



**SKYWORKS®**

**| Small Cell Solutions**



# Introduction to Small Cells

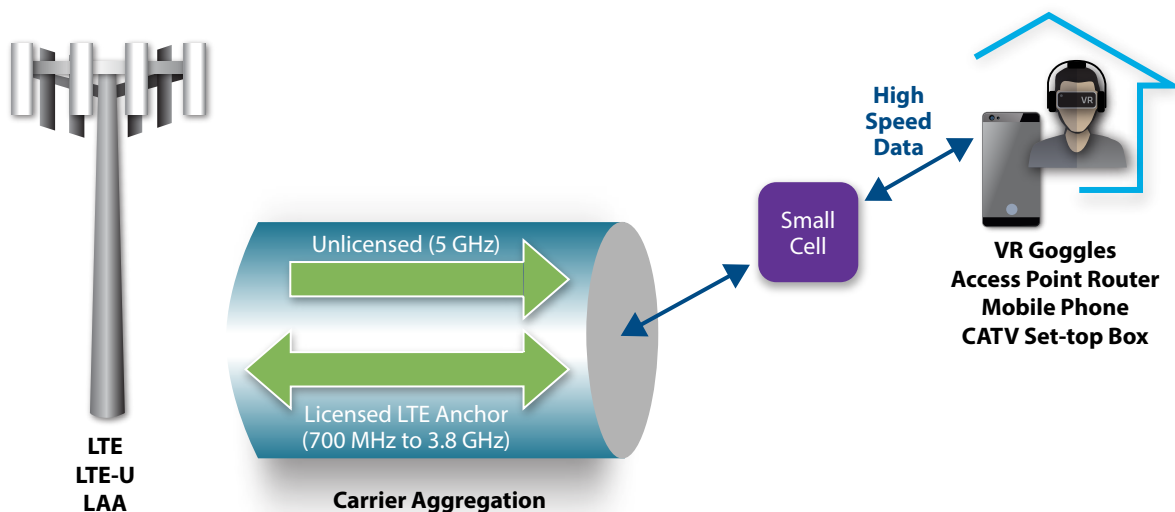
Simply put, small cells are low-cost, easy to deploy low-power radio access nodes that operate in both licensed and unlicensed spectrums and have a typical range of 10 to several hundred meters. With data consumption increasing exponentially across multiple platforms, small cells offer a viable solution for cellular and wireless network providers to cost effectively fulfill increasing data capacity requirements. Small cells essentially bring the network much closer to end users for a better wireless experience.

## Key Applications

The most common use for small cells is in enterprise indoor applications such as offices as well as outdoor spaces such as shopping malls or public venues, where small cells are needed to meet data capacity demands. Small cells are also used to enable Citizens Band Radio Service (Band 48), which was recently established by the FCC for shared wireless broadband use of the 3.5 to 3.7 GHz band. When deployed using small cells, the 3.5 GHz CBRS technology provides mobile operators a way to supplement the coverage and capacity of their licensed services and increase throughput data rates to customers.

## Power Amplifier's Role in the Challenges Facing Small Cells

In a small cell, everything comes down to heat. Power amplifiers (PAs) are used to enhance signal strength and improve the network connection, thereby enhancing data transmission. They are also one of the largest contributors to power consumption and, in turn, impact how much heat is generated by the small box. If PAs consume a lot of power, a fan, along with more metal, are required to dissipate the heat. This increases cost. It also means that very few bands can be supported in the same box. Power-efficient PAs transmit high power RF while consuming less power. By removing the heat, they make it possible to have multiple bands in one box and drive down operating costs – critical factors that make PAs a key enabler of small cell deployment.



**Small Cell Block Diagram**

Small cells enable density within the wireless network and increase data rates to users.

## Key Parameters and Features When Selecting a Power Amplifier for a Small Cell

Power amplifiers are designed with different features and characteristics that enable their use in a range of applications. That is why selecting the correct PA is such a critical task. If designers do not take the time to pick the right one for their application, they may end up negatively impacting the small cells overall cost and/or performance. Here are some key parameters and features to look for when selecting a PA for a small cell:

- **High-Efficiency:** Selecting a power-efficient PA will ensure it is suitable for Power-over-Ethernet (PoE) applications. It will also result in higher overall system efficiency. For comparison purposes, traditional linear PAs offer roughly 8 to 10 percent power-added efficiency (PAE), while a power-efficient PA would average 35 to 40 percent PAE.
- **Low Operating Cost:** Selecting a PA that can lower operating cost is always advantageous. One area where cost can be eliminated is in the heatsink. Power-efficient PAs require less heatsink metal and eliminate the need for fans, both of which reduce costs. Other cost savings can come from selecting a PA suitable for PoE applications. Using PoE eliminates the need to drill in or add more cabling to power the small cell, significantly lowering operating cost.
- **Better Reliability:** As the functionality and integration of system components into smaller and smaller spaces continue to progress, the requirement for higher efficiency PAs becomes more apparent. Higher PA efficiency means lower power dissipation, thus lowering the system operating temperature and improving the overall system reliability.
- **High-Gain:** High-gain PAs improve overall system efficiency by being able to connect directly to the transceiver without having to add a pre-driver PA, which alone could consume 50 to 80 mA of current. By eliminating that block, the high-gain PA reduces power from the driver, increasing system efficiency and driving down cost.
- **Band Coverage:** There are many prevalent bands, so selecting a PA that covers the majority is a better bet, particularly one that addresses the 700 MHz to 6 GHz range. Here again, power efficiency is critical, as it enables multiple bands and carriers to be supported in one small cell. Hence, selecting PAs with the capability to support wide instantaneous bandwidth has become significantly more important as the ever-increasing demand for high speed data continues to rise.
- **Pin-to-Pin Compatibility:** Selecting a PA from a family of PAs that are all pin-to-pin compatible and have a footprint universal to all the bands the family supports (e.g. from 700 MHz to 6 GHz) can be very attractive. It allows the designer to simply copy the footprint when they are designing the PC board. Even the external bill of materials is identical because all of the key circuitry is included inside the PA multi-chip module (MCM).



**Meeting the  
Growing Demand  
for Connectivity –  
Anytime, Anywhere**

# Power Amplifiers by 3GPP Bands

## | The Right Design Choice Starts Here

We invite you to review our small cell product offerings from our broad portfolio. Full product specifications are available starting on page 7 in the order shown on the table below.

**NEW** products (purple, bold) are continually being introduced at Skyworks. For the latest information, please visit the New Products section of our website at [www.skyworksinc.com](http://www.skyworksinc.com).

**Coming Soon** products (orange, bold) indicates products that will be available soon for purchase.

### Linear Power Amplifiers, 19 dBm Output Power

3GPP Band	1	2	3	4	5	6	7	8	9	10	12	13	14	17	18	19	20	25	26	27	28	33	34	35	36	37	38	39	40	41	42	43	46	48	66		
SKY66001-11	■			■						■																											
SKY66002-11		■																■					■			■											
SKY66005-11					■	■	■									■	■			■	■																
SKY66008-11																																					
SKY66013-11												■	■	■	■	■																					

### Linear Power Amplifiers, 23 dBm Output Power

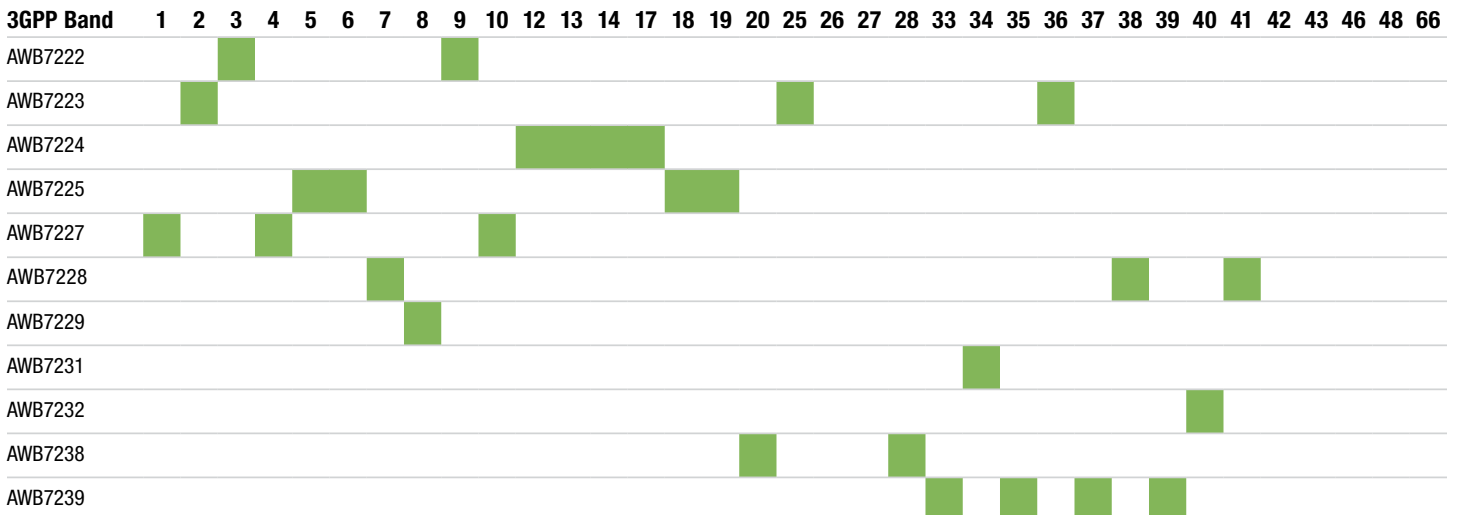
3GPP Band	1	2	3	4	5	6	7	8	9	10	12	13	14	17	18	19	20	25	26	27	28	33	34	35	36	37	38	39	40	41	42	43	46	48	66			
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### Linear Power Amplifiers, 24.5 dBm Output Power

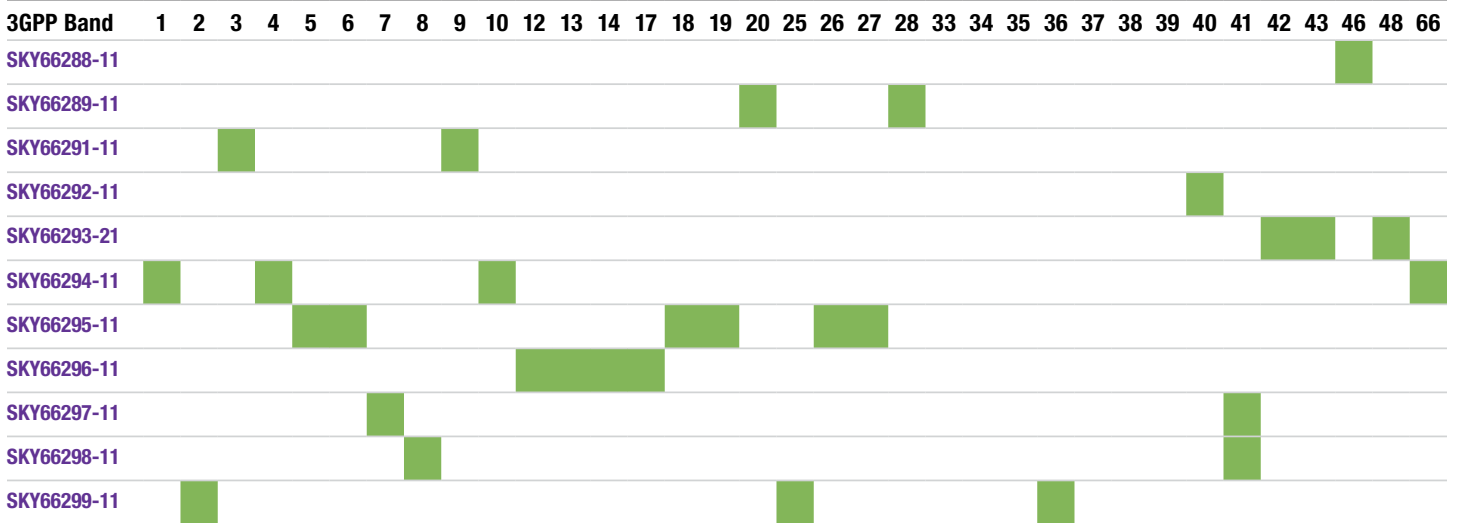
3GPP Band	1	2	3	4	5	6	7	8	9	10	12	13	14	17	18	19	20	25	26	27	28	33	34	35	36	37	38	39	40	41	42	43	46	48	66			
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AWB7138																			■																			

# Power Amplifiers by 3GPP Bands

## Linear Power Amplifiers, 27 dBm Output Power



## High Efficiency DPD-Friendly Power Amplifiers, 28 dBm Output Power



## Reference Designs

Skyworks' family of small cell power amplifiers has been leveraged by Analog Devices (SoC #AD9375) and other Tier 1 and Tier 2 SoC partners for their reference designs\*. When combined with our partners' platforms, this suite of solutions meet today's high efficiency and performance requirements for indoor and outdoor small cells.

\*Other Tier 1 and Tier 2 SoC reference design information available under signed Non-Disclosure Agreement. For more information, please contact [sales@skyworksinc.com](mailto:sales@skyworksinc.com).

# Product Specifications

Specification tables for products in this brochure are provided on the following pages. For a complete list of our newest products, please visit the New Products section of our website at [www.skyworksinc.com](http://www.skyworksinc.com).

## Linear Power Amplifiers, 19 dBm Output Power

Part Number	Frequency (GHz)	Typ. Gain (dB)	OIP3 (dBm)	P <sub>1dB</sub> (dBm)	V <sub>DD</sub> (V)	Typ. Quiescent Current (mA)	Package (mm)
SKY66001-11	2.10–2.20	30	40	–	4.2	57	10-pin MCM 3 x 3 x 0.9
SKY66002-11	1.9–2.025	30	40	–	4.2	60	10-pin MCM 3 x 3 x 0.9
SKY66005-11	0.85–0.92	30	40	–	4.2	46	10-pin MCM 3 x 3 x 0.9
SKY66008-11	0.90–0.99	30	40	–	4.2	48	10-pin MCM 3 x 3 x 0.9
SKY66013-11	0.7–0.8	27.5	40	–	4.2	46	10-pin MCM 3 x 3 x 0.9

## Linear Power Amplifiers, 23 dBm Output Power

Part Number	Frequency (GHz)	Typ. Gain (dB)	OIP3 (dBm)	P <sub>1dB</sub> (dBm)	V <sub>DD</sub> (V)	Typ. Quiescent Current (mA)	Package (mm)
<b>SKY66181-11</b>	1.805–1.88	39	–	31	3.3	360	28-pin MCM 5 x 5 x 1.25
SKY66184-11	2.1–2.2	39	–	31	3.3	400	28-pin MCM 5 x 5 x 1.25
SKY66185-11	0.85–0.9	36.5	–	30	3.3	130	28-pin MCM 5 x 5 x 1.25
SKY66186-11	0.728–0.768	37	–	31	3.3	125	28-pin MCM 5 x 5 x 1.25
<b>SKY66188-11</b>	0.758–0.803	37	–	31	3.3	155	28-pin MCM 5 x 5 x 1.25
<b>SKY66189-11</b>	1.930–1.995	40	–	31	3.3	370	28-pin MCM 5 x 5 x 1.25

## Linear Power Amplifiers, 24.5 dBm Output Power

Part Number	Frequency (GHz)	Typ. Gain (dB)	Power Added Efficiency (%)	Supply Voltage (V)	Package (mm)
AWB7122	1.805–1.880	30	16	4.2	14-pin SMT 7 x 7 x 1.3
AWB7123	1.93–1.99	32	18	4.2	14-pin SMT 7 x 7 x 1.3
AWB7124	0.728–0.768	30	14.5	4.2	14-pin SMT 7 x 7 x 1.3
AWB7125	0.860–0.894	30	16	4.2	14-pin SMT 7 x 7 x 1.3

# Product Specifications

## Linear Power Amplifiers, 24.5 dBm Output Power

Part Number	Frequency (GHz)	Typ. Gain (dB)	Power Added Efficiency (%)	Supply Voltage (V)	Package (mm)
AWB7127	2.11–2.17	32	18	4.2	14-pin SMT 7 x 7 x 1.3
AWB7128	2.545–2.69	28	16	4.2	14-pin SMT 7 x 7 x 1.3
AWB7129	0.925–0.960	30	16	4.2	14-pin SMT 7 x 7 x 1.3
AWB7132	2.3–2.4	28	16	4.2	14-pin SMT 7 x 7 x 1.3
AWB7138	0.791–0.821	30	15	4.2	14-pin SMT 7 x 7 x 1.3

## Linear Power Amplifiers, 27 dBm Output Power

Part Number	Frequency (GHz)	Typ. Gain (dB)	Power Added Efficiency (%)	Supply Voltage (V)	Package (mm)
AWB7222	1.805–1.880	32	14	4.5	14-pin SMT 7 x 7 x 1.3
AWB7223	1.93–1.995	29	14	4.5	14-pin SMT 7 x 7 x 1.3
AWB7224	0.728–0.768	29	13	4.5	14-pin SMT 7 x 7 x 1.3
AWB7225	0.860–0.894	29.5	14	4.5	14-pin SMT 7 x 7 x 1.3
AWB7227	2.11–2.17	29	14	4.5	14-pin SMT 7 x 7 x 1.3
AWB7228	2.496–2.69	28	14	4.5	14-pin SMT 7 x 7 x 1.3
AWB7229	0.925–0.960	29	14	4.5	14-pin SMT 7 x 7 x 1.3
AWB7231	2.01–2.025	29	14	4.8	14-pin SMT 7 x 7 x 1.3
AWB7232	2.3–2.4	29	15	4.5	14-pin SMT 7 x 7 x 1.3
AWB7238	0.791–2.821	30	14	4.5	14-pin SMT 7 x 7 x 1.3
AWB7239	1.850–1.930	30	14	4.5	14-pin SMT 7 x 7 x 1.3



# Product Specifications

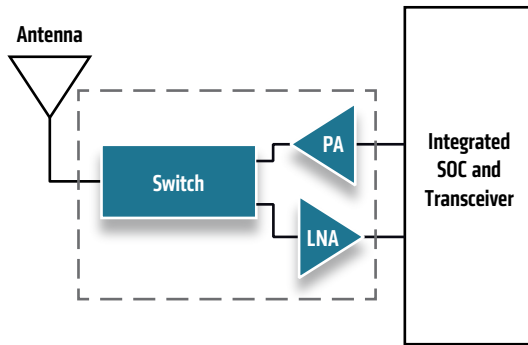
## High Efficiency DPD-Friendly Power Amplifiers, 28 dBm Output Power

Part Number	Frequency (GHz)	Typ. Gain (dB)	Power Added Efficiency (%)	V <sub>DD</sub> (V)	Typ. Quiescent Current (mA)	Package (mm)
SKY66288-11	5.150–5.925	>30	20–25	5	–	16-pin MCM 5 x 5 x 1.3
SKY66289-11	0.791–0.821	36.1	35.5	5	70	16-pin MCM 5 x 5 x 1.3
SKY66291-11	1.8–1.88	37.5	36.5	5	80	16-pin MCM 5 x 5 x 1.3
SKY66292-11	2.3–2.4	35.5	36.5	5	70	16-pin MCM 5 x 5 x 1.3
SKY66293-21	3.4–3.8	33.5	29	5	85	16-pin MCM 5 x 5 x 1.3
SKY66294-11	2.1–2.2	36	37	5	75	16-pin MCM 5 x 5 x 1.3
SKY66295-11	0.8–0.9	34.5	42	5	70	16-pin MCM 5 x 5 x 1.3
SKY66296-11	0.7–0.8	35.5	43	5	70	16-pin MCM 5 x 5 x 1.3
SKY66297-11	2.49–2.69	32.5	36	5	85	16-pin MCM 5 x 5 x 1.3
SKY66298-11	0.9–0.99	34	40	5	86	16-pin MCM 5 x 5 x 1.3
SKY66299-11	1.9–2.0	36	35	5	80	16-pin MCM 5 x 5 x 1.3

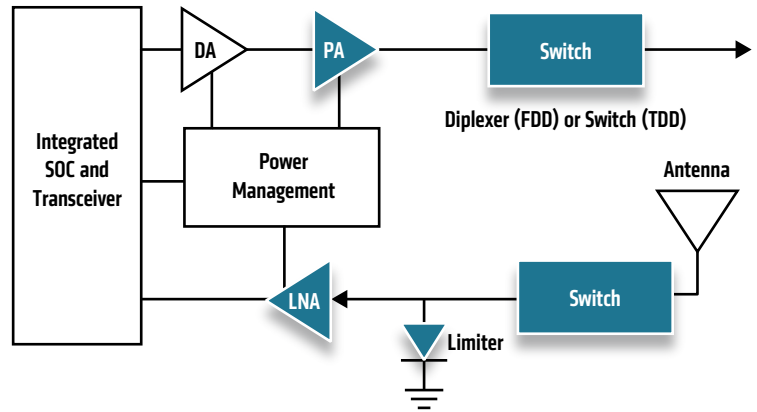
# Related Products

Take advantage of our broad portfolio of solutions by exploring products related to our highly innovative small cell amplifiers.

## Wi-Fi Connectivity



## Small Cell Base Station (19 / 24 dBm Output Power)



### Linear Power Amplifiers, 19 dBm Output Power

Power Amplifier	Limiter Module	Low Noise Amplifier	Switches
SKY66001-11			
SKY66002-11			
SKY66005-11	SKY16601-555LF	SKY67159-396LF	SKY13522-644LF
SKY66008-11	SKY16602-632LF		
SKY66013-11			

### Linear Power Amplifiers, 23 dBm Output Power

Power Amplifier	Limiter Module	Low Noise Amplifier	Switches
SKY66184-11		SKY67159-396LF	
<b>SKY66189-11</b>		SKY67153-396LF	
<b>SKY66181-11</b>	SKY16601-555LF		SKY13522-644LF
<b>SKY66188-11</b>	SKY16602-632LF	SKY67150-396LF	SKY13374-397LF
SKY66185-11		SKY67159-396LF	
SKY66186-11		SKY67153-396LF	

### Linear Power Amplifiers, 24.5 dBm Output Power

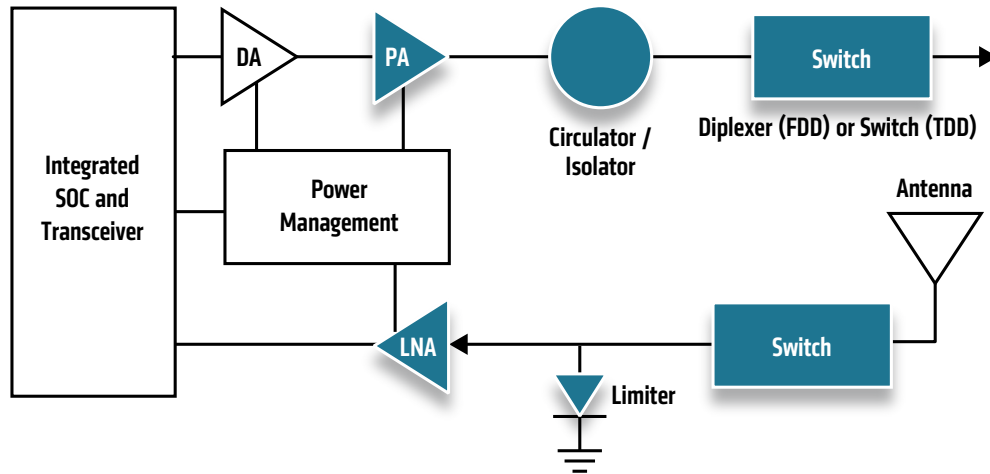
Power Amplifier	Limiter Module	Low Noise Amplifier	Switches
AWB7128			
AWB7132			
AWB7127		SKY67159-396LF SKY67153-396LF	
AWB7123	SKY16601-555LF		SKY13522-644LF
AWB7122	SKY16602-632LF		SKY13374-397LF
AWB7129		SKY67159-396LF SKY67150-396LF	
AWB7125		SKY67153-396LF	
AWB7138			
AWB7124			

### Wi-Fi Connectivity Power Amplifier Modules

Power Amplifier	Rx Modules
SKY85405-11	SKY85605-11
SKY85408-11	SKY85605-11

# Related Products

Small Cell Base Station (27 / 28 dBm Output Power)



## Linear Power Amplifiers, 27 dBm Output Power

Power Amplifier	Circulator	Isolator	Limiter Module	Driver Amplifier	Low Noise Amplifier	Switches
AWB7228	SKYFR-001461	<b>SKYFR-001460</b>		SKY65162-70LF		SKY13522-644LF
AWB7232	SKYFR-001390	<b>SKYFR-001439</b>		SKY65162-70LF		SKY13523-639LF
AWB7227	SKYFR-001390	<b>SKYFR-001439</b>				
AWB7231						SKY13524-639LF
AWB7223	SKYFR-001388	<b>SKYFR-001437</b>	SKY16601-555LF SKY16602-632LF		SKY67159-396LF SKY67150-396LF SKY67153-396LF	
AWB7239				SKY65095-360LF SKY65162-70LF		
AWB7222	SKYFR-001387	<b>SKYFR-001436</b>				SKY13453-385LF
AWB7229						
AWB7225						
AWB7238						
AWB7224	SKYFR-001385	<b>SKYFR-001398</b>				

## High Efficiency DPD-Friendly Power Amplifiers, 28 dBm Output Power

Power Amplifier	Circulator	Isolator	Limiter Module	Driver Amplifier	Low Noise Amplifier	Switches
<b>SKY66288-11</b>	SKYFR-001301					
<b>SKY66293-21</b>	SKYFR-001452	<b>SKYFR-001512</b>				
<b>SKY66297-11</b>	SKYFR-001461	<b>SKYFR-001460</b>		SKY67159-396LF SKY67021-396LF SKY67022-396LF SKY67023-396LF SKY67150-396LF SKY67153-396LF	SKY67159-396LF SKY67150-396LF SKY67153-396LF	
<b>SKY66292-11</b>	SKYFR-001390	<b>SKYFR-001439</b>				
<b>SKY66294-11</b>	SKYFR-001390	<b>SKYFR-001439</b>				
<b>SKY66299-11</b>	SKYFR-001388	<b>SKYFR-001437</b>				
<b>SKY66291-11</b>	SKYFR-001387	<b>SKYFR-001436</b>	SKY16601-555LF SKY16602-632LF			SKY13374-397LF
<b>SKY66295-11</b>						
<b>SKY66296-11</b>	SKYFR-001385	<b>SKYFR-001398</b>				
<b>SKY66289-11</b>	SKYFR-000736	<b>SKYFR-001398</b>		SKY67159-396LF SKY67021-396LF SKY67150-396LF	SKY67159-396LF SKY67021-396LF SKY67150-396LF	
<b>SKY66298-11</b>	SKYFR-001400			SKY67159-396LF SKY67021-396LF SKY67150-396LF	SKY67159-396LF SKY67021-396LF SKY67150-396LF	

Coming Soon products (orange, bold) indicates products that will be available soon for purchase.



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