

Redefining Filter Performance

Advanced NoDrift™ & LowDrift™ Filter Solutions from Qorvo®



qorvo
all around you

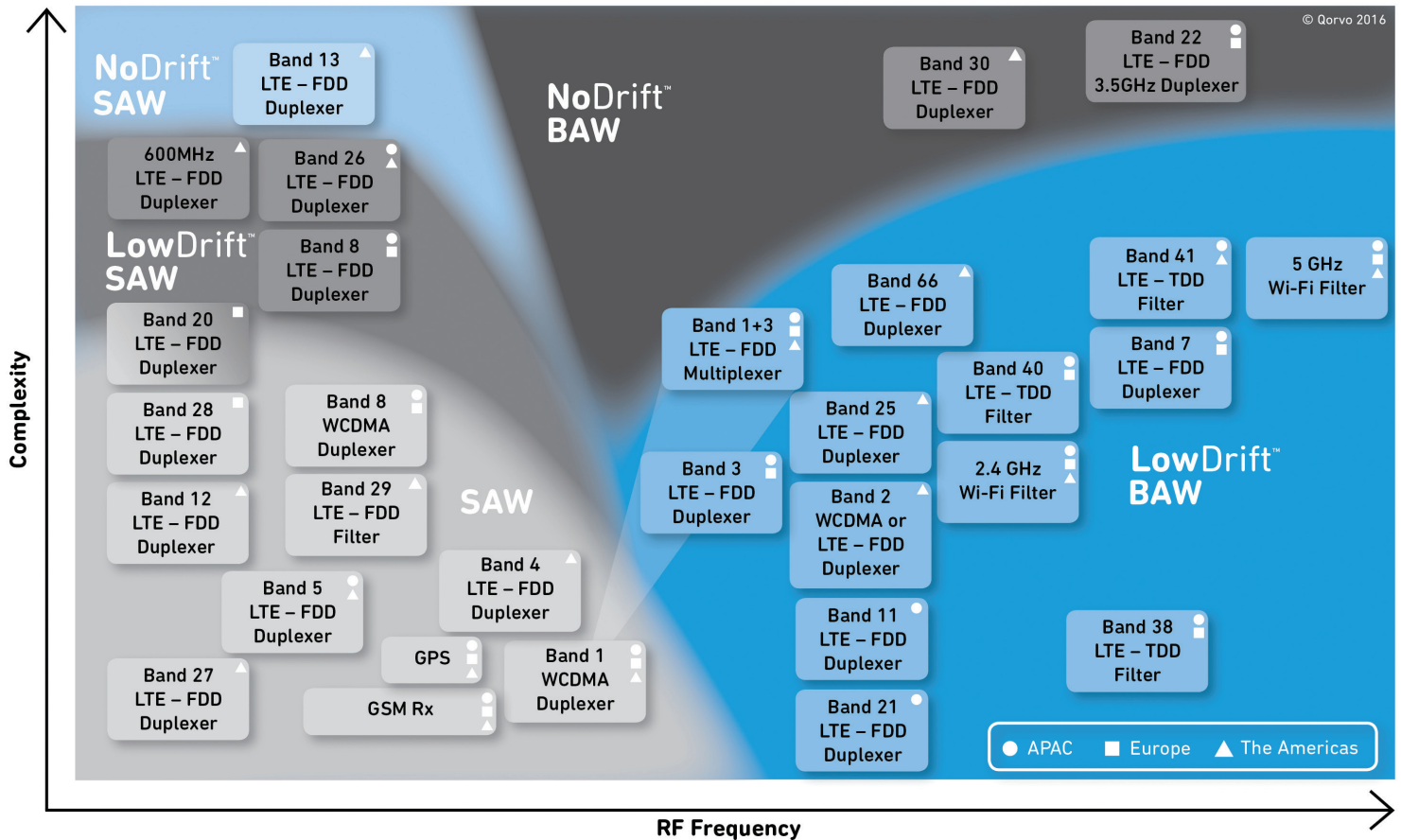
Tackling the Industry's Toughest Interference Challenges

Solving complex LTE interference challenges is a key design consideration for next-gen smartphones, as the information provided below makes clear. With every model you create, you need to develop multiple platforms tailored for different regions, and then factor in global roaming, too. The average number of bands in a smartphone has more than doubled in the last few years and will double again over the next two years. As band counts rise and higher filter performance is required, Qorvo is leveraging its advanced filter technologies, such as NoDrift and LowDrift BAW and SAW, to help you tackle the industry's toughest interference problems.

Key Frequency Bands

Operating Band	Uplink (UL Operating Band) Base Station (BS) Receive User Equipment (UE) Transmit			Downlink (UL Operating Band) Base Station (BS) Transmit User Equipment (UE) Receive			Duplex Mode	LTE Bandwidths	Region(s) of Usage
	FDL_Low	-	FDL_High	FDL_Low	-	FDL_High			
1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD	5, 10, 15, 20	EMEA, Asia, Japan
2	1850 MHz	-	1910 MHz	1930 MHz	-	1990 MHz	FDD	1.4, 3, 5, 10, 15, 20	North America, Canada, Latin America
3	1710 MHz	-	1785 MHz	1805 MHz	-	1880 MHz	FDD	1.4, 3, 5, 10, 15, 20	Europe
4	1710 MHz	-	1755 MHz	2110 MHz	-	2155 MHz	FDD	1.4, 3, 5, 10, 15, 20	North America, Canada, Latin America
5	824 MHz	-	849 MHz	869 MHz	-	894 MHz	FDD	1.4, 3, 5, 10	North America, Canada, Latin America, Australia
7	2500 MHz	-	2570 MHz	2620 MHz	-	2690 MHz	FDD	5, 10, 15, 20	Europe
8	880 MHz	-	915 MHz	925 MHz	-	960 MHz	FDD	1.4, 3, 5, 10	Europe, Latin America
9	1749.9 MHz	-	1784.9 MHz	1844.9 MHz	-	1879.9 MHz	FDD	5, 10, 15, 20	Japan
10	1710 MHz	-	1770 MHz	2110 MHz	-	2170 MHz	FDD	5, 10, 15, 20	-
11	1427.9 MHz	-	1447.9 MHz	1475.9 MHz	-	1495.9 MHz	FDD	5, 10	Japan
12	698 MHz	-	716 MHz	728 MHz	-	746 MHz	FDD	1.4, 3, 5, 10	North America
13	777 MHz	-	787 MHz	746 MHz	-	756 MHz	FDD	5, 10	North America
14	788 MHz	-	798 MHz	758 MHz	-	768 MHz	FDD	5, 10	North America
17	704 MHz	-	716 MHz	734 MHz	-	746 MHz	FDD	5, 10	North America
18	815 MHz	-	830 MHz	860 MHz	-	875 MHz	FDD	5, 10, 15	Japan
19	830 MHz	-	845 MHz	875 MHz	-	890 MHz	FDD	5, 10, 15	Japan
20	832 MHz	-	862 MHz	791 MHz	-	821 MHz	FDD	5, 10, 15, 20	Europe
21	1447.9 MHz	-	1462.9 MHz	1495.9 MHz	-	1510.9 MHz	FDD	5, 10, 15	-
22	3410 MHz	-	3490 MHz	3510 MHz	-	3590 MHz	FDD	5, 10, 15, 20	-
24	1626.5 MHz	-	1660.5 MHz	1525 MHz	-	1559 MHz	FDD	5, 10	North America
25	1850 MHz	-	1915 MHz	1930 MHz	-	1995 MHz	FDD	1.4, 3, 5, 10, 15, 20	North America
26	814 MHz	-	849 MHz	859 MHz	-	894 MHz	FDD	1.4, 3, 5, 10, 15	Japan, North America
27	807 MHz	-	824 MHz	852 MHz	-	869 MHz	FDD	1.4, 3, 5, 10	Latin America
28	703 MHz	-	748 MHz	758 MHz	-	803 MHz	FDD	3, 5, 10, 15, 20	APAC, Latin America
29	N/A	-	N/A	717 MHz	-	728 MHz	FDD	3, 5, 10	North America
30	2305 MHz	-	2315 MHz	2350 MHz	-	2360 MHz	FDD	5, 10	North America
31	452.5 MHz	-	457.5 MHz	462.5 MHz	-	467.5 MHz	FDD	1.4, 3, 5	Brazil
32	N/A	-	N/A	1452 MHz	-	1496 MHz	FDD	5, 10, 15, 20	Japan, EMEA
65	1920 MHz	-	2010 MHz	2110 MHz	-	2200 MHz	FDD	5, 10, 15, 20	Europe, Japan, Korea
66	1710 MHz	-	1780 MHz	2110 MHz	-	2200 MHz	FDD	1.4, 3, 5, 10, 15, 20	North America
67	N/A	-	N/A	738 MHz	-	758 MHz	FDD	5, 10, 15, 20	Europe
68	698 MHz	-	728 MHz	753 MHz	-	783 MHz	FDD	5, 10, 15	Middle East
69	N/A	-	N/A	2570 MHz	-	2620 MHz	FDD	5, 10, 15, 20	Europe
70	1695 MHz	-	1710 MHz	1995 MHz	-	2020 MHz	FDD	5, 10, 15, 20	North America
33	1900 MHz	-	1920 MHz	1900 MHz	-	1920 MHz	TDD	5, 10, 15, 20	-
34	2010 MHz	-	2025 MHz	2010 MHz	-	2025 MHz	TDD	5, 10, 15	China
35	1850 MHz	-	1910 MHz	1850 MHz	-	1910 MHz	TDD	1.4, 3, 5, 10, 15, 20	-
36	1930 MHz	-	1990 MHz	1930 MHz	-	1990 MHz	TDD	1.4, 3, 5, 10, 15, 20	-
37	1910 MHz	-	1930 MHz	1910 MHz	-	1930 MHz	TDD	5, 10, 15, 20	-
38	2570 MHz	-	2620 MHz	2570 MHz	-	2620 MHz	TDD	5, 10, 15, 20	Asia, EMEA
39	1880 MHz	-	1920 MHz	1880 MHz	-	1920 MHz	TDD	5, 10, 15, 20	China
40	2300 MHz	-	2400 MHz	2300 MHz	-	2400 MHz	TDD	5, 10, 15, 20	China, Others
41	2496 MHz	-	2690 MHz	2496 MHz	-	2690 MHz	TDD	5, 10, 15, 20	North America, China
42	3400 MHz	-	3600 MHz	3400 MHz	-	3600 MHz	TDD	5, 10, 15, 20	Japan, EMEA
43	3600 MHz	-	3800 MHz	3600 MHz	-	3800 MHz	TDD	5, 10, 15, 20	APAC, EMEA
44	703 MHz	-	803 MHz	703 MHz	-	803 MHz	TDD	3, 5, 10, 15, 20	APAC
45	1447 MHz	-	1467 MHz	1447 MHz	-	1467 MHz	TDD	5, 10, 15, 20	China
46	5150 MHz	-	5925 MHz	5150 MHz	-	5925 MHz	TDD	20	Worldwide
47	5855 MHz	-	5925 MHz	5855 MHz	-	5925 MHz	TDD	10, 20	North America, Europe
48	3550 MHz	-	3700 MHz	3550 MHz	-	3700 MHz	TDD	5, 10, 15, 20	North America
XGP	2545 MHz	-	2575 MHz	2545 MHz	-	2575 MHz	TDD	-	Japan

Leveraging Advanced Filter Technology for Regional Demands

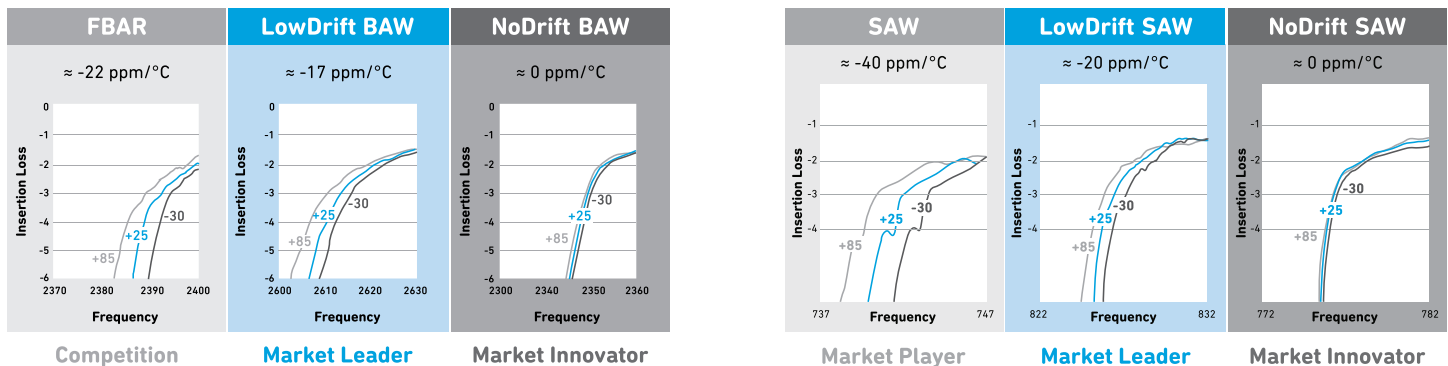


Delivering Breakthrough Filter Performance

Qorvo's LowDrift and NoDrift filter technologies enable system designers to solve coexistence problems which are unaddressed by any other technology. As more LTE bands are squeezed into the crowded global RF spectrum, the space between bands is shrinking. In some cases, the transition between the passband and stop-band is as small as 2 MHz, which makes it almost impossible to meet requirements using traditional filter technologies. That's because the variation in filter response, which is dominated by temperature drift, can exceed the width of the transition band itself. The result is unacceptable interference, high insertion loss, or both.

Qorvo's new advanced LowDrift and NoDrift technologies deliver SAW and BAW filters with dramatically reduced temperature sensitivity for some of today's most challenging interference specifications. They combine low insertion loss with extremely precise selectivity. Using temperature-compensated filters, operators and manufacturers can deliver higher speeds and greater bandwidth by utilizing spectrum that might be lost with traditional filtering technologies.

Qorvo's Filter Technology Reduces TCF (Temperature Coefficient of Frequency) Beyond the Competition



Carrier aggregation creates a complex scenario of multiple bands transmitting and receiving signals simultaneously. Multiplexers provide an elegant solution by integrating all the filters required for multiple aggregated bands into one package. While at the same time providing isolation between bands and concurrently connecting them to the antenna.

Multiplexer Solutions

Bands	Part #	Description	Filter Technology	Size (mm)	Features
Band 1 and 3	QM25005A	Tx/Rx FDD Multiplexer	LowDrift BAW	3.0x2.0x0.73	Enables CA for APAC and EU Regions
Band 1 and 3	QM25002	Tx/Rx FDD Multiplexer	LowDrift BAW	2.5x2.0x0.73	Enables CA for APAC and EU Regions
Band 25 and 66	QM25008	Tx/Rx FDD Multiplexer	LowDrift BAW	2.5x2.0x0.73	Enables CA for North America
Bands 39 and 41Narrow	QM25011	Tx/Rx TDD Multiplexer	LowDrift BAW	1.7x1.3x0.6	Enables CA for APAC Region
Bands 39 and 41Narrow	QM25012	DRx TDD Multiplexer	LowDrift BAW	1.5x1.1x0.6	Enables CA for APAC Region

Filter and Duplexer Solutions

Bands	Part #	Description	Filter Technology	Size (mm)	Features
Band 2	QM23002	LTE SE/SE Duplexer	LowDrift BAW	1.8x1.4x0.73	Performance Optimized for Insertion Loss and Isolation
Band 3	TQQ1003	LTE SE/SE Duplexer	LowDrift BAW	1.8x1.4x0.73	Performance Optimized for Insertion Loss and Isolation
Band 3	QM23003	LTE SE/SE Duplexer	LowDrift BAW	1.8x1.4x0.73	Performance Optimized for Insertion Loss and Isolation
Band 7	TQQ1007	LTE SE/SE Duplexer	LowDrift BAW	1.8x1.4x0.73	Performance Optimized for Insertion Loss and Isolation
Band 7	QM23007	LTE SE/SE Duplexer	LowDrift BAW	1.8x1.4x0.73	Performance Optimized for Insertion Loss and Isolation
Band 13	TQQ1013	LTE SE/SE Duplexer	NoDrift SAW	2.5x2.0x0.9	Solution for Public Safety NS_07 Requirements
Band 25 (BC14)	TQM963014	LTE SE/SE Duplexer	LowDrift BAW	2.6x2.1x0.9	Excellent Triple Beat Performance
Band 30	TQQ1030	LTE SE/SE Duplexer	NoDrift BAW	1.8x1.4x0.73	Meets NS_21 Requirements
Band 38	885026	LTE B38 Tx/Rx Filter	LowDrift BAW	1.4x1.2x0.5	40 dB Min Wi-Fi Rejection to Enable Wi-Fi Coexistence
Band 38 and 40	885043	LTE B38/40 Tx Filter	LowDrift BAW	1.7x1.3x0.5	2-in-1 Filter for Full Band 40 Coverage with Low Loss
Band 40	885049	LTE B40 Tx/Rx Filter	LowDrift BAW	1.4x1.2x0.5	Tx or Rx B40 Filter
Band 40	885075	LTE B40 Tx Filter	LowDrift BAW	1.1x0.9x0.52	B40 Next Generation, Smaller, Better Performance
Band 41	TQQ0041T	LTE B41 SE Tx Filter	LowDrift BAW	1.8x1.4x0.73	Industry's Smallest Band 41W Filter
Band 41	TQQ0041E	LTE B41 SE Tx Filter	LowDrift BAW	2.0x1.6x0.73	Performance Optimized to Meet PC2 Requirements, High Power Handling
Band 41	TQQ0041	LTE B41 Rx Filter	LowDrift BAW	2.0x2.0x0.8	Low IL and High Wi-Fi Attenuation

Q Advantages Using BAW for Multiplexers

BAW devices have a unique advantage over SAW technology in complex multiplexer designs. As you move above the passband, SAW devices suffer from substantial losses due to radiation of acoustic energy into the bulk of the substrate. With the loading of each filter in a complex multiplexer design, the effect of radiation of acoustic energy increases. BAW technology has an intrinsic performance advantage over SAW for these designs, because the SAW bulk radiation acoustic energy is larger than BAW in the upper frequency spectrum. In the below figure as you move up (to the right) in frequency you can see BAW is the best choice for multiplexer filter designs due to this bulk radiation loss effect.

BAW vs. SAW

