

**PRODUCT SUMMARY**

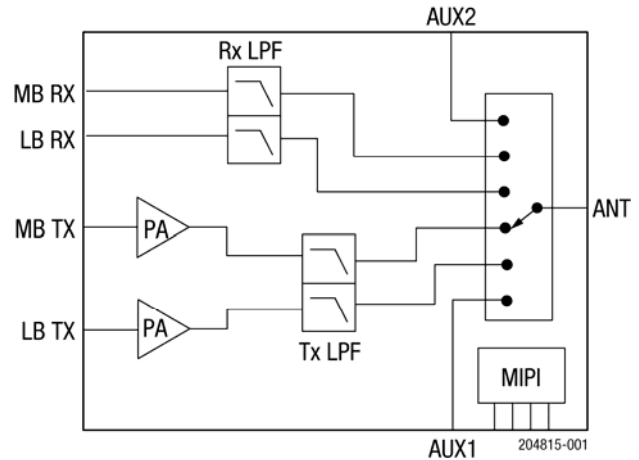
# SKY68020-11: LTE Universal Multi-Band Front-End Module for IoT

**Applications**

- Low-power, low-data-rate cellular IoT
- Half-duplex operation (HD-FDD) LTE:
  - LTE-M
  - NB-IoT
- LTE universal modem products:
  - Low-band: 5, 8, 12, 13, 14, 17, 18, 19, 20, 26, 28, 71, 85
  - Mid-band: 1, 2, 3, 4, 25, 39, 66, 70

**Features**

- Output power: +24 dBm, optimized to support LTE for 1 RB to 6 RB
- Exceptional harmonics performance:
  - Band 13 2<sup>nd</sup> harmonic: -60 dBm/MHz
  - Band 28 2<sup>nd</sup> harmonic: -55 dBm/MHz
  - Band 28 3<sup>rd</sup> harmonic: -52 dBm/MHz
- Broadband PA supporting APT mode of operation or Vcc fixed supply: 2.85 V to 4.5 V
- Integrated Tx low-pass filters for optimized harmonic rejection
- Integrated SP6T antenna Tx/Rx switch
- Integrated Rx low-pass filters for out-of-band rejection
- Two broadband, high-power AUX ports for additional band support
- Low leakage current: 0.4 uA
- Adaptive biasing scheme for maximum PA efficiencies
- MIPI® RFFE control interface, 2.0 compliant
- Pin-to-pin compatible with the SKY68000-31, SKY68001-31, and SKY68001-41
- Operating temperature range: -40°C to +85°C
- Small, low-profile package (4 mm x 5 mm x 0.9 mm) (MSL3 @ 260 °C per JEDEC J-STD-020)



**Figure 1. SKY68020-11 Functional Block Diagram**

**Description**

The SKY68020-11 is a hybrid, multi-band multi-chip RF front-end (RFFE) module supporting cellular LTE-M/NB-IoT (half-duplex system) transceiver platforms. The module integrates the entire RF front end necessary for an LTE multi-band radio operating in low-band (5, 8, 12, 13, 14, 17, 18, 19, 20, 26, 28, 71, and 85), and mid-band (1, 2, 3, 4, 25, 39, 66, and 70) frequencies, including Rx low-pass filters, broadband PA with bias controller, Tx low-pass harmonic filter, antenna switch, and MIPI RFFE controller.

**Tx Section**

The PA load-line is optimized for high efficiency while simultaneously meeting 3GPP ACLR and emissions mask specifications with LTE up to 6 RB. An integrated LPF is implemented to reject the PA and transceiver harmonics while at the same time minimizing any post PA loss for an optimized transmit current consumption. Out-of-band emissions performance is emphasized by the design to be 3GPP-compliant for low-band (5, 8, 12, 13, 14, 17, 18, 19, 20, 26, 28, 71, and 85), and mid-band (1, 2, 3, 4, 25, 39, 66, and 70) frequencies.



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**Rx Section**

Receive low-pass filters are integrated into the module along with the necessary matching to yield a 50 Ω single-ended impedance for the antenna and Rx ports. The filters provide a high level of rejection to out-of-band interferers, protecting the transceiver from high blocking signal levels and to support 3GPP LTE blocking test conformance. The Rx low-pass filters are cascaded with the low throw count switch to establish a lower insertion loss and noise figure than conventional LTE receivers.

**Auxiliary Paths**

The two AUX ports are additional broadband ports that can be used symmetrically for either Tx or Rx operation. The AUX ports can support conventional GSM power levels.

**Smart Biasing**

For most IoT applications, the DC-DC converter might not be available to control the VCC supply of the PA. With a fixed DC supply, Smart Biasing allows for easy power control through the MIPI interface by programming reduced bias current for lower gain states. Based on the application, a set of 4 to 6 different bias conditions with specific fixed-gain steps are predefined. For each of the steps, the transceiver output power can be adjusted to meet the desired total output power.

The key advantages of the smart biasing scheme are:

- Saving current consumption during lower output power operation
- Easy programming of fixed-gain steps through the MIPI interface
- Reducing the required output dynamic range of the transceiver

**MIPI RFFE Controller Interface**

The SKY68020-11 functional operation is fully controllable by a single MIPI interface which is used to drive the PA in various optimized bias modes as well as providing band selection and controlling the antenna switch Tx, Rx, and band selection.

Figure 1 shows the block diagram for the SKY68020-11.

**Ordering Information**

Part Number	Product Description	Evaluation Board Part Number
SKY68020-11	LTE Universal Multi-Band Front-End Module for IoT	SKY68020-11EK1

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