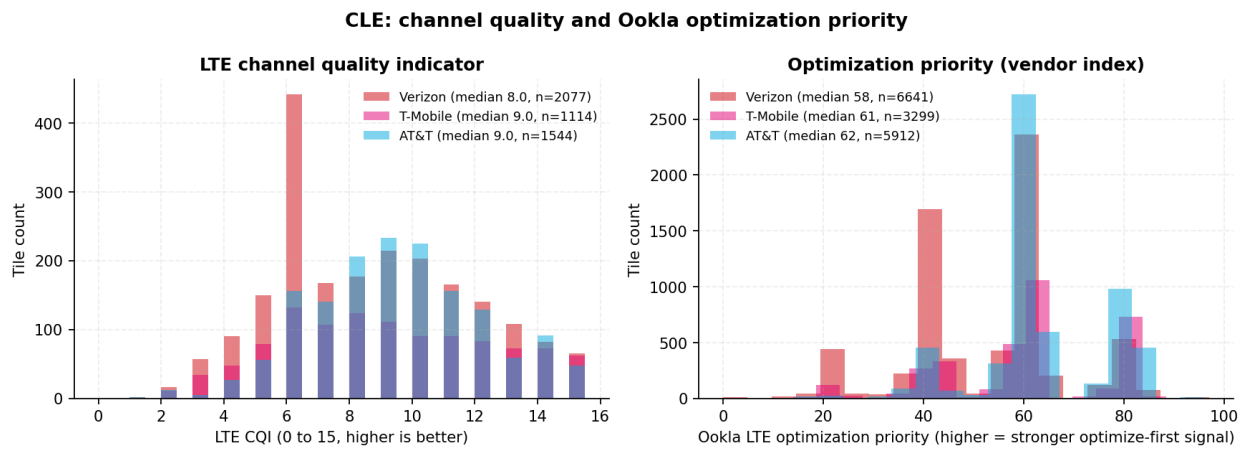


FIG. 8. LTE channel quality indicator (CQI) distribution and Ookla's LTE optimization priority index (vendor layer). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

RSRQ medians: Verizon NR -11.0 / LTE -10.0 dB; T-Mobile NR -11.0 / LTE -11.0 dB; AT&T NR -11.0 / LTE -13.0 dB. RSRQ degrades as subframe utilization rises, so a weak RSRQ on a strong-RSRP network is consistent with a loaded serving layer. This is an inference; the export carries no load field (section 16).

CQI medians: Verizon median 8.0 (n=2,077); T-Mobile median 9.0 (n=1,114); AT&T median 9.0 (n=1,544). CQI is the closest throughput proxy in an export that carries no throughput fields. Ookla's LTE optimization priority is the vendor's own index for tiles where signal is strong but quality is poor. Venue medians: Verizon median 58 (n=6,641); T-Mobile median 61 (n=3,299); AT&T median 62 (n=5,912). The medians sit close together, so the discriminating signal is in the distribution tails.

3.6 Serving-cell volatility (handover-churn proxy)

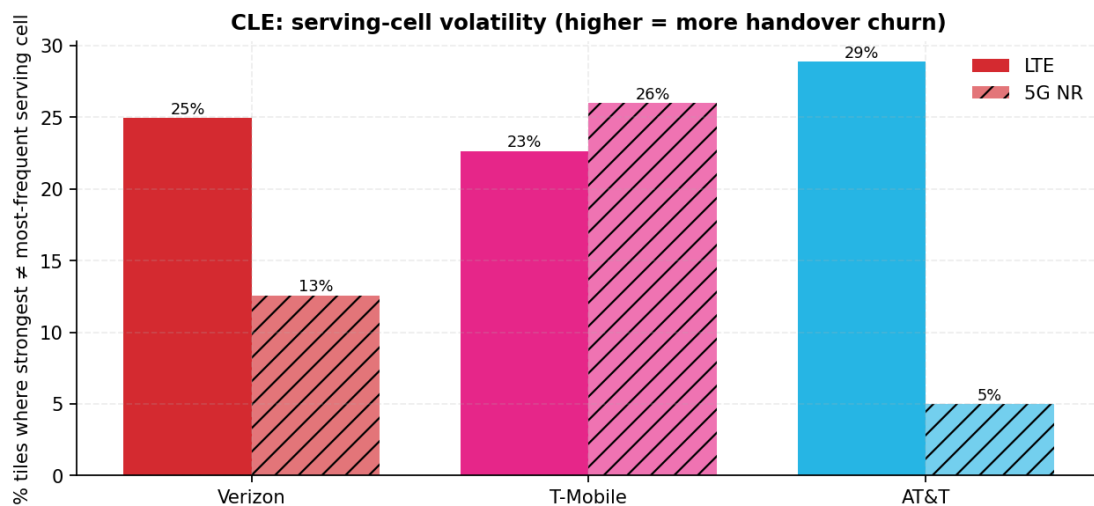


FIG. 9. Share of tiles where the strongest observed cell differs from the most-frequent serving cell. Proxy for handover instability and dominance conflict. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

Where the strongest cell at a tile is not the most-frequent serving cell, the network is handing over between competing cells. Measured churn: Verizon LTE 25% (n=7,483) / 5G 13% (n=2,838); T-Mobile LTE 23% (n=4,819) / 5G 26% (n=7,048); AT&T LTE 29% (n=6,917) / 5G 5% (n=503). Cell, PCI, and

band fields populate only where Ookla resolved a serving cell, which is why AT&T's 5G n is 503 here against 2,663 for RSRP (field population table, section 16). With no DAS on the record, churn reflects how each carrier's macro sectors overlap across the field. This is a proxy; the export carries no handover trace.

4. The view by zone

Concourse gate counts (A 13, B 11, C 25) sit below the 30-point floor. All zone comparisons in this section therefore run on the tile basis. A tile belongs to the zone of its nearest gate or tenant point within 500 m, which gives hundreds of tiles per carrier per zone. Gate tallies appear as counts with n visible and are not ranked.

4.1 Healthy share and median RSRP by zone

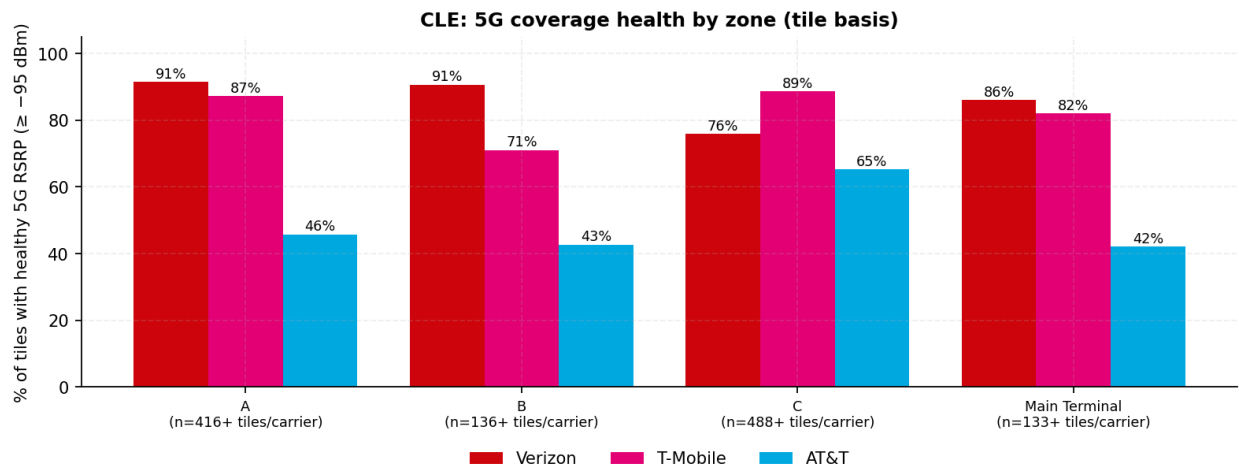


FIG. 10. Share of zone tiles with healthy 5G RSRP by carrier (tile basis; minimum n per carrier on the axis). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

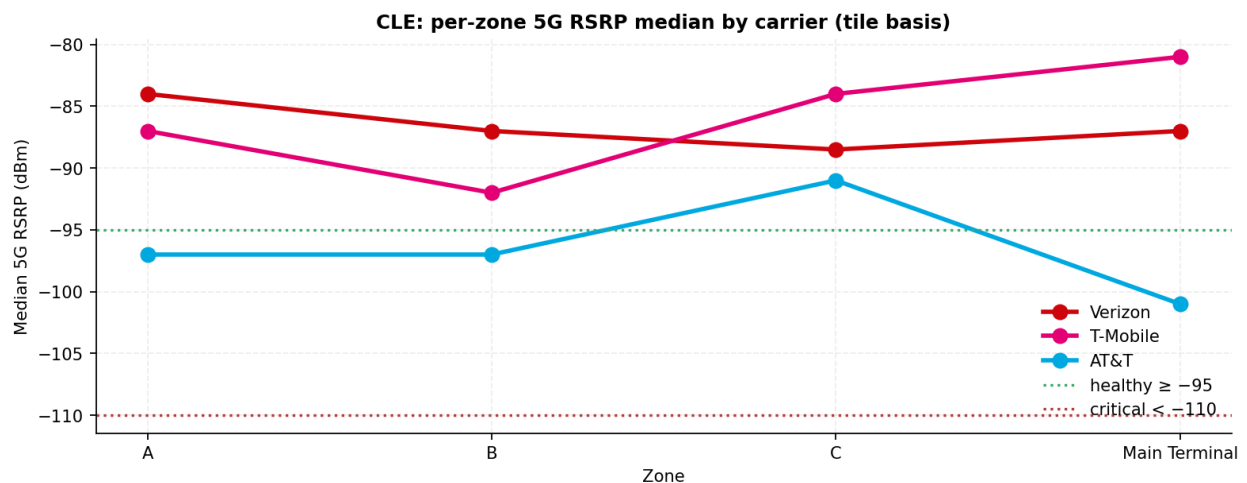


FIG. 11. Per-zone median 5G RSRP per carrier (tile basis). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-

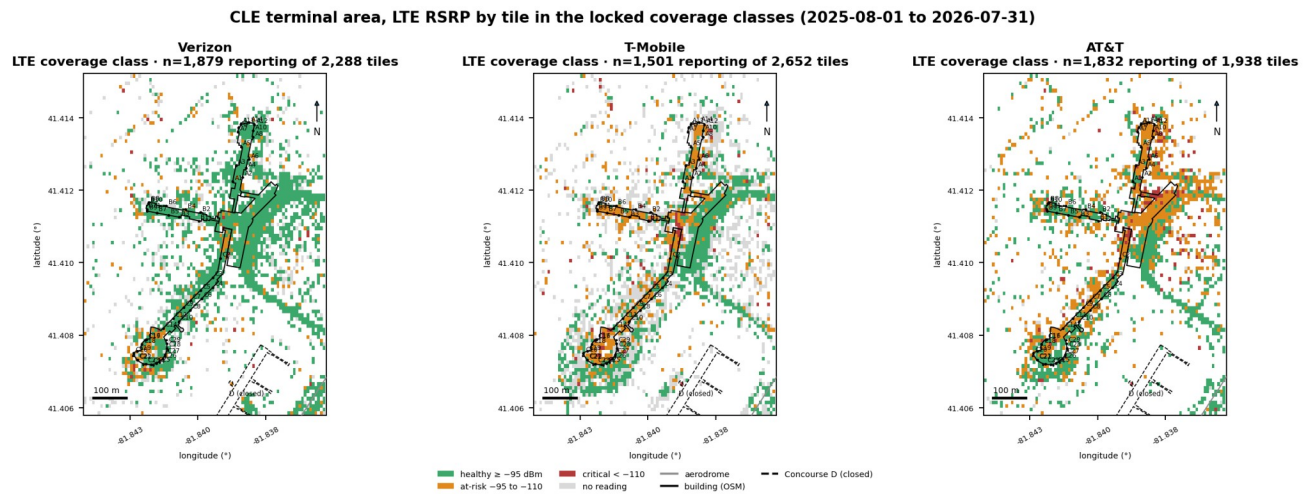


FIG. 12. Terminal-area map of LTE RSRP by tile and carrier, colored by the locked coverage class. Grey tiles carry no LTE reading.
Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

Zone	Verizon healthy tiles	T-Mobile healthy tiles	AT&T healthy tiles	Median 5G RSRP (dBm)
A	91% (n=869)	87% (n=1,213)	46% (n=416)	Verizon -84.0 / T-Mobile -87.0 / AT&T -97.0
B	91% (n=308)	71% (n=390)	43% (n=136)	Verizon -87.0 / T-Mobile -92.0 / AT&T -97.0
C	76% (n=1,510)	89% (n=2,125)	65% (n=488)	Verizon -88.5 / T-Mobile -84.0 / AT&T -91.0
Main Terminal	86% (n=178)	82% (n=205)	42% (n=133)	Verizon -87.0 / T-Mobile -81.0 / AT&T -101.0

Zone leader on the tile median: A Verizon, B Verizon, C T-Mobile, Main Terminal T-Mobile. Verizon leads the two Concourses where every gate reads it strongest; T-Mobile leads Concourse C on the tile median and the Main Terminal (Verizon holds the higher Main Terminal healthy share).

4.2 Coverage class and PCI diversity

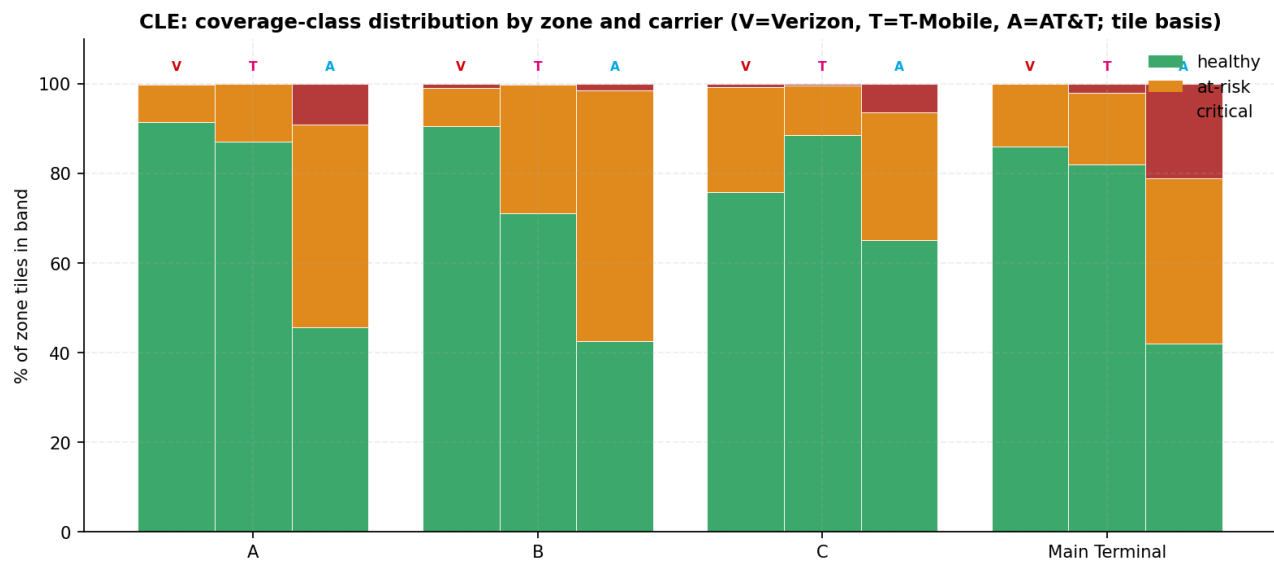


FIG. 13. Coverage-class distribution by zone and carrier (tile basis; V=Verizon, T=T-Mobile, A=AT&T). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

Critical-band gates (below -110 dBm) by carrier: Verizon 0, T-Mobile 0, AT&T 0 of 49 gates (counts). On the tile basis, AT&T's critical share peaks in Main Terminal at 21% of tiles (n=133). Verizon's healthy share does not drop below 76% in any zone.

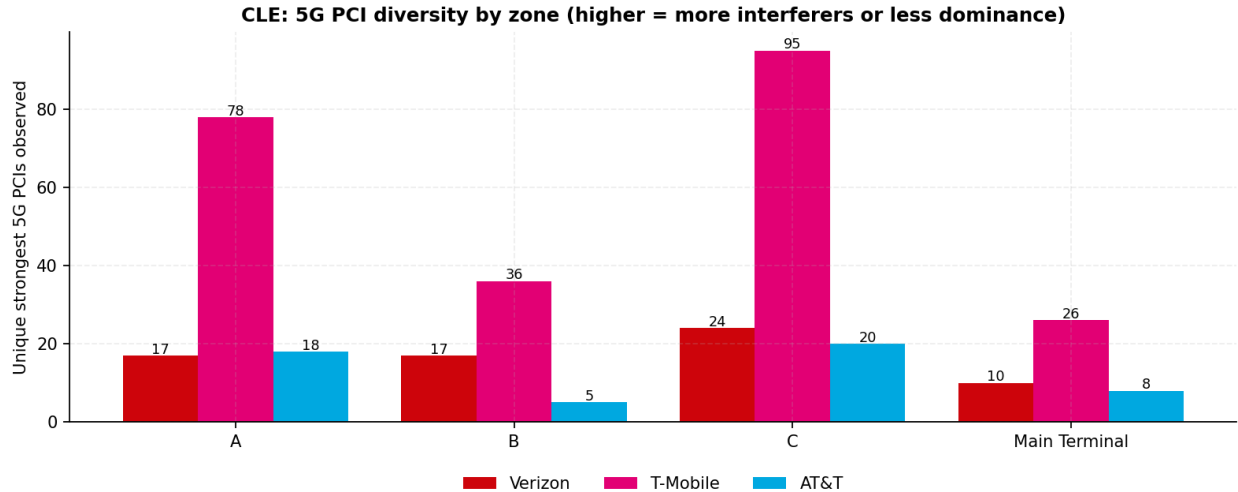


FIG. 14. Unique strongest-serving physical cell identities (PCIs) per zone per carrier. Reads in both directions; always pair with SINR (section 16). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

With no DAS on the record, the PCI picture in each zone reflects which macro sectors reach it. Higher diversity with healthy SINR means several sectors serve the zone cleanly. Higher diversity with poor SINR means they compete.

4.3 Cross-carrier concordance by gate

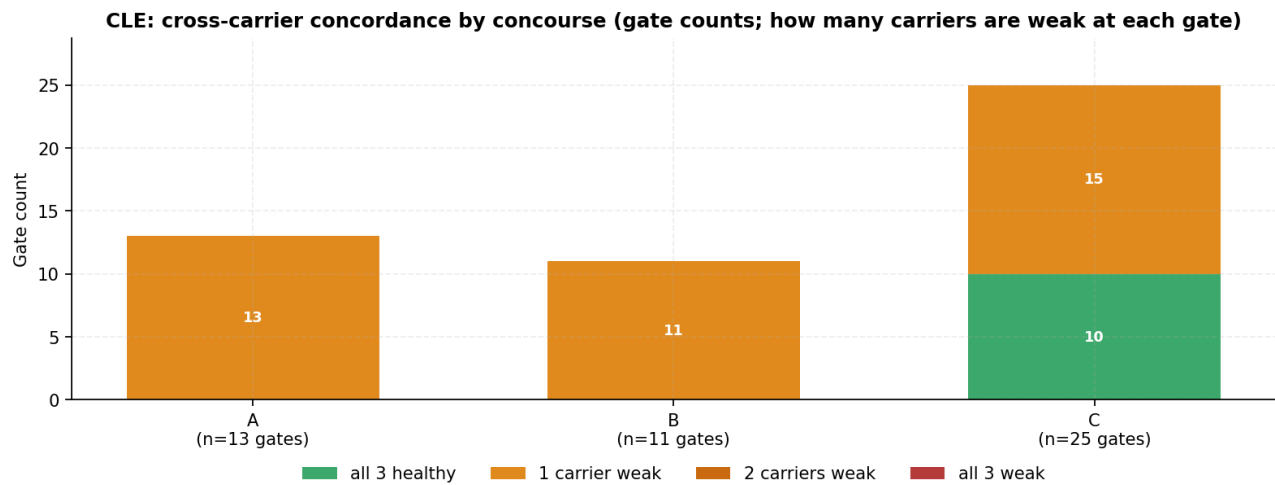


FIG. 15. Per concourse: how many of the three carriers are below the healthy line at each gate (gate counts). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

This split shapes the procurement question. A gate weak for all three carriers points to a building, geometry, or propagation problem. A gate weak for exactly one carrier points to that carrier's path.

Counts across 49 gates: 10 gates healthy for all three, 39 weak for one carrier, 0 weak for two, and 0 weak for all three. Where one carrier is weak, that carrier is AT&T at 39 of 39 gates.

Zero all-weak gates means the tiles show no gate-wide propagation problem in this window; the weakness is AT&T-specific. A neutral-host system would address it as a hosted AT&T path. The concordance does not itself demonstrate a building problem, and the Department should weigh that against the solicitation's whole-terminal premise. Capacity growth under CLEvolution, construction-phase coverage, and the 2032 terminal are separate questions that this export does not measure.

4.4 Concourse C

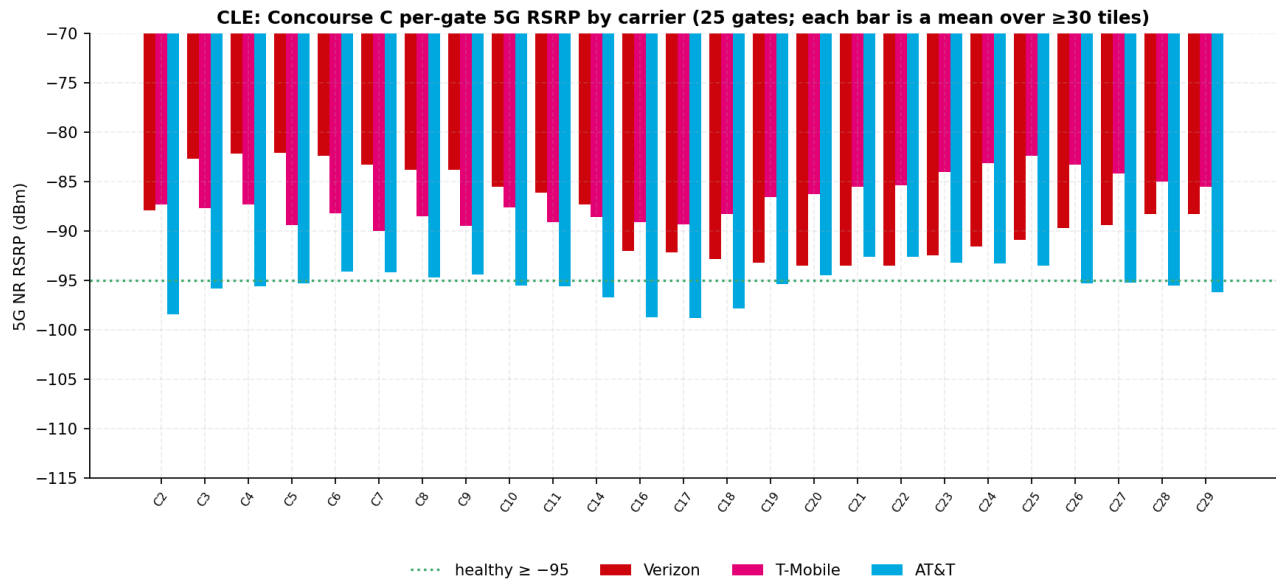


FIG. 16. Per-gate 5G RSRP across the 25 Concourse C gates (OpenStreetMap inventory). Each bar is a mean over at least 30 tiles within 80 m of the gate. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

Concourse C hosts United, American, JetBlue, and Air Canada (Tier B) and holds 25 of the 49 measured gates. Best-5G counts: T-Mobile 15, Verizon 10. Tile-basis healthy shares: T-Mobile 89%, Verizon 76%, AT&T 65% ($n \geq 488$ tiles per carrier). AT&T is healthy at 10 of 25 Concourse C gates (count), its best concourse.



PHOTO. Concourse C seating at the United gates, November 2023. · Photo: Kevin Payravi, CC BY-SA 4.0, via Wikimedia Commons



PHOTO. Gate C28 at the end of Concourse C, November 2022. The C22 to C29 cluster is where the Concourse C footprint widens on the maps. · Photo: Kevin Payravi, CC BY-SA 4.0, via Wikimedia Commons

4.5 Concourses A and B

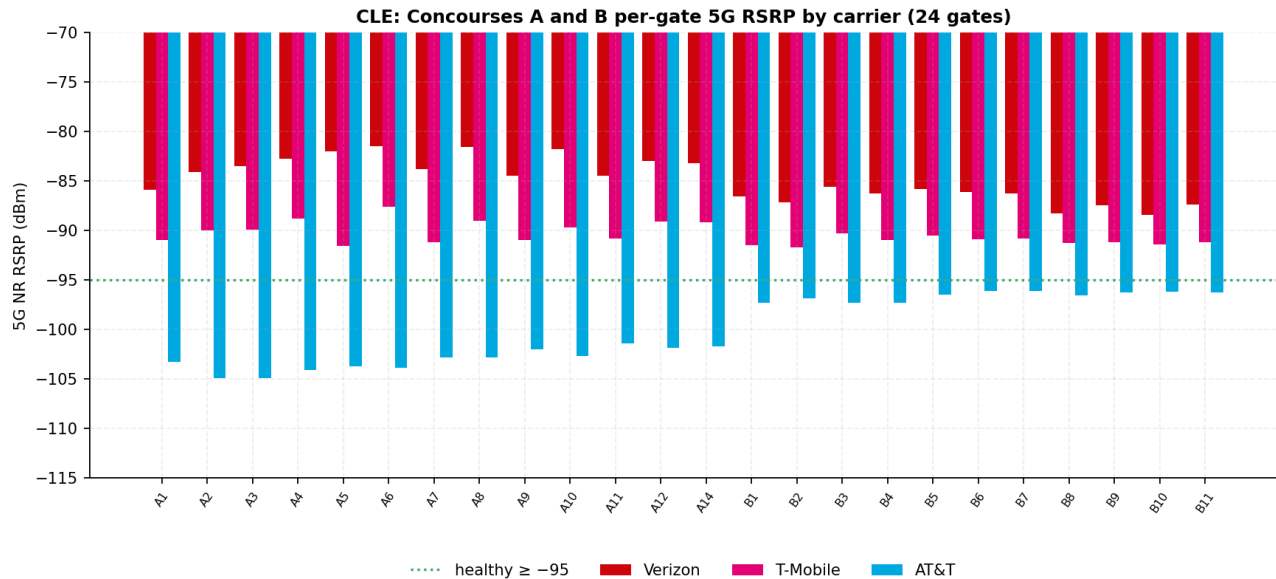


FIG. 17. Per-gate 5G RSRP across the 24 Concourse A and B gates (OpenStreetMap inventory). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

Concourse A hosts Frontier and Concourse B hosts Delta and Southwest (Tier B). Verizon is the best 5G carrier at every gate in both concourses (13 of 13 and 11 of 11, counts). Tile-basis healthy shares in A: Verizon 91%, T-Mobile 87%, AT&T 46%; in B: Verizon 91%, T-Mobile 71%, AT&T 43%. AT&T is healthy at 0 of 13 A gates and 0 of 11 B gates (counts). These two concourses are where AT&T's tile healthy share is lowest, and section 14 names them first.



PHOTO. Concourse moving sidewalk, January 2019. The long concourse corridors are the gate-area tiles behind the per-gate bars. · Photo: Cards84664, CC BY-SA 4.0, via Wikimedia Commons

4.6 Building-masked view (OSM polygons)

CLE building-masked view using the OSM building-polygon mask (2025-08-01 to 2026-07-31)

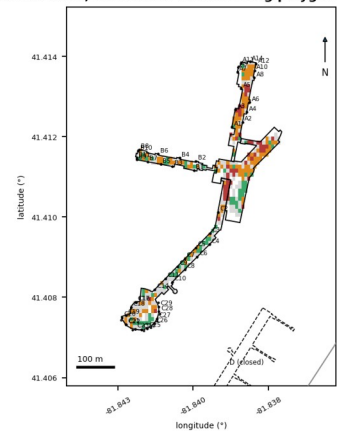
Verizon
5G NR class, tiles inside OSM building polygons · n=427



T-Mobile
5G NR class, tiles inside OSM building polygons · n=431



AT&T
5G NR class, tiles inside OSM building polygons · n=393



Building (OSM polygon)	Verizon: n · healthy · median	T-Mobile: n · healthy · median	AT&T: n · healthy · median
Main Terminal	128 · 77% · -92.0 dBm	152 · 82% · -83.0 dBm	90 · 27% · -105.5 dBm
A	66 · 98% · -86.0 dBm	68 · 66% · -93.0 dBm	54 · 9% · -105.0 dBm
B	45 · 98% · -87.0 dBm	46 · 85% · -90.0 dBm	31 · 42% · -97.0 dBm
C	142 · 68% · -91.0 dBm	151 · 83% · -90.0 dBm	77 · 43% · -97.0 dBm

FIG. 18. Tiles whose centroid falls inside a pinned OSM building polygon (Main Terminal, A, B, C), colored by 5G NR class, with the per-building per-carrier table. This is our OSM building-polygon mask, not Ookla's Indoor layer. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

Building (OSM polygon)	Verizon: n · healthy · median 5G RSRP	T-Mobile: n · healthy · median 5G RSRP	AT&T: n · healthy · median 5G RSRP
Main Terminal	128 · 77% · -92.0 dBm	152 · 82% · -83.0 dBm	90 · 27% · -105.5 dBm
A	66 · 98% · -86.0 dBm	68 · 66% · -93.0 dBm	54 · 9% · -105.0 dBm
B	45 · 98% · -87.0 dBm	46 · 85% · -90.0 dBm	31 · 42% · -97.0 dBm
C	142 · 68% · -91.0 dBm	151 · 83% · -90.0 dBm	77 · 43% · -97.0 dBm

The mask is a point-in-polygon test of tile centroids against the pinned OpenStreetMap footprints, so it selects tiles over the buildings rather than tiles measured inside them (section 16). It replaces nothing in the ranking; every cell above clears the 30-tile floor and agrees with the zone view. Inside the footprints, AT&T's healthy share is lowest over A (9% of n=54), and T-Mobile leads the Main Terminal footprint (median -83.0 vs Verizon -92.0 dBm). Ookla's own Indoor layer is captured separately as portal captures (Tier B, section 15) and is not used here.

5. Tenant level

The 82 mapped points come from a Google Places (New) capture supplemented by OpenStreetMap (70 Google and 12 OpenStreetMap points, pinned 2026-09-08; Tier B, points only). Category point counts sit below the 30-point floor. Category comparisons therefore run on the tile basis behind each category's points: tiles within 80 m of any point, deduplicated. Point counts appear on every axis.

5.1 Category signal strength and quality

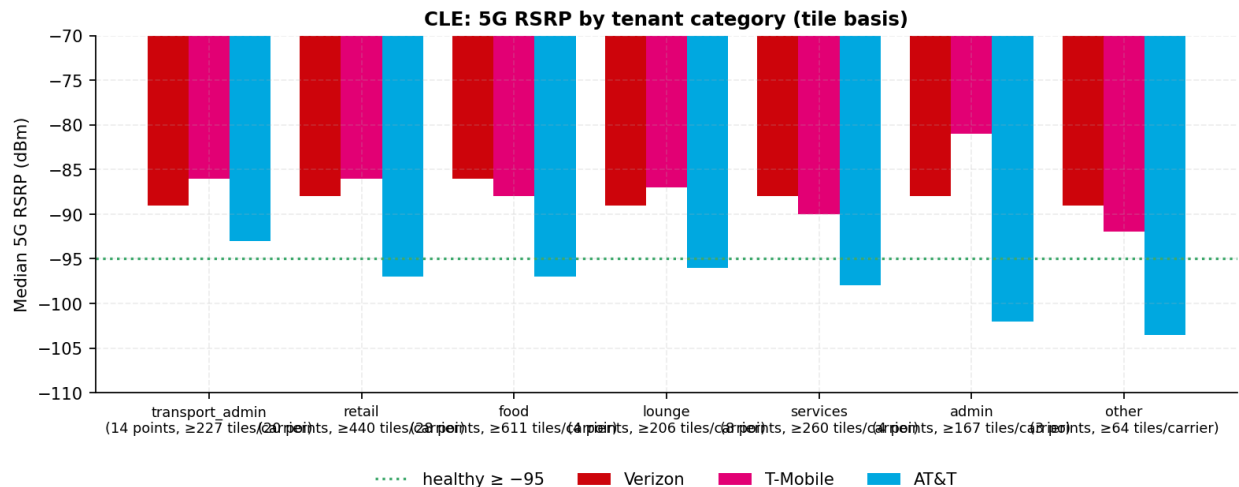


FIG. 19. Median 5G RSRP by tenant category (tile basis; points and minimum tiles per carrier on the axis). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

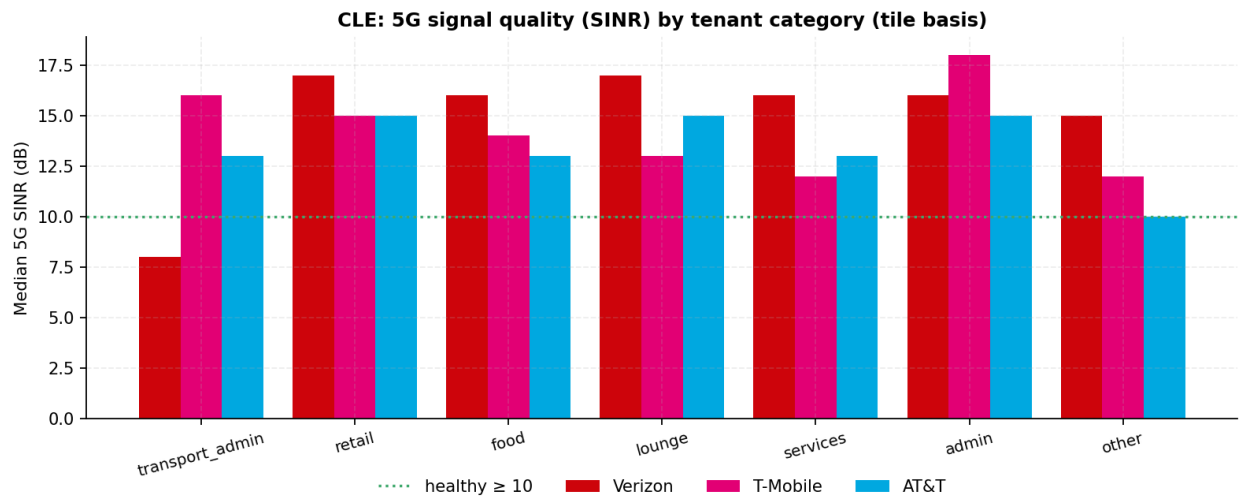


FIG. 20. Median 5G SINR by tenant category (tile basis). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

Ranked categories clear the floor for every carrier: transport_admin, retail, food, lounge, services, admin, other. Categories reported as counts only (a carrier's tile basis below 30): lodging (1 point). Verizon leads every ranked category and AT&T trails every one. Read the chart as a pattern; the point counts are small.

5.2 Terminal vs periphery RSRP proxy

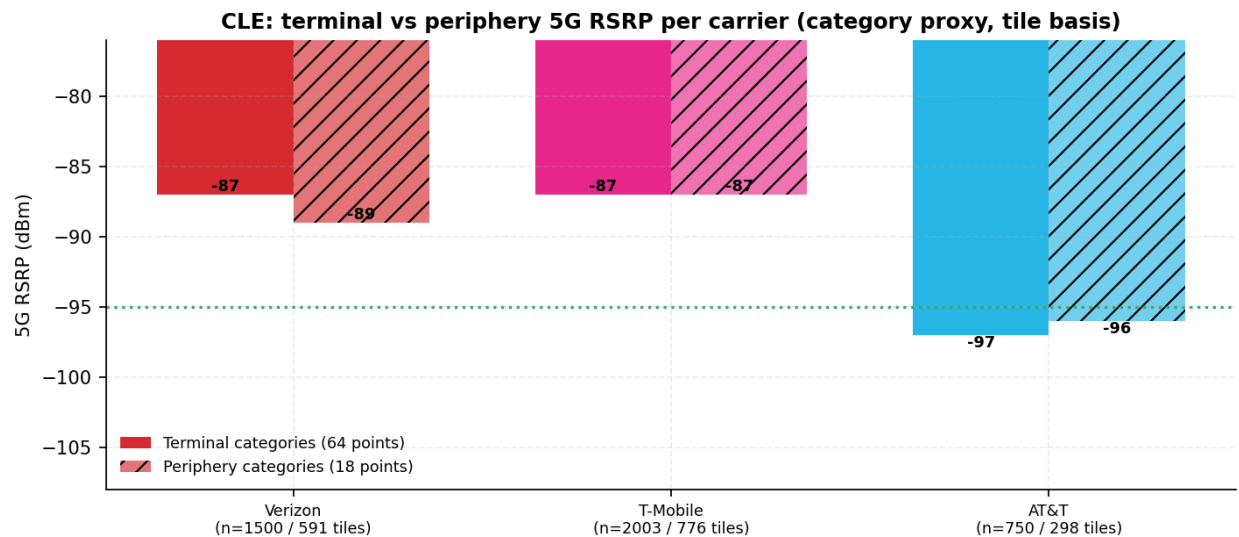


FIG. 21. Per-carrier median 5G RSRP, terminal tenant categories vs periphery categories, on the tile basis. Proxy: category-based masking, not Ookla's building-polygon indoor mask (queued, section 15). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

- Verizon: periphery -89.0 dBm (n=591 tiles behind 18 points), terminal -87.0 dBm (n=1,500 tiles behind 64 points), periphery minus terminal -2.0 dB
- T-Mobile: periphery -87.0 dBm (n=776 tiles behind 18 points), terminal -87.0 dBm (n=2,003 tiles behind 64 points), periphery minus terminal +0.0 dB
- AT&T: periphery -96.0 dBm (n=298 tiles behind 18 points), terminal -97.0 dBm (n=750 tiles behind 64 points), periphery minus terminal +1.0 dB

Terminal categories cover the concessions and services inside the terminal footprint; periphery categories cover the parking lots, the cell phone lot, the hotel, and roadside businesses. A large positive periphery-minus-terminal delta is consistent with macro spillover. A flat delta is ambiguous between close-in macro coverage and an in-building source. Distance to macro sites confounds both readings, and the Site Finder layer (section 15) is queued to resolve it. Deltas: Verizon -2.0 dB, T-Mobile +0.0 dB, AT&T +1.0 dB. AT&T's small periphery-stronger delta is consistent with, but not proof of, macro spillover; Verizon's and T-Mobile's flat deltas stay ambiguous.



PHOTO. RTA Red Line station entrance at the airport, September 2016. The station and the lots are the periphery side of the proxy. ·
Photo: Jacob G., CC BY-SA 4.0, via Wikimedia Commons

5.3 Airline gate clusters

Concourse: airlines (Tier B)	Gates (n)	Verizon median 5G RSRP, dBm (tile n)	T-Mobile median 5G RSRP, dBm (tile n)	AT&T median 5G RSRP, dBm (tile n)
A: Frontier Airlines	13	-84.0 (n=869)	-87.0 (n=1213)	-97.0 (n=416)
B: Delta Air Lines and Southwest Airlines	11	-87.0 (n=308)	-92.0 (n=390)	-97.0 (n=136)
C: United Airlines, American Airlines, JetBlue Airways, and Air Canada	25	-88.5 (n=1510)	-84.0 (n=2125)	-91.0 (n=488)

An airline reads its exposure through its concourse and the passenger's carrier. In this window, the only airline cluster where a carrier other than Verizon leads is Concourse C, where T-Mobile leads on the tile median.

5.4 Retail and food brand coverage

Brand	Points (n)	Verizon median 5G RSRP (dBm)	T-Mobile median 5G RSRP (dBm)	AT&T median 5G RSRP (dBm)
Hudson	3	-89.3	-89.6	-102.1
Starbucks	2	-87.0	-87.7	-98.7

Auntie Anne's	1	-89.5	-86.2	-96.9
Dunkin'	1	-91.0	-90.1	-99.5
Chick-fil-A	1	-89.7	-87.1	-97.7
Cinnabon	2	-88.6	-85.5	-97.1
Potbelly	1	-89.5	-87.6	-97.3
Burger King	1	-88.5	-90.1	-91.8
Great Lakes Brewing	1	-86.4	-88.0	-95.5
Panini's	1	-81.6	-89.1	-103.6
Bruegger's	1	-87.6	-83.5	-95.6

Multi-location brands are a cross-zone consistency check. Point counts are small (3 at most), so this table is a count-only view. Each point value is a mean over the tiles within 80 m of the point (per-point tile n in Appendix A).

5.5 Airline lounges

2 lounge points are in the pinned capture: The Club CLE, United Club.

6. Load and density

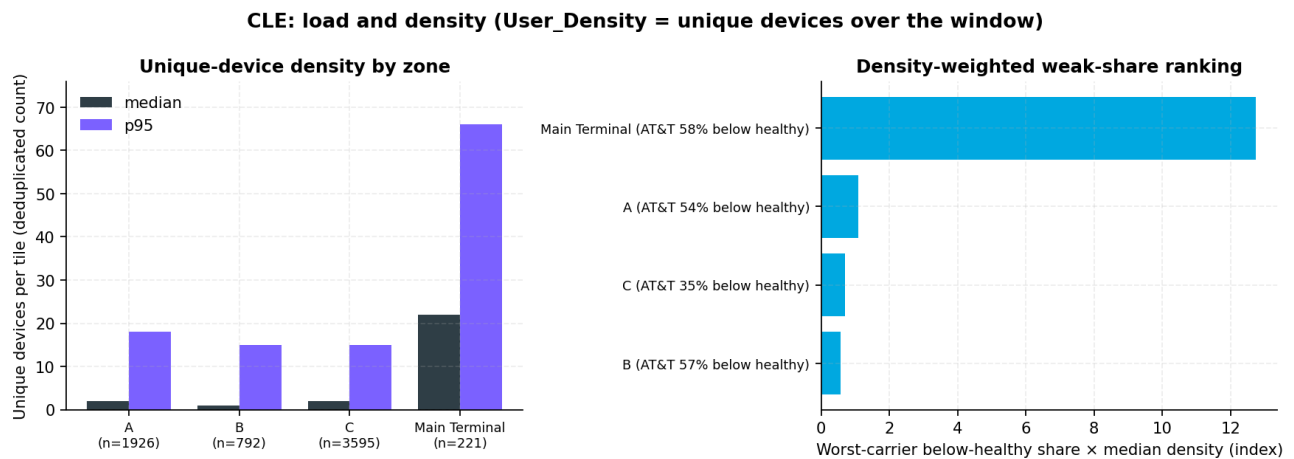


FIG. 22. Unique-device density by zone (median and p95 per tile) and the density-weighted weak-share ranking (tile basis). User_Density = unique devices over the window, deduplicated. · Source: Ookla Cell Analytics All Networks usage export, 2025-08-01 to 2026-07-31

Density is this dataset's demand signal. Ookla's User_Density field counts the unique Android devices observed per tile over the window, deduplicated. It does not count simultaneous users and it does not measure time spent. Zone medians: A 2 (p95 18, n=1,926), B 1 (p95 15, n=792), C 2 (p95 15, n=3,595), Main Terminal 22 (p95 66, n=221). The on-airport median is 2 devices per tile across 14,065 usage tiles.

The density-weighted ranking multiplies each zone's worst-carrier below-healthy 5G tile share by its median density, so it points to where weak signal meets the most devices. Main Terminal leads the ranking (AT&T below healthy on 58% of tiles, median density 22). The worst carrier is AT&T in 4 of 4 zones.

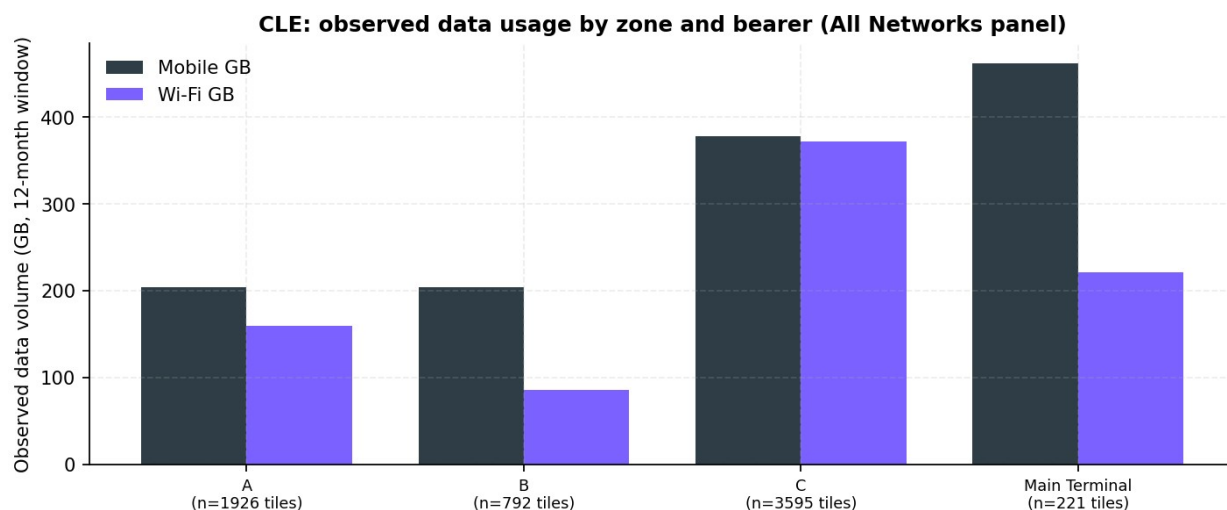


FIG. 23. Observed data volume by zone and bearer (GB over the 12-month window). · Source: Ookla Cell Analytics All Networks usage export, 2025-08-01 to 2026-07-31

Usage volume shows where bandwidth is consumed, by bearer and by zone. It is observed sample volume from the crowdsourcing panel. It is not total traffic.

7. Wi-Fi as an augmentation layer

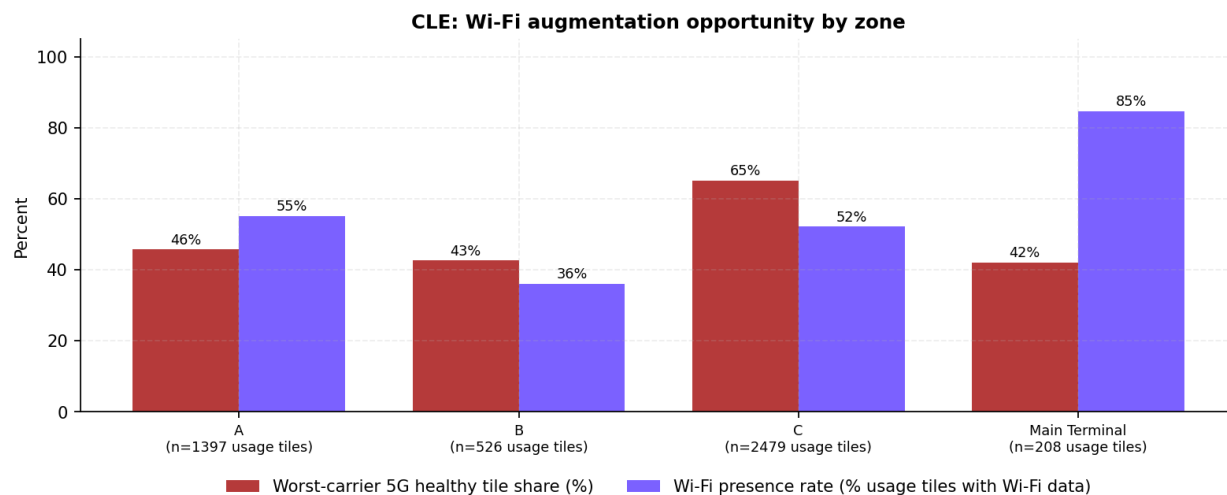


FIG. 24. Worst-carrier 5G healthy tile share vs Wi-Fi presence rate by zone. Zone n counts usage tiles that report the Wi-Fi field, so it is smaller than the density n in FIG. 22. · Source: Ookla Cell Analytics All Networks usage export, 2025-08-01 to 2026-07-31

Wi-Fi usage is observed on 53% of the 10,518 on-airport usage tiles that report the Wi-Fi field. A non-reporting tile means no measurement and is excluded from the denominator; it is not evidence of no Wi-Fi. The augmentation opportunity is largest where the worst-served carrier is weakest and Wi-Fi presence is high.

7.1 Offload share (venue and zone level only)

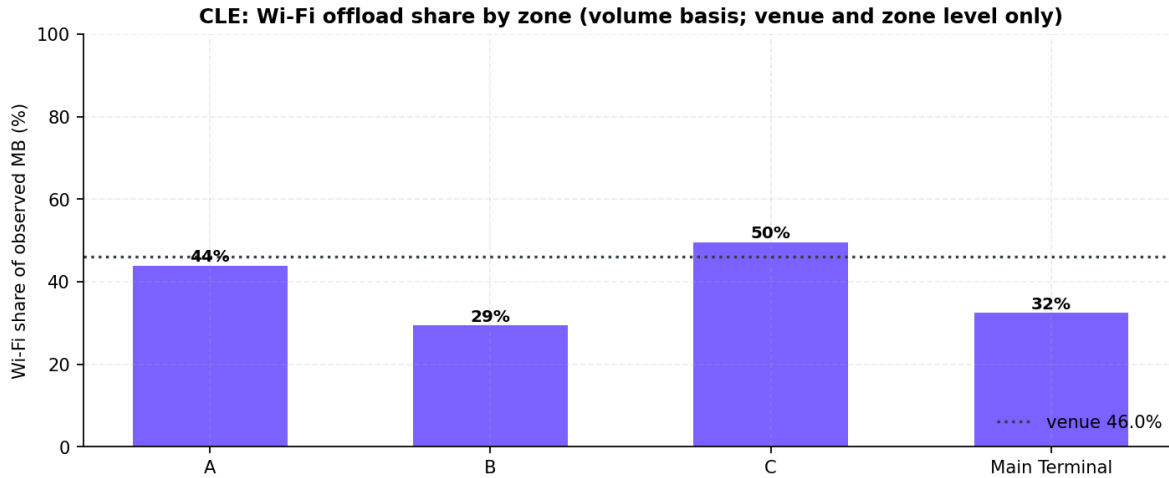


FIG. 25. Wi-Fi share of observed data volume by zone, with the venue reference line. · Source: Ookla Cell Analytics All Networks usage export, 2025-08-01 to 2026-07-31

Venue-wide, 46.0% of observed data volume moves over Wi-Fi (Σ Wi-Fi MB $\div$ Σ all MB on the All Networks panel, $n=14,065$ tiles). Locked rule (section 16): offload is computed at venue and zone level only. The export does not attribute Wi-Fi usage to any cellular carrier's subscribers, so per-carrier offload is not derivable and not implied. The figure blends airport-run Wi-Fi with tenant and personal networks.

Scope decomposition: tiles assigned to a zone blend to 40.2% offload; the remaining on-airport tiles (airfield, roadways, remote lots) run 59.1% Wi-Fi, pulling the venue figure to 46.0%.

7.2 Tenant-level Wi-Fi footprint

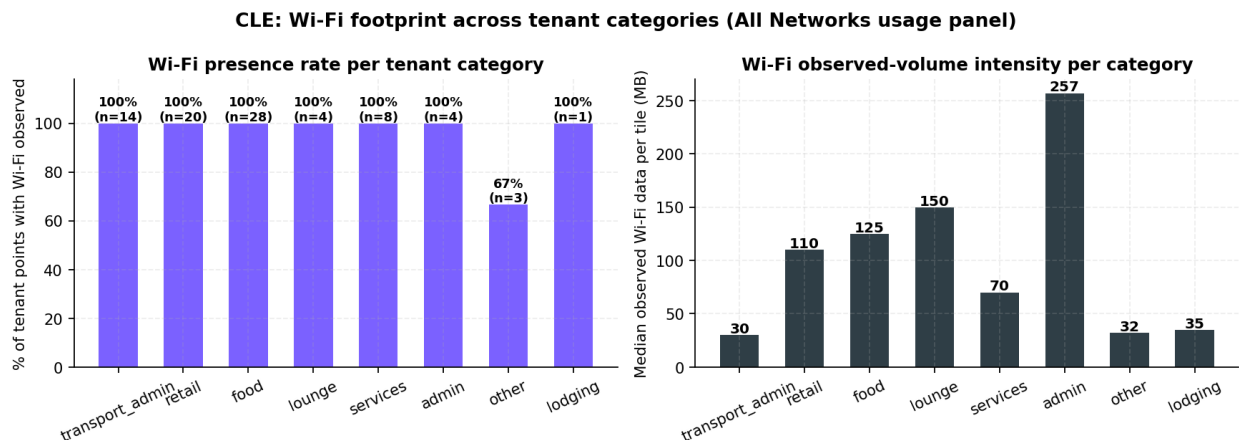


FIG. 26. Wi-Fi observation rate and intensity across tenant categories (point counts on the axis). · Source: Ookla Cell Analytics All Networks usage export, 2025-08-01 to 2026-07-31

Wi-Fi presence and observed volume peak where passengers spend time. The public network is CLE_Public_WiFi (cited, not held); the Wi-Fi figures here come solely from the Ookla usage layer. Controller telemetry (section 15) would convert presence into capacity.

8. Private wireless

No private wireless, Citizens Broadband Radio Service (CBRS), or public-safety deployment is recorded for CLE in the sources this report holds, and the public Ookla layer does not characterize private networks. Whether a CBRS private-network layer is scoped alongside the neutral-host DAS and the CLEvolution program is a design question for the Department of Port Control. Typical medium-hub workloads:

Workload	Why a private network fits	Coordination required
Baggage handling system instrumentation	Deterministic latency, contained RF, isolation from passenger traffic	Facilities, baggage system vendor
Ramp and ground-service vehicle telematics	Outdoor airside coverage with controlled SIM provisioning	Airside operations
Push-to-talk and operational voice	Guaranteed-quality voice independent of public carriers	Public safety, ground handlers
Fixed cameras and IoT in non-public areas	Bandwidth without consuming public-carrier capacity	Facilities maintenance
Construction-phase connectivity (CLEvolution)	Coverage that survives terminal demolition and rebuild sequencing	Program management, contractors
Federal inspection devices	Isolated network for federal device workflows	CBP IT, Department of Port Control

9. Spectrum and service availability

9.1 Band distribution

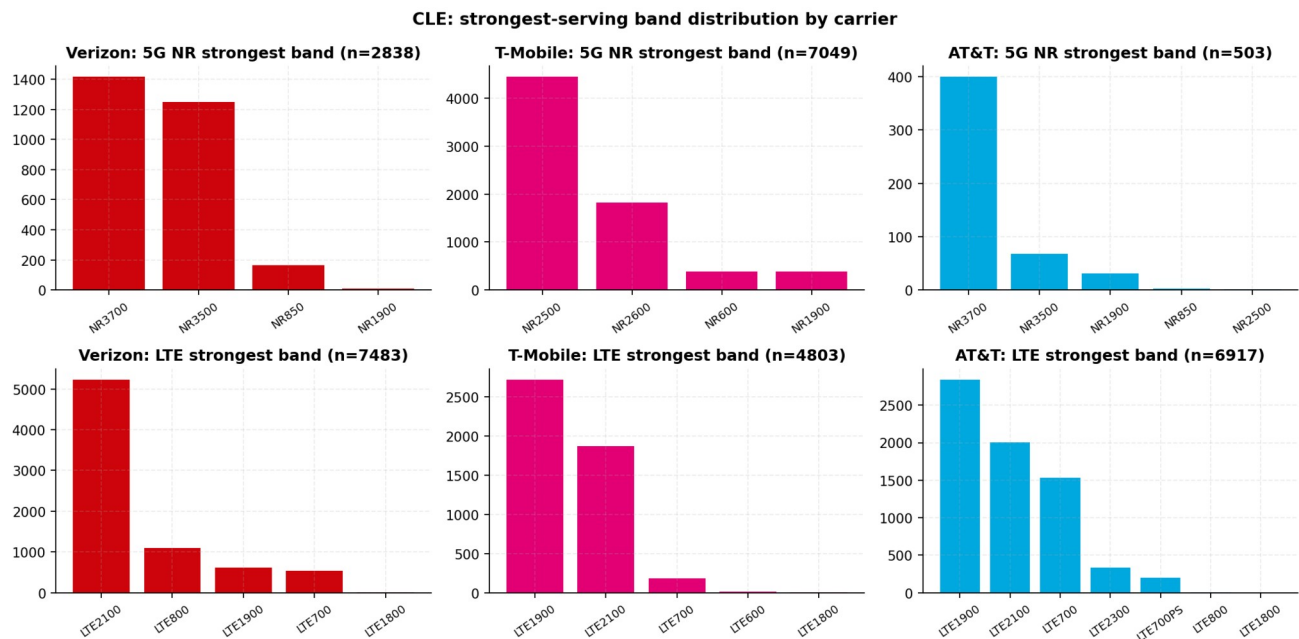


FIG. 27. Strongest-serving band distribution per carrier, 5G NR and LTE (n on each panel). · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

Legend: Ookla band labels are technology plus approximate frequency in MHz, printed verbatim from the export. For example, NR2500 and NR2600 are both 2.5 GHz spectrum, and LTE800 and NR850 are both 850 MHz cellular spectrum. LTE700PS is FirstNet Band 14, the public-safety broadband band. Cell, PCI, and band fields populate only where Ookla resolved a serving cell, so band n is smaller than RSRP n (section 16).

The bands a tile attaches to most often show which spectrum each carrier puts to work at the venue. Sub-1 GHz attachment implies coverage-grade bands. Mid-band attachment implies strong penetration or an in-building source.

Verizon (n = 2,838 NR tiles, 7,483 LTE tiles):

NR band	Tiles (n)	LTE band	Tiles (n)
NR3700	1417	LTE2100	5233
NR3500	1248	LTE800	1093
NR850	165	LTE1900	613
NR1900	8	LTE700	536

T-Mobile (n = 7,049 NR tiles, 4,803 LTE tiles):

NR band	Tiles (n)	LTE band	Tiles (n)
NR2500	4451	LTE1900	2725
NR2600	1825	LTE2100	1877
NR600	387	LTE700	180
NR1900	386	LTE600	16

AT&T (n = 503 NR tiles, 6,917 LTE tiles):

NR band	Tiles (n)	LTE band	Tiles (n)
NR3700	400	LTE1900	2842
NR3500	68	LTE2100	2001
NR1900	31	LTE700	1533
NR850	3	LTE2300	337
NR2500	1	LTE700PS	201

9.2 Service availability

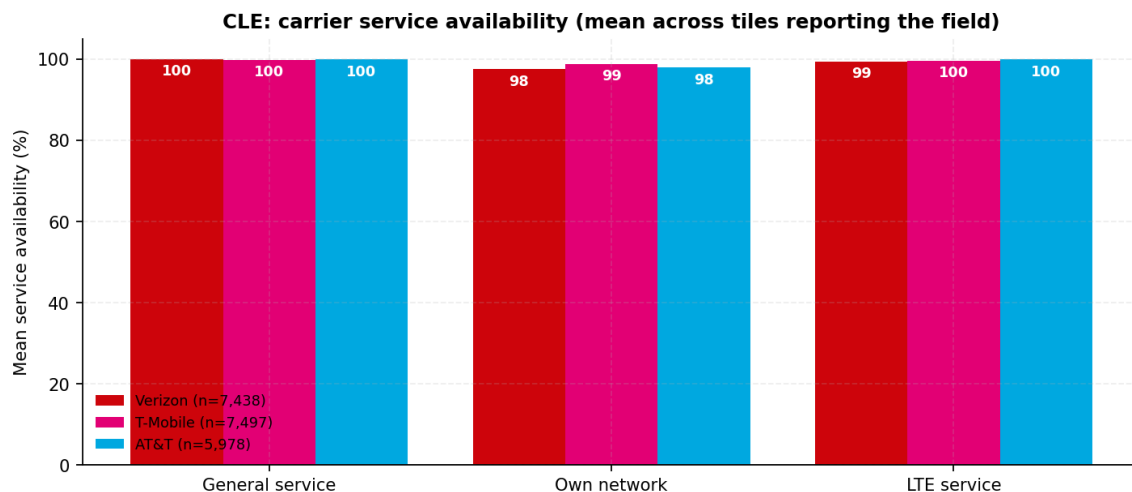


FIG. 28. Service availability (general, own network, general LTE), mean across tiles reporting the field. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

On reporting tiles, all three carriers show near-universal LTE service availability, the graceful-degradation floor. Basis disclosure: availability fields are not populated on every tile (general-LTE reporting share: Verizon 84%, T-Mobile 84%, AT&T 81%). The mean is over reporting tiles only.

9.3 Macro-site geometry

Macro-site geometry (Ookla Site Finder centroids) is queued for the next revision, so this report publishes no site figure. Until then, the section 3 and 5.2 readings on macro coverage rest on the RF tiles alone.

10. Carrier-asymmetry atlas

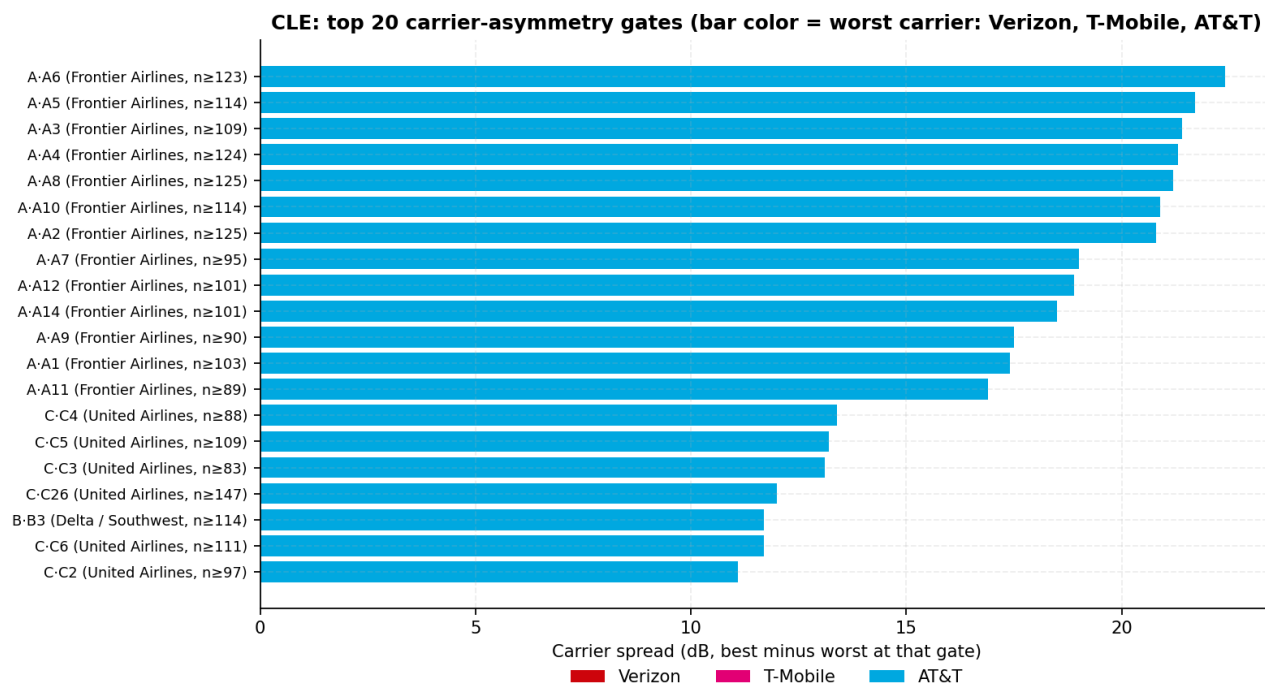


FIG. 29. Top 20 gates by best-minus-worst carrier 5G RSRP spread, among the 49 gates where every carrier's per-gate n is at least 30 tiles. Bar color is the worst carrier at that gate. Gate refs follow the OpenStreetMap inventory. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31

These 20 gates are where a passenger's experience varies most by carrier (spreads of 11 to 22 dB). Worst-carrier tally across all 49 ranked gates: AT&T 47, Verizon 2. They serve two purposes: worst-case examples for the stakeholder narrative, and the validation-point list for post-deployment monitoring (section 14). A hosted AT&T path should compress this spread.

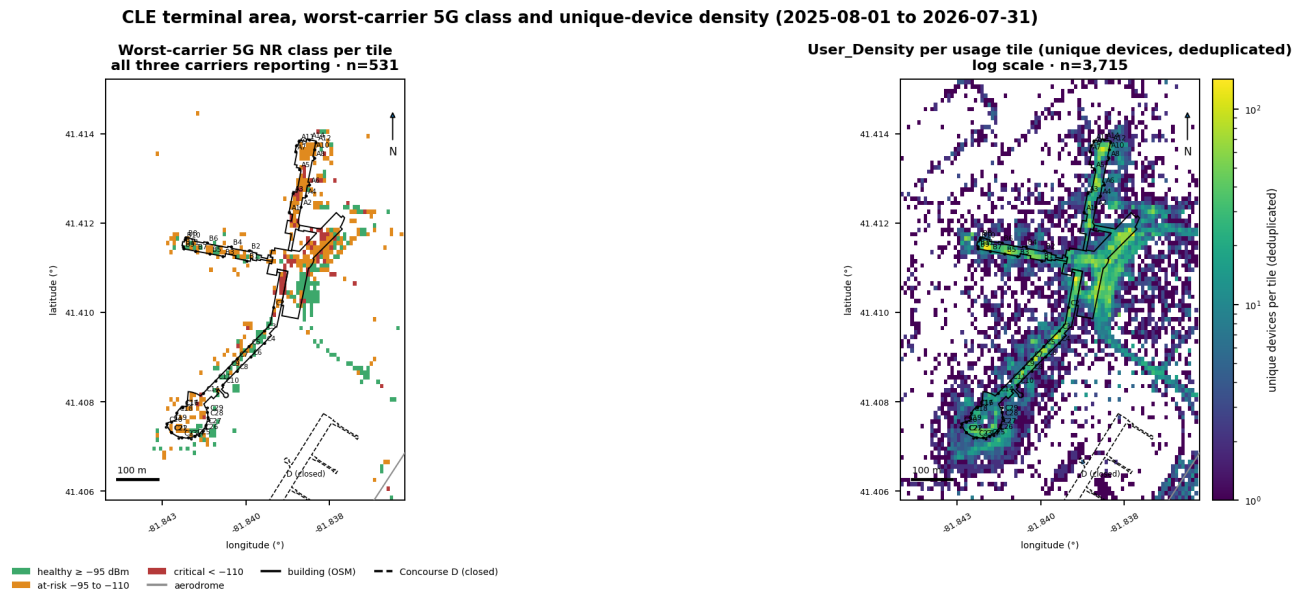


FIG. 30. Left: each terminal-area tile colored by the worst carrier's 5G NR class where all three carriers report. Right: User_Density per usage tile (unique devices, deduplicated) on a log scale over the same extent. · Source: Ookla Cell Analytics per-carrier RF tile export, 2025-08-01 to 2026-07-31; Ookla Cell Analytics All Networks usage export, 2025-08-01 to 2026-07-31

FIG. 30 pairs the two questions the Department asks first: where is the weakest carrier weak, and where are the devices. Amber concentrates along Concourses A and B and the Main Terminal spine, and the density panel shows the same spine carrying the highest unique-device counts.

11. Federal and operational-critical tenants

Point	Zone	Per-carrier 5G RSRP (class, n tiles)
National Weather Service - Cleveland, OH	outside zones	Verizon -105.0 dBm (at-risk, n=7); T-Mobile -101.5 dBm (at-risk, n=2); AT&T -95.0 dBm (healthy, n=1)
CLE Fire Station	C	Verizon -89.5 dBm (healthy, n=6); T-Mobile -80.5 dBm (healthy, n=16); AT&T -117.0 dBm (critical, n=1)

2 federal or operational-critical points are identifiable by name in the pinned capture (National Weather Service - Cleveland, OH, CLE Fire Station). No Customs and Border Protection (CBP) point is in the capture; CLE's federal inspection facility needs tenant attestation before it can be measured here. AT&T's FirstNet Band 14 (LTE700PS) appears on 201 AT&T LTE tiles (section 9.1); public-safety coverage posture is a section 15 layer. These readings are single-point aggregates, reported for scope and not ranked.

12. Passenger-impact translation



PHOTO. The airfield and terminal complex from the air, May 2012, with the runway and taxiway system to the left and the terminal and Concourse D to the right. The photograph predates the measurement window and is illustrative only. · Photo: Ken Lund, CC BY-SA 2.0, via Wikimedia Commons

Carrier	Gates below healthy 5G	Share of gates	Illustrative annual enplanements at those gates (uniform per-gate proxy)
Verizon	0 of 49	0%	under 0.1M
T-Mobile	0 of 49	0%	under 0.1M
AT&T	39 of 49	80%	about 3.9M

Translation method: CLE records 4,855,943 calendar-year enplanements (KG record, cited, not held) and 10,003,833 two-way passengers in 2025 (Crain's Cleveland Business, cited, not held). Per-gate volumes are not held, so the last column distributes annual enplanements uniformly across measured gates as an explicit proxy. It is an illustrative order-of-magnitude translation from RF to people. It is not a measurement, and it assigns every gate the same volume regardless of airline. A gate-level passenger feed (section 15) would replace it. This number will be lifted out of context; it must travel with its label. Even at proxy precision the point stands: on AT&T, 80% of gates sit below the healthy 5G threshold in this window.

13. Prioritized recommendations

Ordered by impact, each with an owner.

#	Recommendation	Owner
1	Confirm the status of the neutral-host	Department of Port Control

	DAS solicitation (NET-11423). If it proceeds, use this baseline as the design input and write the section 14 criteria into the award: AT&T healthy at 90% or more of gates and of tiles in Concourses A, B, C, and the Main Terminal, and asymmetry compression at the named gates.	
2	Attest the source of each carrier's terminal coverage. Ask each carrier whether any in-building or close-in small-cell asset serves the passenger buildings. Verizon's and T-Mobile's flat terminal-vs-periphery proxies (-2.0 and +0.0 dB) are ambiguous, and the answer changes the DAS design.	Department of Port Control with the carriers
3	Sequence the DAS with CLEvolution. The RFP already carries a six-month relocation clause; a system installed in the existing terminal must survive, or be designed to migrate into, the 2032 terminal and the 2029 ground transportation center (cited, not held).	Program management (Jacobs), Department of Port Control
4	Re-measure over a like-for-like window after any in-building system goes live: the same 12-month length, or a matched shorter window that is disclosed. Crowdsourced tiles serve as the before-and-after comparison; acceptance itself is per-carrier commissioning against the same thresholds (section 14).	Imagine Wireless
5	Treat Wi-Fi as a coexisting capacity layer in the design (venue offload 46%, section 7.1). Obtain controller telemetry to size it.	Airport IT
6	Decide the CBRS and private-wireless question alongside the DAS build (section 8), not after it.	Department of Port Control
7	Pull the section 15 layers before the next issue: Site Finder centroids and the Ookla Indoor layer captures. Each upgrades a named claim from proxy to measurement.	Imagine Wireless

14. Post-deployment monitoring criteria and re-measurement plan

These are monitoring criteria for the before-and-after comparison, not the DAS acceptance test. Acceptance itself is per-carrier commissioning (walk test and scanner survey) against the same thresholds. Thresholds are the locked ladder (section 16). Gate refs and counts come from the OpenStreetMap inventory (A 13, C 25; the airport's guide lists 12 and 23). Gate-named criteria must be reconciled against the Department's gate plan before adoption.

Zone or point	Carrier	Criterion (threshold)	Re-test
All measured gates	Every hosted carrier	5G SS-RSRP median ≥ -95 dBm per gate	Like-for-like window after go-live
All measured gates	AT&T	Healthy 5G at $\geq 90\%$ of gates (this window: 10 of 49, 20%)	Like-for-like window after go-live
Concourse A	AT&T	Healthy 5G on $\geq 90\%$ of zone tiles (this window: 46%, n=416)	Like-for-like window after go-live
Concourse B	AT&T	Healthy 5G on $\geq 90\%$ of zone tiles (this window: 43%, n=136)	Like-for-like window after go-live
Concourse C	AT&T	Healthy 5G on $\geq 90\%$ of zone tiles (this window: 65%,	Like-for-like window after go-live

Main Terminal	AT&T	n=488) Healthy 5G on ≥ 90% of zone tiles (this window: 42%, n=133)	Like-for-like window after go-live
All zones	Verizon	Hold parity: healthy 5G on ≥ 76% of tiles in each zone (this window's floor)	Like-for-like window after go-live
All zones	T-Mobile	Hold parity: healthy 5G on ≥ 71% of tiles in each zone (this window's floor)	Like-for-like window after go-live
Concourses A and B	T-Mobile	Healthy LTE tile median ≥ -95 dBm per zone (this window: A -94.0 dBm, n=722; B -100.0 dBm, n=204)	Like-for-like window after go-live
Gate A-A6 (OSM ref)	worst this window: AT&T	Best-minus-worst carrier spread ≤ 10 dB (this window 22 dB)	Like-for-like window after go-live
Gate A-A5 (OSM ref)	worst this window: AT&T	Best-minus-worst carrier spread ≤ 10 dB (this window 22 dB)	Like-for-like window after go-live
Gate A-A3 (OSM ref)	worst this window: AT&T	Best-minus-worst carrier spread ≤ 10 dB (this window 21 dB)	Like-for-like window after go-live
Gate A-A4 (OSM ref)	worst this window: AT&T	Best-minus-worst carrier spread ≤ 10 dB (this window 21 dB)	Like-for-like window after go-live
Gate A-A8 (OSM ref)	worst this window: AT&T	Best-minus-worst carrier spread ≤ 10 dB (this window 21 dB)	Like-for-like window after go-live

Re-measurement uses the same instrument as this baseline (Ookla Cell Analytics, identical thresholds). The window is like for like: the same 12-month length, or a matched shorter window that is disclosed alongside the result. Ookla's date-range comparison renders the before and after directly.

15. Next layers to add

Layer	What it resolves	Source
Ookla Site Finder centroids (LTE and 5G)	Macro-site geometry behind the section 3 and 5.2 readings; queued for the next revision	Ookla portal pull
Tenant attestation for federal facilities	CBP and FIS points are absent from public place data; add them through tenant attestation	Department of Port Control
Indoor mask	OSM building-polygon mask shipped in rev 1 (section 4.6); Ookla native Indoor layer pinned as portal captures, Tier B	Ookla portal captures
Date-range comparison	Before and after for any in-building system; converts this snapshot into a trend	Ookla portal pull
Poor multi-network coverage	Vendor-ranked building-versus-carrier problem split; corroborates section 4.3	Ookla portal pull
3D Z-axis view	15 m vertical bands; the export is flat but the portal is not	Ookla portal pull
Per-gate passenger counts	Replaces the section 12 uniform-distribution proxy with measured exposure	Department of Port Control, airline schedules
Solicitation status, award, and design documents	Hosted carriers, zones, and commissioning criteria for the section 14 plan	Department of Port Control
Gate plan reconciliation	Aligns OpenStreetMap gate refs with the Department's gate list before gate-named criteria are adopted	Department of Port Control
Wi-Fi controller telemetry	Airtime, retries, client density; converts presence into capacity	Airport IT

Carrier asset attestation	Any in-building or small-cell asset serving the terminal in this window	Verizon, T-Mobile, AT&T
Public-safety (NFPA 1221) coverage	Emergency responder radio coverage posture; FirstNet Band 14 is present in the data	Authority having jurisdiction, integrator
Walk test: jet bridges, baggage corridors, construction zones	Areas crowdsource cannot reach; the acceptance instrument	Scanner survey

16. Method, thresholds, confidence, and caveats

Measurement source: Ookla Cell Analytics per-carrier RF tile exports and the All Networks usage export for CLE, 12-month window 2025-08-01 through 2026-07-31, clipped to the KCLE aerodrome polygon (OpenStreetMap way 181471348) plus a 200 m buffer (25,152 on-airport RF tiles retained from 168,206 exported; 14,065 usage tiles retained from 101,836). Measurement freshness at issue is 39 days, within the platform's 90-day policy. Join: tiles to gate and tenant points within an 80 m radius. Gates and gate refs come from a pinned OpenStreetMap inventory (49 gates: A 13, B 11, C 25; the airport's guide lists 12 in A and 23 in C), so gate-named criteria must be reconciled against the Department's gate plan before adoption. Tenants come from a pinned OpenStreetMap capture (82 points, no polygons, no Z-axis). Tile-to-zone assignment: nearest gate or tenant point within 500 m (disclosed proxy). Building mask (section 4.6): point-in-polygon of tile centroids against the pinned OSM footprints, so it selects tiles over a building, not tiles measured inside it. Maps: equirectangular axes in degrees, north up, no basemap tiles, rebuilt from the pinned CSVs. Central tendency: median for every headline figure; means only where labeled. Carrier mapping: the export's Verizon, T-Mobile US, and AT&T US operators are printed as Verizon, T-Mobile, and AT&T. Carrier ordering throughout: strongest at the gates first (Verizon, T-Mobile, AT&T), asserted against the data at build time.

Tile geometry and sample basis: each RF tile is 0.0001° by 0.0001°, about 8 m by 11 m at 41.4° N. The three carrier panels cover 14,273 unique tile centroids on the airport, 3,805 of them seen by all three carriers. The export carries no per-tile scan count, so every n in this report counts tiles, not scans. The 30-tile floor guards spatial support, not scan volume. Ookla aggregates each tile from its panel over the window.

Field population: cell, PCI, and band fields populate only where Ookla resolved a serving cell, so their n is smaller than the RSRP n for the same carrier. The table shows the number of on-airport tiles that populate each field.

Field	Verizon	T-Mobile	AT&T
NR_SS_RSRP	6,158	7,749	2,663
NR_Strongest_Cell	2,838	7,048	503
NR_Strongest_PCI	2,838	7,050	503
NR_Strongest_Band	2,838	7,049	503
LTE_RSRP	7,483	4,803	6,917
LTE_Strongest_Cell	7,483	4,819	6,917
LTE_CQI	2,077	1,114	1,544
Optimization_Priority	6,641	3,299	5,912
General_LTE_Service	7,455	7,499	5,978
All on-airport tiles	8,840	8,892	7,420

Threshold ladder (locked, one ladder everywhere): 5G NR SS-RSRP and LTE RSRP healthy ≥ -95 dBm, at risk -95 to -110 , critical < -110 . 5G SS-SINR healthy ≥ 10 dB, at risk 0 to 10, critical < 0 . RSRQ healthy ≥ -10 dB. No venue-specified threshold was provided. Noise floor: margins under 1 dB are not rankings; every rank statement in this report prints its margin. Minimum-sample rule: no chart or comparative claim ships on fewer than 30 underlying tiles or points. Because every concourse holds fewer than 30 gates and every tenant category fewer than 30 points, zone and category comparisons run on the tile

basis (hundreds of tiles per carrier per cell), and gate or point tallies appear as counts with n visible, not ranked (applied: sections 4.3, 4.4, 4.5, 5.4, 5.5, 10, 11).

Units rule: Ookla User_Density is the count of unique Android devices observed per tile over the measurement window, deduplicated. It does not count simultaneous users and it does not measure time spent, and neither reading appears anywhere in this report. Wi-Fi offload = $\sum \text{Wi-Fi MB} \div \sum (\text{Wi-Fi} + \text{Mobile}) \text{ MB}$ by volume, computed at venue and zone level only on the All Networks panel. Per-carrier offload is not derivable from this dataset and is not implied. The offload figure cannot separate airport-run Wi-Fi from tenant or personal networks.

Sample basis and inference limits: crowdsourced background scans from consumer Android handsets (a panel Ookla characterizes as about 3% of devices; iOS devices are not sampled), aggregated per tile over 12 months. The panel's composition differs by carrier, so cross-carrier comparisons inherit a device-population bias this export cannot correct. Supported: medians, shares, and distributions at venue, zone, gate-cluster, and tenant-category level with n disclosed. Not supported: throughput, latency, or jitter (not in this export), per-carrier Wi-Fi offload, sub-tile positioning, and floor separation. Nothing in this report is measured indoors: there is no indoor mask and no Z-axis, and gate values are tiles within 80 m of a point that can straddle the apron.

Confidence tagging: facts sourced from public records rather than measurement are tagged "cited, not held" inline and are Tier C in the claims ledger. Measured claims are Tier A and reproduce from the raw exports through the verification bundle. Transcribed values (concourse airline assignments, Tier B) carry capture dates in the provenance manifest. Knowledge-graph facts (hub class, enplanements, the DAS Master row, and the RFP evidence chunks) are pinned in the build's source folder and tagged "KG record" inline; the graph holds no deployment, vendor, or leadership rows for CLE.

Caveats: the dataset is gate-area and public-corridor weighted; it does not cover jet-bridge interiors or baggage corridors. PCI diversity, serving-cell volatility, and band distributions are aggregate proxies, not active traces or carrier network-management data. The optimization priority index is Ookla's vendor-defined layer, reported as such. Engineering inferences about cause are labeled as inferences where they appear.

Provenance discipline: every numerical value in this report is computed from the cited source files at build time or carries an inline cited-not-held tag. No value is estimated or invented. Photographs are Tier B illustrative material from Wikimedia Commons under the licenses listed in the provenance manifest; they are not measurements.

Appendix A. Lowest-reading mapped points per carrier (5G NR RSRP; n ≥ 30 tiles only)

The 82 mapped points blend terminal concessions with periphery businesses (lots, the hotel, roadside services). That mix is deliberate: it is the periphery bucket of the section 5.2 proxy. This table is an inventory of the lowest-reading points on or near airport property. Only points whose per-carrier aggregate rides on n ≥ 30 tiles appear.

Verizon

RSRP (dBm)	Zone	Category	Point	n (tiles)
-99.5	(outside zones)	services	United States Postal Service	103
-97.5	(outside zones)	services	Century Federal Credit Union	39

-97.5	(outside zones)	lodging	The Orbit Hotel	33
-97.4	(outside zones)	retail	Menzies Aviation CLE Fuel Farm	43
-94.6	(outside zones)	transport_admin	Cell Phone Lot	96
-94.4	(outside zones)	transport_admin	Brookpark Rd & Rocky River Dr	101
-93.7	(outside zones)	retail	Aeromag Contego CLE Llc	65
-93.0	(outside zones)	transport_admin	Rocky River Dr & Brookpark Rd	84
-92.5	(outside zones)	transport_admin	Brookpark Rd & Rocky River Dr	96
-92.4	C	food	Starbucks Coffee Company	167
-91.4	(outside zones)	retail	Mazzella	65
-91.1	(outside zones)	transport_admin	Brookpark Rd & Rocky River Dr	107
-91.1	C	food	Cantina Taqueria	173
-91.0	C	food	Dunkin'	168
-90.9	Main Terminal	retail	Ohio Game Day Sports	149
-90.8	Main Terminal	retail	Rock and Roll Hall of Fame - Airport Store	172
-90.7	Main Terminal	retail	Johnston & Murphy	168
-90.5	C	services	ATM	163
-90.4	Main Terminal	food	Embers	176
-90.4	Main Terminal	retail	Sunglass Hut	169

T-Mobile

RSRP (dBm)	Zone	Category	Point	n (tiles)
-99.3	(outside zones)	lodging	The Orbit Hotel	46
-97.3	(outside zones)	services	United States Postal Service	74
-95.9	(outside zones)	transport_admin	Brookpark Rd & Rocky River Dr	88
-95.7	(outside zones)	services	Century Federal Credit Union	47
-94.4	(outside zones)	transport_admin	Brookpark Rd & Rocky River Dr	82
-93.5	(outside zones)	transport_admin	Brookpark Rd & Rocky River Dr	103
-92.7	B	lounge	The Club CLE	135
-92.6	(outside zones)	retail	FedEx Ship Center	62
-92.6	Main Terminal	retail	Ohio Game Day Sports	162
-92.4	Main Terminal	retail	Kids Works	149
-92.1	Main Terminal	retail	Hudson Booksellers	152
-91.0	A	food	800 Degrees Woodfired Pizza Kitchen	120
-90.9	A	other	Cleveland Shines	124
-90.9	(outside zones)	transport_admin	Rocky River Dr & Brookpark Rd	93
-90.8	A	services	OH! Lottery	126
-90.7	B	food	Menchie's Frozen Yogurt	125
-90.7	B	food	Subway	125
-90.7	B	retail	Vino Volo	133
-90.5	A	food	Farmer's Fridge	128
-90.5	B	food	Quaker Steak & Lube	120

AT&T

RSRP (dBm)	Zone	Category	Point	n (tiles)
-112.7	(outside zones)	retail	NASA Glenn Exchange	35

-105.4	A	retail	Hudson	121
-105.0	A	other	Cleveland Shines	111
-104.5	A	food	Sammy's Beach Bar & Grill	125
-104.4	C	transport_admin	Airport Station	60
-104.3	A	food	800 Degrees Woodfired Pizza Kitchen	112
-104.1	A	services	OH! Lottery	113
-103.6	A	food	Panini's Bar & Grill	123
-103.4	A	food	Farmer's Fridge	121
-102.7	A	food	Starbucks Coffee Company	125
-102.1	Main Terminal	retail	Hudson Booksellers	120
-101.6	Main Terminal	admin	Ticketing & Baggage Claim	187
-101.5	Main Terminal	retail	Ohio Game Day Sports	113
-101.2	C	retail	InMotion	68
-101.2	Main Terminal	retail	Kids Works	115
-100.4	Main Terminal	food	Embers	148
-100.0	A	transport_admin	Hopkins Airport	99
-100.0	Main Terminal	retail	Johnston & Murphy	135
-100.0	Main Terminal	retail	Sunglass Hut	136
-99.6	Main Terminal	retail	Rock and Roll Hall of Fame - Airport Store	143

Appendix B. Strongest-serving band tables per carrier (with footprint share)

The same top-6 bands as section 9.1, extended with each band's share of the carrier's band-reporting tile footprint. Labels are Ookla's, printed verbatim (legend in section 9.1).

Verizon: 5G NR strongest band (n=2,838)

Band	Tile count (n)	Share of NR footprint
NR3700	1417	49.9%
NR3500	1248	44.0%
NR850	165	5.8%
NR1900	8	0.3%

Verizon: LTE strongest band (n=7,483)

Band	Tile count (n)	Share of LTE footprint
LTE2100	5233	69.9%
LTE800	1093	14.6%
LTE1900	613	8.2%
LTE700	536	7.2%
LTE1800	8	0.1%

T-Mobile: 5G NR strongest band (n=7,049)

Band	Tile count (n)	Share of NR footprint
NR2500	4451	63.1%
NR2600	1825	25.9%
NR600	387	5.5%
NR1900	386	5.5%

T-Mobile: LTE strongest band (n=4,803)

Band	Tile count (n)	Share of LTE footprint
LTE1900	2725	56.7%
LTE2100	1877	39.1%
LTE700	180	3.7%

LTE600	16	0.3%
LTE1800	5	0.1%

AT&T: 5G NR strongest band (n=503)

Band	Tile count (n)	Share of NR footprint
NR3700	400	79.5%
NR3500	68	13.5%
NR1900	31	6.2%
NR850	3	0.6%
NR2500	1	0.2%

AT&T: LTE strongest band (n=6,917)

Band	Tile count (n)	Share of LTE footprint
LTE1900	2842	41.1%
LTE2100	2001	28.9%
LTE700	1533	22.2%
LTE2300	337	4.9%
LTE700PS	201	2.9%
LTE800	2	0.0%

Appendix C. Full gate table

Per-gate mean 5G NR RSRP and SINR per carrier to one decimal, with the per-carrier tile n. Healthy means RSRP ≥ -95.0 dBm. Best 5G carrier is a count. Gate refs follow the OpenStreetMap inventory.

Conc	Gate	Verizon RSRP / SINR (n)	T-Mobile RSRP / SINR (n)	AT&T RSRP / SINR (n)	Best 5G
A	A1	-85.9 / +13.3 (125)	-91.0 / +10.7 (110)	-103.3 / +10.4 (103)	Verizon
A	A2	-84.1 / +14.0 (144)	-90.0 / +12.4 (135)	-104.9 / +8.7 (125)	Verizon
A	A3	-83.5 / +14.0 (126)	-89.9 / +11.1 (112)	-104.9 / +7.9 (109)	Verizon
A	A4	-82.8 / +14.6 (141)	-88.8 / +12.9 (141)	-104.1 / +8.4 (124)	Verizon
A	A5	-82.0 / +15.3 (123)	-91.6 / +11.2 (114)	-103.7 / +7.4 (116)	Verizon
A	A6	-81.5 / +15.1 (134)	-87.6 / +14.0 (142)	-103.9 / +7.7 (123)	Verizon
A	A7	-83.8 / +13.1 (96)	-91.2 / +10.8 (96)	-102.8 / +7.8 (95)	Verizon
A	A8	-81.6 / +15.3 (126)	-89.0 / +14.4 (137)	-102.8 / +7.9 (125)	Verizon
A	A9	-84.5 / +12.5 (95)	-91.0 / +11.6 (94)	-102.0 / +8.3 (90)	Verizon
A	A10	-81.8 / +14.5 (114)	-89.7 / +13.9 (126)	-102.7 / +8.1 (114)	Verizon
A	A11	-84.5 / +12.5 (96)	-90.8 / +11.8 (95)	-101.4 / +8.9 (89)	Verizon
A	A12	-83.0 / +13.7 (105)	-89.1 / +14.0 (119)	-101.9 / +8.7 (101)	Verizon
A	A14	-83.2 / +13.4 (105)	-89.2 / +14.1 (110)	-101.7 / +8.7 (101)	Verizon
B	B1	-86.6 / +19.4 (122)	-91.5 / +12.4 (136)	-97.3 / +14.1 (99)	Verizon
B	B2	-87.2 / +19.3 (121)	-91.7 / +12.3 (134)	-96.9 / +14.5 (99)	Verizon
B	B3	-85.6 / +20.6 (123)	-90.3 / +14.1 (128)	-97.3 / +15.1 (114)	Verizon
B	B4	-86.3 / +20.2 (121)	-91.0 / +13.6 (132)	-97.3 / +15.0 (112)	Verizon
B	B5	-85.8 / +20.6 (119)	-90.5 / +14.5 (126)	-96.5 / +15.0 (115)	Verizon

B	B6	-86.1 / +19.9 (118)	-90.9 / +14.2 (121)	-96.1 / +15.5 (110)	Verizon
B	B7	-86.3 / +18.4 (106)	-90.8 / +14.5 (116)	-96.1 / +15.0 (116)	Verizon
B	B8	-88.3 / +17.8 (87)	-91.3 / +14.2 (103)	-96.6 / +14.0 (92)	Verizon
B	B9	-87.5 / +17.9 (87)	-91.2 / +14.2 (103)	-96.3 / +14.3 (93)	Verizon
B	B10	-88.4 / +17.7 (86)	-91.4 / +14.1 (104)	-96.2 / +14.4 (93)	Verizon
B	B11	-87.4 / +17.9 (86)	-91.2 / +14.2 (104)	-96.3 / +14.3 (91)	Verizon
C	C2	-87.9 / +16.4 (136)	-87.3 / +13.7 (155)	-98.4 / +14.9 (97)	T-Mobile
C	C3	-82.7 / +20.1 (117)	-87.7 / +13.6 (148)	-95.8 / +15.1 (83)	Verizon
C	C4	-82.2 / +20.9 (116)	-87.3 / +14.1 (146)	-95.6 / +15.3 (88)	Verizon
C	C5	-82.1 / +21.9 (139)	-89.4 / +12.3 (153)	-95.3 / +15.5 (109)	Verizon
C	C6	-82.4 / +21.9 (134)	-88.2 / +13.2 (162)	-94.1 / +16.7 (111)	Verizon
C	C7	-83.3 / +21.7 (135)	-90.0 / +12.0 (166)	-94.2 / +16.3 (111)	Verizon
C	C8	-83.8 / +20.5 (134)	-88.5 / +12.6 (174)	-94.7 / +17.1 (113)	Verizon
C	C9	-83.8 / +20.3 (140)	-89.5 / +11.7 (168)	-94.4 / +16.9 (117)	Verizon
C	C10	-85.5 / +18.7 (126)	-87.6 / +11.8 (173)	-95.5 / +17.1 (122)	Verizon
C	C11	-86.1 / +18.4 (130)	-89.1 / +11.4 (164)	-95.6 / +16.2 (120)	Verizon
C	C14	-87.3 / +17.1 (129)	-88.6 / +11.4 (164)	-96.7 / +15.3 (123)	Verizon
C	C16	-92.0 / +13.6 (134)	-89.1 / +11.4 (158)	-98.7 / +12.8 (136)	T-Mobile
C	C17	-92.2 / +13.3 (131)	-89.3 / +11.4 (156)	-98.8 / +12.5 (134)	T-Mobile
C	C18	-92.8 / +12.8 (140)	-88.3 / +12.1 (169)	-97.8 / +13.0 (130)	T-Mobile
C	C19	-93.2 / +11.6 (140)	-86.6 / +12.5 (176)	-95.4 / +14.2 (135)	T-Mobile
C	C20	-93.5 / +10.5 (125)	-86.3 / +12.8 (172)	-94.5 / +14.7 (125)	T-Mobile
C	C21	-93.5 / +11.1 (140)	-85.5 / +13.9 (178)	-92.6 / +16.5 (145)	T-Mobile
C	C22	-93.5 / +11.0 (141)	-85.4 / +13.9 (179)	-92.6 / +16.5 (145)	T-Mobile
C	C23	-92.5 / +12.4 (157)	-84.0 / +14.4 (193)	-93.2 / +16.9 (157)	T-Mobile
C	C24	-91.6 / +13.6 (161)	-83.1 / +14.8 (200)	-93.3 / +17.7 (160)	T-Mobile
C	C25	-90.9 / +14.7 (150)	-82.4 / +15.2 (198)	-93.5 / +17.9 (149)	T-Mobile
C	C26	-89.7 / +15.9 (147)	-83.3 / +14.8 (205)	-95.3 / +17.1 (147)	T-Mobile
C	C27	-89.4 / +16.4 (150)	-84.2 / +14.1 (199)	-95.2 / +17.3 (149)	T-Mobile
C	C28	-88.3 / +16.8 (147)	-85.0 / +13.5 (193)	-95.5 / +17.1 (149)	T-Mobile
C	C29	-88.3 / +16.8 (143)	-85.5 / +12.9 (182)	-96.2 / +16.6 (142)	T-Mobile