PRODUCT SUMMARY

SKY66430-11: 5G Massive IoT System-in-Package

Applications

- Personal / pet tracking
- Industrial asset tracking
- Smart metering
- Wearable medical devices
- Security / alarm systems
- Fleet management
- Industrial monitoring devices
- Low-power IoT devices

Features

- Complete BB to RF solution in a single package:
  - Integrated baseband, transceiver, RF front end, RAM memory, and power management
  - 8.8 x 10.8 x 0.95 mm BGA package, 0.5 mm pitch
  - Device weight: 229 mg
- Compliant to 3GPP Rel-14 including VoLTE support, upgradable to 3GPP Rel-15
- Optimized for half-duplex operation (HD-FDD) for LTE-M/NB-IoT
- Pre-certified with major MNOs, FCC / IC/ TELEC / ACMA, and GCF / PTCRB
- Global frequency band support:
  - Low-band: B5, B8, B12, B13, B14, B17, B18, B19, B20, B26, B28, B85
  - Mid-band: B1, B2, B3, B4, B25, B66
- Best-in-class deep sleep power consumption of 1 uA
- Positioning over LTE (PoLTE), a low-power, cloud-based solution for indoor/outdoor positioning
- Extremely low leakage internal PMU that enables operability for 10 years
- Smart PA biasing scheme to maximize efficiencies during low-output power operation
- Throughput:
  - LTE-M (1.4 MHz bandwidth) up to 300 kbps DL, 375 kbps UL
  - NB-IoT (200 kHz bandwidth):
    - o NB1: 27.2 kbps DL, 62.5 kbps UL
    - o NB2: 120 kbps DL, 170 kbps UL
- Single 3.1 V to 5.5 V supply operation
- Operating temperature range: -40 °C to +85 °C
- Skyworks conformal shielding, silver (Ag) free
- Lead (Pb)-free and RoHS-compliant
- MSL3 @ 260 °C per JEDEC J-STD-020

Description

The SKY66430-11 is a multi-band multi-chip System-in-Package (SiP) supporting 5G Massive IoT (LTE-M/NB-IoT) platforms. The SiP integrates the entire RF front end, transceiver, power management, memory, and baseband modem for an LTE multi-band radio operating in the 698 to 2200 MHz frequency range. NOR flash, crystals, and a few passives external to the package complete the SiP implementation.

Front-End Section

The front-end section includes RX low-pass filters, broadband PA with bias controller, TX low-pass harmonic filter, and antenna switch.

RX Section

Receive low-pass filters are integrated into the SiP along with the necessary matching to yield a 50 ohm single-ended impedance for the antenna. The filters provide a high level of rejection to out-of-band interferers, protecting the transceiver from high blocking signal levels and guaranteeing 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 receiver designs.

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 B5, B8, B12, B13, B14, B17, B18, B19, B20, B26, B28, B85 and mid-band B1, B2, B3, B4, B25, B66.

This SiP includes the Sequans Monarch 3330 chipset

Transceiver Section

A direct-conversion RF solution using low power technology has the following functional characteristics:

- Direct conversion in the TX and RX paths
- On-chip Fractional-N frequency synthesizers
- On-chip anti-alias filters
- On-chip AGC circuit
- On-chip reconstruction filters
- On-chip calibration including VCO and DC offset correction in the RX paths
- RX and TX gain and phase correction loops between the RF and baseband
- Software control for synthesizer, TX/RX, adjustment, and gain control
- External clock reference of 38.4 MHz

Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.

Baseband Modem Section

- DL processing block, handling LTE downlink physical layer (RX)
- UL processing block, handling LTE uplink physical layer (TX)
- Synchronization processing block, handling frequency search and synchronization to LTE network
- Optimized for Cat-M1 channels defined in 3GPP Releases 13 and 14, upgradable to Release 15
- An MCU with instruction and data cache, running LTE protocol stack at frequency up to 312 MHz
- A quad-IO SPI interface (QSPI) to 1.8 V serial NOR flash of 64 Mbit or 128 Mbit size, running at 104 MHz, with support of eXecute-in-Place (XIP) and critical word first wrapping reads
- A pSRAM controller interfacing with an embedded 64-Mbit pSRAM at 104 MHz
- Three high-speed UARTs with hardware flow control
- One I^2C master up to 3.4 Mbps
- One SPI master and slave up to 13 MHz
- Muxed GPIOs interruptible, with support of pulse counter and PWM functionality
- Two UICC interfaces compliant with ETSI TS 102 221 specification, including SIM card removal detection and support for 1.8 V and 3 V voltage levels
- Secured JTAG, with possibility of enabling or disabling the interface by hardware or secured software

NOTE: *This SiP includes the Sequans Monarch 3330 chipset. For more specific information related to that chipset, which is not included in this data sheet, refer to the data sheet for that product.*

A functional block diagram is shown in Figure 1. A typical application block diagram is shown in Figure 2. The pinout is shown in Figure 3. Signal pin assignments and functional pin descriptions are described in Table 1.
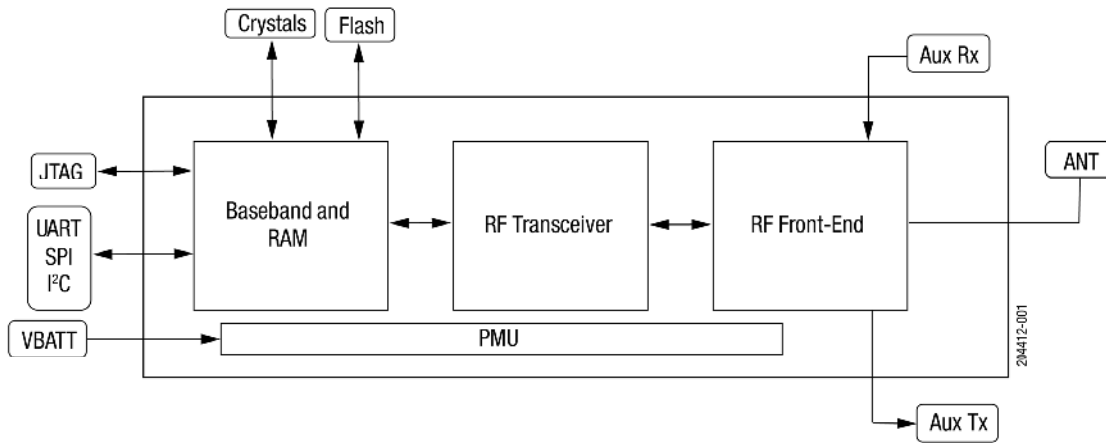
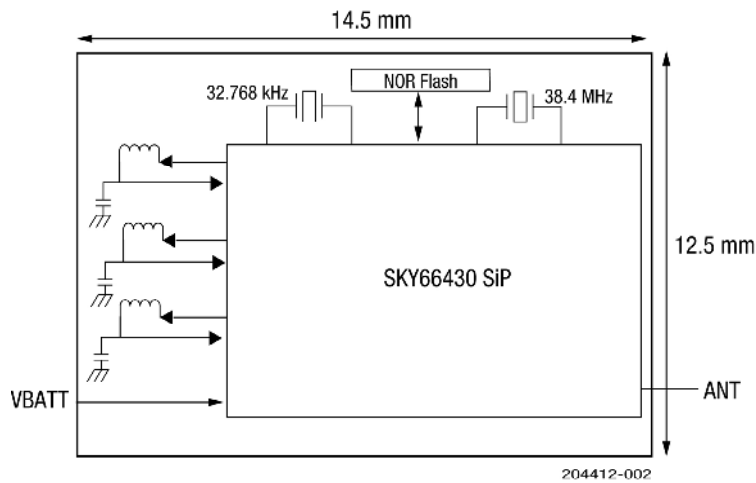**Figure 1. SKY66430-11 Functional Block Diagram**

Figure 2. SKY66430-11 Typical Application Block Diagram

FCC Regulatory Approval for the SKY66430-11

Note: *This section applies to the SKY66430-11 part number only. The LTE Bands that are compliant with FCC are Band 2, Band 4, Band 5, Band 12, Band 13, and Band 25.*

Attention

SKY66430-11 FCC-ID: 2AAGM66430 (single modular approval)

This above identified LTE radio module is not intended to be provided to end users, but is for installation by OEM integrators only.

Installation/Integration

OEM integrators must follow SKY66430-11 installation instructions to provide for and benefit from FCC compliant module integrations and must abide especially by the following:

The maximum antenna gain value (accounting for cable attenuation) to comply with the FCC maximum ERP/EIRP limits and with RF Exposure rules is 2 dBi.

The SKY66430-11 module integration guidelines must be closely followed.

Compliance of host integrations of the module is limited to hosts adaptation designs which are identical to SKY66430-11 reference design.

Host integrations with adaption designs deviating from SKY66430-11 reference design require either class 2 permissive change to this modular approval or a separate host approval with different FCC-ID.

Host integrations with co-located (simultaneously operating) radio transmitters must be evaluated in accordance with FCC multi-transmitter rules and may require either class 2 permissive change to this modular approval or a separate host approval with different FCC-ID, dependent on the result of the evaluation; Inquiry at FCC or a TCB is urgently recommended.

Integrations of the module into host products which are intended for portable use, i.e. less than 20 cm distance between its radiating structures (antenna) and the body of nearby persons, or which otherwise put additional technical requirements like Hearing Aid compatibility require either class 2 permissive change to this modular approval or a separate host approval with different FCC-ID.

Compliance with Unwanted Emission Limits for Digital Device

If the OEM host integration fully complies with the above described reference design and can completely inherit and rest on compliance of the existing modular approval the OEM remains still responsible to show compliance of the overall end-product with the FCC limits for unwanted conducted and radiated emissions from the digital device (unintentional radio) portion of such end-product (commonly addressed as part 15B compliance or similar).

End-Product Labelling

- FCC-ID
The module's FCC-ID must either be visible from the exterior of the host product (e.g. per window) or per electronic display, or shall be displayed on an additional exterior label per the following or similar string: `contains FCC-ID: 2AAGM66430`

- Digital Device - Unwanted Emissions Notice
If the end-product falls under part 15 of the FCC rules (it shall display the following user notice on its exterior acc. to part 15.19 (the notice may be printed in the manual in case the host is too small):

```
This device complies with Part 15 of the FCC Rules. Operation is subject to the following
two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may
```

```
   cause undesired operation.
```

- Further Labelling Requirements may apply dependent on the FCCrule parts relevant to the host product.

- End-Product User Instructions / Notices in the Manual
  At a minimum, end-product users must be provided with the following notices at a prominent location of the product literature furnished with the product:

```
 * Product Modifications
   Modifications not expressly approved by the party responsible for compliance could void the
   user's authority to operate this equipment.

 * RF Exposure Compliance
   This equipment complies with FCC radio frequency radiation exposure rules and limits set
   forth for an uncontrolled environment, when installed and operated with minimum distance
   of 20cm between its radiating structures (antenna) and the body of nearby persons and
   when not operated simultaneously with other nearby
   radio-transmitters.
```

- Maximum Antenna Gain
  The user instructions of end-products equipped with standard external antenna connectors for the modular radio transmitter providing the option to connect other antennae than those which may or may not be bundled with the end-product must list the maximum allowed antenna gain values as derived from those given above, accounting for the cable attenuations of the actual installation.

- Digital Device - Unwanted Emissions Notice
  If the end-product is or contains a digital device (unintentional radio portions) and is not exempted by its use case (like vehicular use) the following part 15.105 (b) user notice shall be provided at prominent location of the product literature:

```
This equipment has been tested and found to comply with the limits for a Class B digital
device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable
protection against harmful interference in a residential installation.
This equipment generates uses and can radiate radio frequency energy and, if not installed
and used in accordance with the instructions, may cause harmful interference to radio
communications. However, there is no guarantee that interference will not occur in a
particular installation. If this equipment does cause harmful interference to radio or
television reception, which can be determined by turning the equipment off and on, the user
is encouraged to try to correct the interference by one or more of the following measures:
o    Reorient or relocate the receiving antenna.
o    Increase the separation between the equipment and receiver.
o    Connect the equipment into an outlet on a circuit different from that to which the
receiver is connected.
o  Consult the dealer or an experienced radio/TV technician for help
```

- Further User Notices
  May be required dependent on the FCC rule parts relevant to the host product.

- Non-Allowed User Instructions
  The end-product user guidance may NOT include instructions about how to install or de-install the module.

Industry Canada Statement

Note: *This section applies to SKY66430-11 part number only.*

This device complies with ISED's licence exempt RSSes. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d' ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et

(2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be colocated with any other transmitter or antenna

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

1. L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et

2. Le module émetteur peut ne pas être coïmp lanté av ec un autre émetteur ou antenne.

Tant que les 2 conditions ci dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

Important Note

In the event that these conditions cannot be met (for example certain laptop configurations or colocation with another transmitter), then the Canada authorization is no longer considered valid and the IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

Note Importante

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: `"Contains IC:66430"`.

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: `"Contient des IC: 12732A-66430"`.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

Japan Regulatory Certification

The SKY66430-11 is certified by regulatory authorities in Japan for both JATE and TYPE (TELEC).

JAPAN

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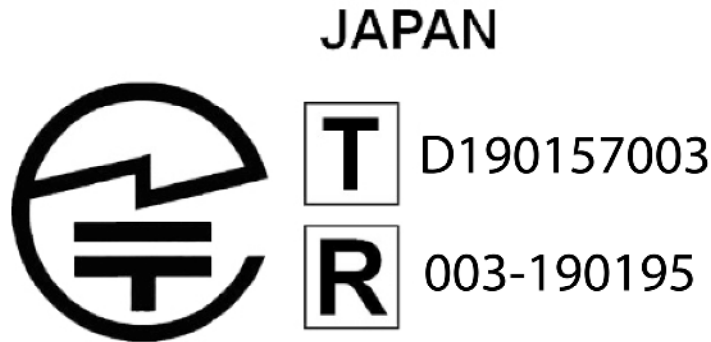
Ordering Information

Part Number	Product Description	Evaluation Board Part Number
SKY66430-11	5G Massive IoT System-in-Package	SKY66430-11EK1

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