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Addressing LTE Multimode, Multiband Complexity with Comprehensive RF Solutions

3G/LTE Summit
September 14–16, 2015
Hong Kong
4G+ growth has huge implications for RF front-end design

**Number of bands**

- 2G: 3 bands
- Early 3G: 5 bands
- 3G Today: 9 bands
- Early 4G Multimode: 16 bands
- 4G Today: 49 bands
- 4G+ Combinations

4G+ drives explosive growth in bands needed in handsets

**Complexity of RF front end design grows dramatically**
Several drivers of RFFE design complexity

- More Antennas
- Smaller Antennas
- Metal Back
- RF Co-existence
- Wider Freq Range
- Freespace vs Real-use
- Industrial Designs

Faster Processors
Smaller Device Vol
Antenna Mismatch
Carrier Aggregation
Multiple Rx Chains

10 band 20 bands 30 bands 45 bands >50 Bands
700-2700MHz 600MHz-3.5GHz 75 CA Combos 180 CA Combos
10 CA Combos >250 CA Combos
700-2700M Hz 750-2700MHz
5.8 GHz

Thermal Performance
Form Factors
Bands

Design challenges demand innovative system-level solutions
Qualcomm® RF Front End Solutions
Strong Traction with OEMs

350 Commercial Designs
40 OEMs

Qualcomm RF Front End Solutions are products of Qualcomm Technologies, Inc.
Using modem intelligence to go beyond components

System-Level Solutions
A leading RF HW+SW solutions that utilizes Qualcomm® Snapdragon™ modem intelligence

Global and Regional Solutions
Network proven RFFE solutions for LTE/LTE-A across all tiers

Tools for Ease of Design
Easier design-in of sophisticated modem features with reduced time to design and acceptance
System Level RFFE Solutions
HW+SW co-design to address RF complexity

Qualcomm Snapdragon and Qualcomm RF Front End are products of Qualcomm Technologies, Inc.

Envelope Tracking
- QFE3100
- Reduced power consumption
- Improved thermal footprint
- Tools for ease of design-in

Dynamic Antenna Tuning
- QFE2550
- Fewer dropped calls, faster data
- Reduced power consumption
- Tools for ease of design-in

Multimode PA + Ant Switches
- QFE43x5, QFE4320
- Improved output power, efficiency
- Tools for ease of design-in
Video: Advanced Antenna Tuning for better RF performance
RFFE Solutions for LTE/LTE-A

**Regional LTE CA**

Region- or operator-specific CA band combinations

**Global LTE CA**

Global CA band combinations in single design

**QFE4320**: Introduced with Snapdragon 617, 430. Supports 820, 810, 808 698–915 MHz, 1710–2025 MHz LTE FDD/TDD, TD-SCDMA, DC-HSPA+, WCDMA, GSM, 1x, DO Pin compatible with QFE3320. 14-band configurable via SP16T

**QFE4345**: LTE FDD, LTE TDD, UMTS, TD-SCDMA, CDMA2000 (1710–2025 MHz)

Pin compatible with QFE3345/35 respectively

**QFE4335**: LTE FDD, UMTS, CDMA2000 (695–915 MHz)

Pin compatible with QFE3320, 14-band configurable via SP16T

**QFE4310x5**: Next-Gen PA + Switch 898–915 MHz, 1710–2025 MHz LTE FDD/TDD, TD-SCDMA, DC-HSPA+, WCDMA, GSM, 1x, DO Pin compatible with QFE3320, 14-band configurable via SP16T

**QFE4345**: Next-Gen PA 898–915 MHz, 1710–2025 MHz LTE FDD, UMTS, TD-SCDMA, CDMA2000 (1710–2025 MHz) Pin compatible with QFE3345/35 respectively

**QFE4335**: Next-Gen PA 898–915 MHz, 1710–2025 MHz LTE FDD, UMTS, CDMA2000 (695–915 MHz) Pin compatible with QFE3320, 14-band configurable via SP16T
RF system level tools for ease of design

**Accelerate RFFE development**  
**Reduce Time to Market**

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<th><strong>Design Tools</strong></th>
<th><strong>Evaluation Tools</strong></th>
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<td><strong>Antenna Related Tools</strong></td>
<td><strong>In-phone remote/wireless test</strong> for tuning and optimization of antenna/tuner design over WLAN</td>
<td><strong>In-phone network analyzer Android app</strong> to show antenna impedance conditions in real-time</td>
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<td>Automation tool to tune antenna performance across frequency and bands</td>
<td><strong>Standalone PA characterization in ET mode</strong> with off-the-shelf test equipment</td>
<td>AutoPin to significantly reduce PA CHAR time and minimize total design-in time</td>
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<tr>
<td><strong>Envelope Tracker + PA Tools</strong></td>
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<td>Automation tool to tune PAs for optimal ET performance</td>
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Accelerate RFFE development  
Reduce Time to Market
Qualcomm® RF Transceiver Products
Comprehensive suite of RF transceivers

**WTR 3925**
World’s 1st commercial single-chip RF transceiver supporting CA in all 3GPP band combinations

**WTR 2965**
Global CA transceiver for mid-/entry-level tiers

**WTR 4905**
Multimode RF transceiver optimized for the volume tier

**WTR 3950**
World’s 1st dedicated commercial transceiver for LTE-U operation and carrier aggregation in unlicensed 5GHz bands

Announced with Snapdragon 617 and 430 this week

See LTE-U Demo this week
World’s first commercial LTE-U 5GHz transceiver

**WTR 3950**

**LTE-U with 2DL-CA**
40MHz Carrier Aggregation of Licensed + Unlicensed Band Carriers
*60MHz with two contiguous unlicensed

**LTE-U with 3DL-CA**
60MHz Carrier Aggregation of Licensed + Unlicensed Band Carriers

The WTR3950 commercial sales become available from Sep 11.
Global CA transceiver for mid/entry-level tiers

WTR 2965

- Low cost global 2xCA transceiver
- Scalable across 4G+/4G/3G/2G
- Superior power efficiency
- Supports all 3GPP bands
- Integrated GPS/GLONASS/Beidou/Galileo core
- Snapdragon 620, 618, 617
Using modem intelligence to go beyond components

**System-Level Solutions**
A leading RF HW+SW solutions that utilizes Snapdragon modem intelligence

**Global and Regional Solutions**
Network proven RFFE solutions for LTE/LTE-A across all tiers

**Tools for Ease of Design**
Easy design-in of sophisticated modem features with reduced time to design and acceptance
Thank you

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Qualcomm® Antenna Tuning benefits the whole ecosystem

QFE2550 – Advanced Closed Loop Antenna Matching Tuner

**OEMs**

Better RF performance in real use conditions

- Sleeker phones, metal-back designs
- Easier antenna design, shorter design cycle
- Lower power consumption, longer battery life
- Fewer dropped calls, faster data
- Extend antenna frequency range
- Allow lower band (600MHz) in industrial designs

**Operators**

Deliver better quality of service

- Better network coverage
- Faster data speeds

**Users**

More bars in more places

- Fewer dropped calls and faster data
- Longer battery life
- Sleeker, better looking devices