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Grant Thornton

Methods and techniques for assessing coverage by radiocommunication services — with a focus on mobile 5G

AT A GLANCE **Study 18** examines how the coverage of a geographical area by radiocommunication services — above all mobile 4G/5G — can be detected and verified. It reviews five forward-looking approaches: satellite spectrum monitoring, drone-borne measurement, advanced simulation and machine-learning models, upgraded measurement technologies (voice quality), and the simultaneous, correlated verification of radio and quality-of-service parameters. Each is assessed for benefits, feasibility, cost and the conditions needed to deploy it.

What the study covers

Measuring radio-signal coverage, continuously monitoring it and evaluating the parameters of the services provided are essential tasks for operating wireless electronic-communications networks and using spectrum efficiently — and, ultimately, for protecting consumers. The study maps the current methods used in the Czech Republic (portable signal-level meters, vehicle drive-test rigs, software prediction models and real-time network monitoring), identifies their most significant weaknesses, and proposes new methods and techniques that improve the accuracy or efficiency of coverage verification.

Why it matters

Radio spectrum is a limited natural resource that must be managed to prevent interference between services. In principle, coverage monitoring is well handled today — sound methodologies and adequate tools exist. The pressure comes from a rising number of frequency bands to monitor, tighter demands on accuracy and speed, and a growing volume of monitored parameters. These demands drive the search for new techniques that build on, or complement, the established ones.

Five approaches assessed

Satellite monitoring

Real-time spectrum monitoring from orbit. Found largely unusable for the terrestrial segment, but relevant for the emerging space-telecommunications sector.

Drone-borne measurement

A safe, fast and relatively low-cost complement to drive/walk tests, ideal for inaccessible or hazardous areas. Mature payloads and methods already exist.

Simulation & machine learning

More sophisticated models — increasingly using AI — sharpen prediction accuracy, but require unified inputs and large training datasets.

Advanced voice-quality testing

Upgraded measurement equipment for voice services, where objective quality scoring (e.g. POLQA, MOS) remains a current need.

Correlated radio + QoS verification

Verifying radio-interface parameters and quality-of-service parameters together, reflecting the end-user experience more closely. Feasible, but data-intensive.

Focus on mobile 5G

Throughout, the primary attention is on mobile-service coverage — LTE and especially 5G — the networks where verification needs are growing fastest.

A multirotor drone carrying a frequency-spectrum measurement payload — a practical tool for measuring coverage where drive or walk tests cannot reach. (Source: Study 18)

Key findings

Satellites — not yet practical for terrestrial networks

Monitoring terrestrial mobile networks from orbit is practically unusable today, for technical reasons (base stations emit minimal power skyward) and economic ones. It stays relevant for monitoring "radio smog" radiated into space and for the growing space-telecommunications agenda.

Drones — effective, but the law lags

Suitable measuring instruments and methodologies are available, and complete integrated systems exist. The gap is legislative: regulators such as the Czech Telecommunication Office (CTO) have no exemption for measurement flights and must, for example, seek a landowner's consent even when that land hosts an unauthorised interference source — which makes such checks pointless.

Simulation vs. reality — unify the inputs

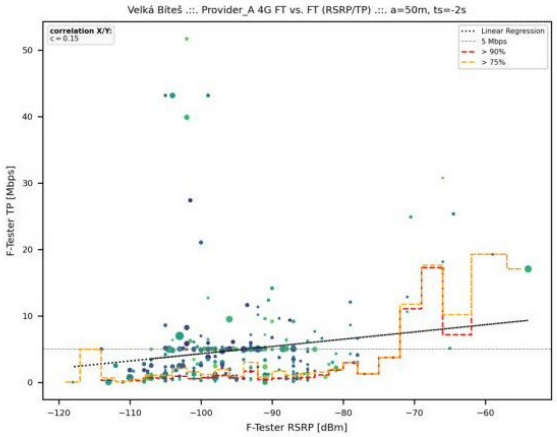
Software prediction and field measurements diverge, and results differ between operators and the regulator because each uses different starting conditions and tools. Aligning baseline conditions and creating a publicly available "reference" terrain model (with the cadastre authority, ČÚZK) would reduce these discrepancies.

Voice testing — vendors have converged

Across reputable international vendors, voice-quality testing rests on the same methodologies (notably POLQA, reported on the MOS scale); monitoring solutions and data-handling tools differ only marginally in functionality.

Correlated radio + QoS — feasible with big data

Simultaneous, correlated verification of radio and service-quality parameters is possible but needs large datasets from many locations. Averaging over a reference grid of squares is decisive. From the dependence of throughput on signal level, threshold RSRP values can be read off; the analysis found no reason to change the current RSRP coverage limits set in tender conditions.



Throughput (Mbps) against the RSRP signal level (dBm) from a drive-test dataset. The fitted curves indicate the signal levels at which a large share of end users reach a target data rate — the basis for validating coverage limits. (Source: Study 18)

Recommendations

Continuously track developments in coverage detection and verification — international standards, measurement methods, evaluation techniques and simulations — and in particular:

- Analyse measurement and testing needs for fixed LTE and fixed 5G, including within VHCN networks and conditions.
- Analyse measurement and testing needs for private 5G networks, especially in industry, including the expected use of the 26 GHz band.
- Expand the usability of drones, notably by introducing legislative exemptions for measurement flights.
- Initiate a detailed comparison of operators' and the regulator's simulation and measurement tools to standardise baseline conditions, methodologies and criteria.
- Analyse the relationships between radio and quality-of-service parameters in depth and over time, to validate or revise coverage limits, and optimise the data-measurement methodology.
- Address radio-spectrum management for space telecommunications, reflecting the outcomes of the WRC-27 and WRC-31 conferences and the development of satellite technologies.

KEY TAKEAWAY Coverage verification is mature in principle but under growing pressure. Drones, advanced simulation/ML and correlated radio–QoS analysis offer the clearest near-term gains — provided baseline conditions are unified, a shared reference terrain model is built, and regulators gain the legal room to measure: a shared priority for EU spectrum authorities.