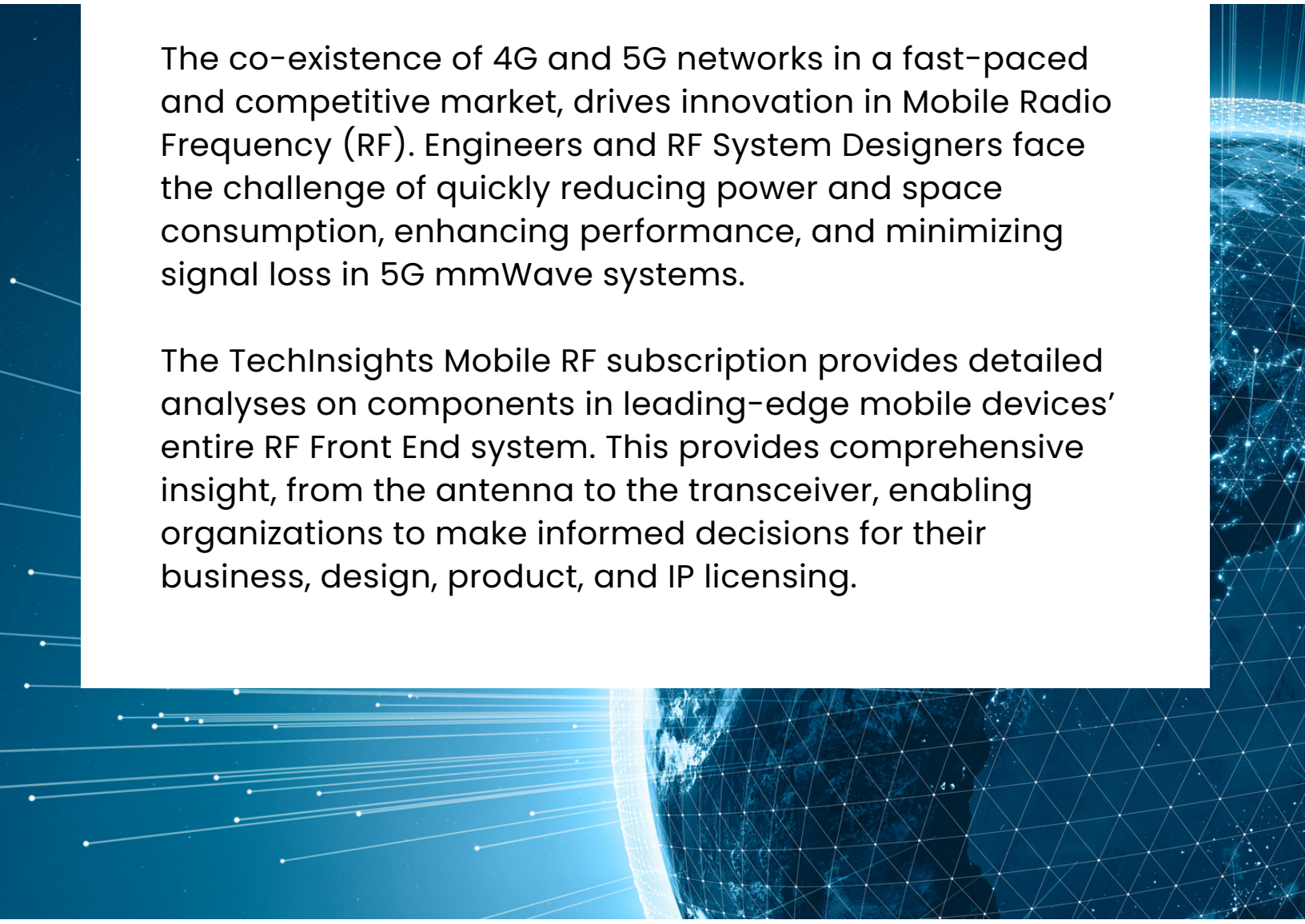
TechInsights Mobile RF Subscription

Capitalize on technology innovation to optimize RFFE design

The co-existence of 4G and 5G networks in a fast-paced and competitive market, drives innovation in Mobile Radio Frequency (RF). Engineers and RF System Designers face the challenge of quickly reducing power and space consumption, enhancing performance, and minimizing signal loss in 5G mmWave systems.

The TechInsights Mobile RF subscription provides detailed analyses on components in leading-edge mobile devices' entire RF Front End system. This provides comprehensive insight, from the antenna to the transceiver, enabling organizations to make informed decisions for their business, design, product, and IP licensing.



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Why You Need a Mobile RF Subscription

- **Get an accurate pulse of the competitive RF landscape** with visibility into the latest cutting-edge RF design approaches across market leaders and upcoming potential disruptors to ensure you stay ahead of the competition.
- **Understand the impact of disruptive technology and RFFE innovation** with insightful perspective and interpretation from our subject matter experts.
- **Make business, design, and product decisions with confidence** based on high quality analysis with unparalleled detail at the microscopic level, thanks to TechInsights' state of the art lab technology that's capable of high-quality images and analyses spanning floorplan, process, and circuit. Some 3D views of components are included as well (Figure 1).

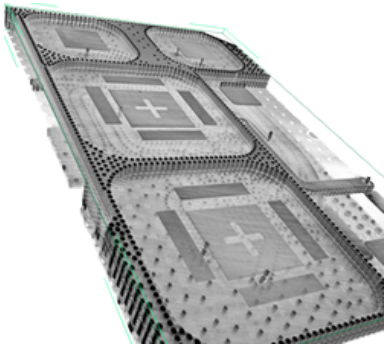


Figure 1: 3D view of an antenna-in-package.

- **Save time and costs** by extending your organization's productivity with competitive insight across a broad range of RF system on chips (SoCs) that would otherwise be cost-prohibitive to analyze internally at the same scale.

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Key Features of the Mobile RF Subscription

- **In-depth technical analysis** of a wide range of components used in RF systems of market-leading smart phones to reveal innovative design approaches of competitors (Figure 2)

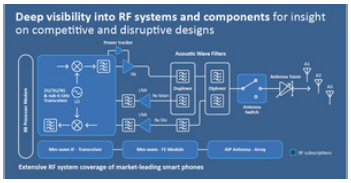


Figure 2: Components analyzed in the TechInsights Mobile RF subscription.

- **Topographical layout analysis** revealing component and die interconnections at a printed circuit board (PCB), front-end module (FEM), and integrated circuit (IC) level verified with PCB, package, and IC delayering (Figure 3), plus high-resolution imaging to provide an overview of RFFE approaches in the market.

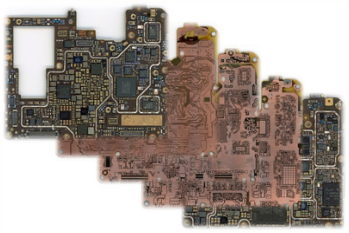


Figure 3: PCB delayering of a mobile phone.

- **Structural analysis** provides insights into materials, technology node, key feature measurements and foundry for various components in RFFE systems, such as transceivers, front end power management ICs, and acoustic filters. This analysis enables a competitive insight on RFFE ICs that impact RF system design.

- **Circuit analysis** detailing transistor level and hierarchal block interconnections for leading-edge front end module die designs including schematic-to-layout traceability through TechInsights' proprietary CircuitVision software for a granular understanding of competitors' RFIC circuit designs. This provides the ability to navigate between the transistor layout and seeing it directly in the schematic (Figure 4).

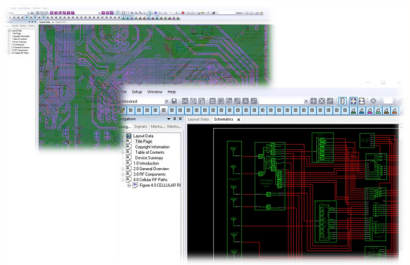


Figure 4: CircuitVision format showing the layers of a PCB with annotations.

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Key Features of the Mobile RF Subscription

- **Online briefings** presented by our subject matter experts provide trend projections, insightful commentary, and thought-provoking perspective on the cellular 5G, 5G-A, and 6G landscape to enable a thorough understanding of the current mobile RF climate.
- **Upcoming analysis** that provides visibility into innovative RF devices and parts that are flagged by our subject matter experts for future analysis to help inform your own roadmap decisions.
- **Self-serve online access** to all previous and current analyses, as well as the features above, via the TechInsights Platform, anytime, anywhere for easy access and sharing of content with other subscribers in your organization.

Why Choose TechInsights?

- Our RF block diagrams have no black boxing to provide the most comprehensive schematical representation of mobile handsets in the market.
- We provide the full picture of RFFE design approaches in market-leading smart phones with extensive system coverage that span circuit, structural, and layout/topographical analyses of RFICs.
- Our expertise and visibility into the competitive RF technology landscape enables us to quickly deliver expert-led analysis on disruptive events with market and technical impact (such as MediaTek's Dimensity 1050 and their innovative antenna in package design).
- We track and analyze innovation out of China that includes handsets such as the Huawei Mate 60 Pro (mobile RF architecture, transceivers, front end power management ICs and front end modules), foundry (e.g. SMIC), RFIC (e.g. HiSilicon, Unisoc, etc), and front end module (e.g. Maxscend, Lansus, VanChip, OnMIcro, Smarter Micro, etc).
- Our combination of top-tier experts and cutting-edge equipment maintain and enhance understanding of innovations in today's chips.
- We've made substantial investments in laboratory technology, including the Raith CHIPSCANNER for imaging at the 3nm node.
- We can achieve delayering at 3nm and beyond with appropriate sample preparation techniques.
- We've acquired a second-generation ion beam etcher (IBE) to enhance delayering capabilities for chips.
- Our transmission electron microscope (TEM) offers high-resolution viewing.
- Our TALOS TEM refines resolution and allows for clearer identification of smaller features and materials (elements).

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Product Offerings

TechInsights provides a variety of Mobile RF product offerings to suit your needs

Product Offering	IDM	Fabless	Foundry	Product Manufacturer	Capital Equipment
Comprehensive	✓	✓	✓	✓	✗
Process	✗	✗	✓	✗	✓
Front End Module	✓	✗	✗	✓	✗
Circuit	✓	✓	✗	✓	✗

Information Included	Type of Analysis	Comprehensive	Process	Front End Module	Circuit
Acoustic Wave Filter	Process	✓	✓	✓	✗
Mobile RF Architecture	Block Diagram	✓	✗	✓	✓
Front End Die Circuit	Circuit	✓	✗	✓	✓
Front End Module Architecture	Circuit	✓	✗	✓	✓
Front End Power Management Architecture	Circuit	✓	✗	✗	✓
Front End Power Management Floorplan	IC Floorplan	✓	✓	✗	✓
Transceiver Architecture	Circuit	✓	✗	✗	✓
Transceiver Floorplan	IC Floorplan	✓	✓	✗	✓
RFIC Packaging	Packaging	✓	✓	✓	✗

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Mobile RF Subscription Overview

Mobile RF Architecture

Provides the most detailed RF front end block diagrams (from the antennae to the RF transceiver) for flagship 5G handsets in the industry for an **in-depth understanding of RF front end design.** There is no black boxing, and the reports include all passives in the system, antenna tuners, filters, FEM high level layout, pin ins/pin outs, circuit board delayering, and cross-probing between the schematic and the layout of the physical printed circuit board (PCB).

Transceiver Floorplan

Provides insight into competitive designs including high level block identification, high level process data and manufacturing costs for leading-edge 5G and FR2 transceivers in flagship handsets across market leaders and disruptors.

Transceiver Architecture

Enables a better comparison and understanding of how design constraints and challenges are addressed for leading-edge 5G and FR2 transceivers. Includes and and builds on the Transceiver Floorplan content to identify key functional blocks and the connections between them.

Front End Power Management Floorplan

Focuses on power supply management, which is a key design challenge for RF Front End systems within market leading 5G handsets. Provides insight into competitive designs including high level block identification, high level process data and manufacturing costs for envelope/average power trackers and FR2 PMICs from recent 5G smartphone platforms and wearables.



Front End Power Management Floorplan Architecture

Enables a better comparison and understanding of how design constraints for power supply management are addressed. Includes and builds on the Front End Power Management Floorplan content to provide detailed block level architecture of envelope/average power trackers and FR2 PMICs.

Front End Module Architecture

Provides more insight on how leading manufacturers are shifting away from discrete components to more space-efficient solutions like power amplifier modules (PAM) and transceiver antenna modules. Shows interconnectivity of the die, filters and components from highly integrated RF Front End Modules (FEMs) found on cutting-edge designs from the latest 5G handsets.

Front End Die Circuit

Reveals how leading manufacturers are addressing space and power challenges in RF power amplifiers (PAs), low noise amplifiers (LNAs) and RF switches found on current RF Front End Modules. Extends the analysis from the Front End Module Architecture content to reveal more detailed insight at the circuit level.

Acoustic Wave Filter

Provides more insight into filter design strategies and their integration in RF front end (RFFE) SiPs to support evolving 5G demands and requirements. This content includes structural, materials, and topographical analyses of acoustic filters from highly integrated 5G RF Front End Modules and System-in-Packages (SiPs).

RFIC Packaging

Enables the comparison of various RFIC advanced packaging implementations to gain a better understanding of how they impact RF system design. This includes aspects such as DC and RF performance pertaining to module packaging, size and thermals, and heterogeneous integration. Analysis includes SEM cross-sectional and EDS materials analyses.

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