

SC20-A Manual

LTE Module Series

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About the Document

History

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1 Introduction

This document defines the SC20 module and describes its air interface and hardware interface which are connected with your application.

This document can help you quickly understand module interface specifications, electrical and mechanical details as well as other related information of SC20 module. Associated with application notes and user guide, you can use SC20 module to design and set up mobile applications easily.

1.1. Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating SC20 module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for the customer's failure to comply with these precautions.



Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. You must comply with laws and regulations restricting the use of wireless devices while driving.



Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden, so as to prevent interference with communication systems. Consult the airline staff about the use of wireless devices on boarding the aircraft, if your device offers an Airplane Mode which must be enabled prior to boarding an aircraft.



Switch off your wireless device when in hospitals or clinics or other health care facilities. These requests are designed to prevent possible interference with sensitive medical equipment.

SOS

Cellular terminals or mobiles operating over radio frequency signal and cellular network cannot be guaranteed to connect in all conditions, for example no mobile fee or with an invalid SIM card. While you are in this condition and need emergent help, please remember using emergency call. In order to make or receive a call, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.



Your cellular terminal or mobile contains a transmitter and receiver. When it is ON , it receives and transmits radio frequency energy. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.



In locations with potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially exposable atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders, etc.



Please do not discard. Maybe wireless devices have an impact on the environment so please do not arbitrarily discarded.



The device is restricted to indoor use only when operating in the 5150 to 5350 Mhz frequency range.

| | | | | | | |
|----|----|----|----|----|----|----|
| AT | BE | BG | HR | CY | CZ | DK |
| EE | FI | FR | DE | EL | HU | IE |
| IT | LV | LT | LU | MT | NL | PL |
| PT | RO | SK | SI | ES | SE | UK |

2 Product Concept

2.1. General Description

SC20 is a series of 4G smart modules based on Qualcomm platform and Android operating system, with providing industrial grade performance. It supports worldwide LTE-FDD/LTE-TDD/WCDMA/TD-SCDMA/EVDO/CDMA/GSM coverage, and also supports short-range wireless communication via Wi-Fi 802.11a/b/g/n and BT4.1 LE. Additionally, SC20 integrates GPS/GLONASS/BeiDou satellite positioning systems. Due to multiple speech and audio codecs as well as the built-in high performance Adreno™ 304 graphics processing unit, it enables smooth play of 720P videos. The module also offers multiple audio and video input/output interfaces as well as abundant GPIO interfaces.

The following table shows the supported network types and frequency bands of SC20. Including a series of product such as: SC20-CE, SC20-A, SC20-AU, SC20-E, SC20-J.

Table 1: SC20-A Frequency Bands

| Type | Frequency |
|---------------------|-------------------------------|
| LTE-FDD | B2/B4/B5/B7/B12/B13/B25/B26 |
| WCDMA | B1/B2/B4/B5/B8 |
| GSM | 850/1900MHz |
| Wi-Fi 802.11a/b/g/n | 2412-2472MHz; 5180-5825MHz |
| BT4.1 LE | 2402-2480MHz |
| GNSS | GPS/GLONASS/BeiDou |

SC20 is an SMD type module, which can be embedded into applications through its 210-pin pads including 146 LCC signal pads and 64 other pads. With a compact profile of 40.5mm × 40.5mm × 2.8mm, SC20 can meet almost all requirements for M2M applications such as CPE, automotive, smart metering, tracking, security, routers, wireless POS, mobile computing devices, PDA phone, tablet PC, etc.

2.2. Key Features

The following table describes the detailed features of SC20 module.

Table 2: SC20 Key Features

| Feature | Details |
|-----------------------------|---|
| Applications Processor | ARM Cortex-A7 microprocessor cores (quad-core) up to 1.1 GHz 512KB L2 cache |
| Modem DSP | QDSP6 v5 core up to 691.2 MHz 768KB L2 cache |
| Memory | 8GB EMMC+8Gb LPDDR3 |
| Operating System | Android OS 5.1 |
| Power Supply | Supply voltage: 3.5V~4.2V Typical supply voltage: 3.8V |
| LTE Features | Support 3GPP R10 CAT4 FDD and TDD Support 1.4 to 20 MHz RF bandwidth Support DL 2 x 2 MIMO FDD data rate: Max 150Mbps (DL), 50Mbps (UL) TDD data rate: Max 130Mbps (DL), 35Mbps (UL) |
| WCDMA Features | Support 3GPP R8 DC-HSPA+ Support 16-QAM, 64-QAM and QPSK modulation 3GPP R6 HSUPA: Max 5.76Mbps (UL) 3GPP R8 DC-HSPA+: Max 42Mbps (DL) |
| TD-SCDMA Features | Support CCSA Release 3 Max 4.2Mbps (DL), 2.2Mbps (UL) |
| CDMA Features | Max 3.1Mbps (DL), 1.8Mbps (UL) |
| GSM/GPRS/EDGE Data Features | GPRS Support GPRS multi-slot class 33 Coding scheme: CS-1, CS-2, CS-3 and CS-4 Maximum of four Rx time slots per frame EDGE Support EDGE multi-slot class 33 Support GMSK and 8-PSK |
| WLAN Features | Support 2.4G and 5G frequency band, (SC20-CE does not support 5G frequency). Support 802.11a/b/g/n, data rate up to 150Mbps Support AP mode; |
| Bluetooth Feature | BT4.1 LE |

| | |
|--------------------------|--|
| GNSS Features | GPS/GLONASS/BeiDou |
| SMS | Text and PDU mode Point to point MO and MT SMS cell broadcast SMS storage: ME by default |
| AT Commands | Compliant with 3GPP TS 27.007, 27.005 and Quectel enhanced AT commands |
| LCM Interface | 4 lanes MIPI_DSI, up to 1.5Gbps each Support WVGA (2 lanes MIPI_DSI), up to 720p (4 lanes MIPI_DSI) 24bit color depth |
| Camera Interface | Use MIPI_CSI, up to 1.5Gbps per lane, support two cameras 2-lane MIPI_CSI for rear camera, up to 8MP 1-lane MIPI_CSI for front camera, up to 2MP |
| Audio Interface | Audio input 2 groups analog microphone input, integrate internal bias voltage Audio output Class AB stereo headphone output Class AB earpiece differential output Class D speaker differential amplifier output |
| USB Interface | Compliant with USB 2.0 specification; the data transfer rate can reach up to 480Mbps Used for AT command communication, data transmission, software debugging and firmware upgrade Support USB OTG (Need additional 5V power supply chip) USB Driver: Support Windows XP, Windows Vista, Windows 7, Windows 8, Windows CE5.0/6.0*, Linux 2.6/3.0, Android 2.3/4.0/4.2 |
| USIM Interface | 2 groups of USIM interface Support USIM/SIM card: 1.8V, 3.0V |
| UART Interface | 2 groups of UART interface 4-wire UART interface with RTS and CTS hardware flow control 2-wire UART interface for software debugging Baud rate up to 4Mbps |
| SDIO Interface | Support SD3.0; 4bit SDIO; SD Card Support hot plug |
| I2C Interface | 3 groups I2C, used for TP, camera, sensor peripherals, etc. |
| ADC Interface | Support 3 ADC interfaces, used for input voltage sense, battery temperature detection and general purpose ADC |
| Real Time Clock | Implemented |
| Antenna Interface | MAIN antenna, DRX antenna, GNSS antenna and Wi-Fi/BT antenna |
| Physical Characteristics | Size: 40.5±0.15 × 40.5±0.15 × 2.8±0.2 mm Interface: LCC |

| | |
|-------------------|--|
| | Weight: approx. 9.6g |
| Temperature Range | Operating temperature range: -35°C~+65°C 1) Extended temperature range : -40°C~+75°C 2) |
| Firmware Upgrade | Over USB interface |
| RoHS | All hardware components are fully compliant with EU RoHS directive |

NOTES

¹⁾ Within operation temperature range, the module is 3GPP compliant.

²⁾ Within extended temperature range, the module remains the ability to establish and maintain a voice, SMS, data transmission, emergency call, etc. There is no unrecoverable malfunction. There are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like Pout might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet 3GPP compliant again.

* means this feature is under development.

2.3. Functional Diagram

The following figure shows a block diagram of SC20 and illustrates the major functional parts.

- Power management
- Radio frequency
- Baseband
- LPDDR3+EMMC flash
- Peripheral interface
 - USB interface
 - USIM interface
 - UART interface
 - SDIO interface
 - I2C interface
 - ADC interface
 - LCD (MIPI) interface
 - TP interface
 - CAM (MIPI) interface
 - AUDIO interface



In order to help you to develop applications with SC20, Quectel supplies an evaluation board (SMART-EVB), RS-232 to USB cable, USB data cable, power adapter, earphone, antenna and other peripherals to control or test the module. For details, please refer to **document [1]**.

3 Application Interfaces

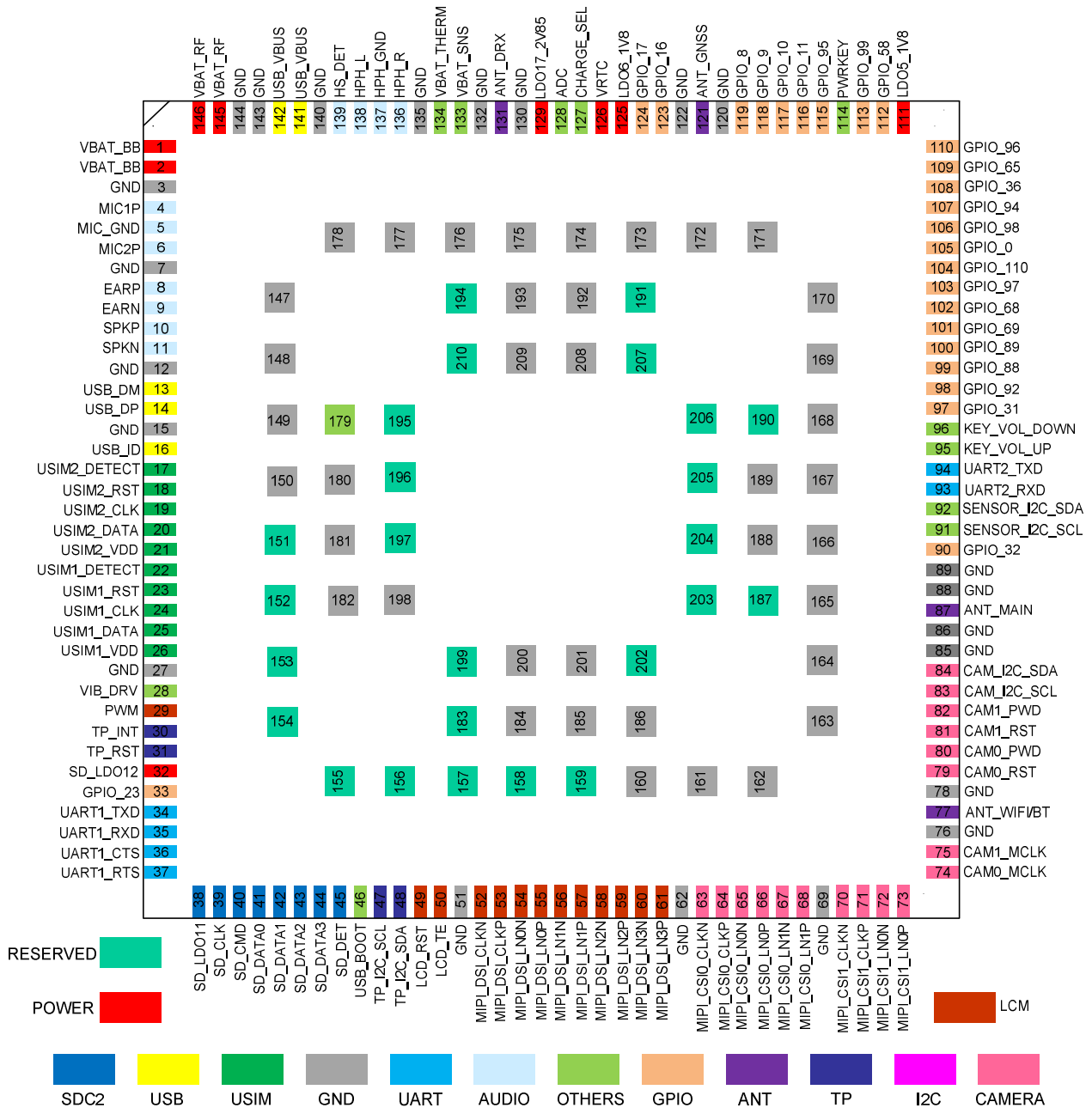
3.1. General Description

SC20 is equipped with 146-pin 1.0mm pitch SMT pads plus 64-pin ground pads and reserved pads that can be embedded into cellular application platform. The following chapters provide the detailed description of pins/interfaces listed below.

- Power supply
- VRTC interface
- LCM interface
- TP interface
- Camera interface
- Audio interface
- USB interface
- USIM interface
- UART interface
- SDIO interface
- I2C interface
- ADC interface

3.2. Pin Assignment

The following figure shows the pin assignment of SC20 module.



4 Wi-Fi and BT

SC20 module provides a shared antenna interface ANT_WIFI/BT for Wi-Fi and Bluetooth (BT) functions. The interface impedance is 50Ω. External antennas such as dipole antenna can be connected to the module via the interface, so as to achieve Wi-Fi and BT functions.

4.1. Wi-Fi Overview

SC20 module supports 2.4G and 5G double-band WLAN wireless communication based on IEEE 802.11 a/802.11b/ 802.11g/ 802.11n standard protocols. The maximum data rate is up to 150 Mbps.

The features are as below:

- Support Wake-on-WLAN (WoWLAN)
- Support ad hoc mode
- Support WAPI SMS4 hardware encryption
- Support AP mode
- Support Wi-Fi Direct
- Support MCS 0-7 for HT20 and HT40

NOTE

SC20-CE only supports 2.4G single band WIFI, and does not support 802.11a.

4.1.1. Wi-Fi Performance

The following table lists the Wi-Fi transmitting and receiving performance of SC20 module (SC20-CE does not support 5G frequency band).

Referenced specifications are listed below:

| No. | Document |
|-----|--|
| 1 | IEEE 802.11n WLAN MAC and PHY, October 2009 + IEEE 802.11-2007 WLAN MAC and PHY, June 2007 |

2 IEEE Std 802.11b, IEEE Std 802.11d, IEEE Std 802.11e, IEEE Std 802.11g, IEEE Std 802.11i: IEEE 802.11-2007 WLAN MAC and PHY, June 2007

4.2. BT Overview

SC20 module supports BT4.1 (BR/EDR+BLE) specification, as well as GFSK, 8-DPSK, $\pi/4$ -DQPSK modulation modes.

- Supports max. 7 wireless connections.
- Supports max. 3.5 piconets at the same time.
- Supports one SCO (Synchronous Connection Oriented) or eSCO connection.

The BR/EDR channel bandwidth is 1MHz, and can accommodate 79 channels. The BLE channel bandwidth is 2MHz, and can accommodate 40 channels.

Table 3: BT Data Rate and Version

| Version | Data rate | Maximum Application Throughput | Comment |
|-----------|-----------|--------------------------------|---------|
| 1.2 | 1 Mbit/s | >80 Kbit/s | |
| 2.0 + EDR | 3 Mbit/s | >80 Kbit/s | |
| 3.0 + HS | 24 Mbit/s | Reference 3.0 + HS | |
| 4.0 | 24 Mbit/s | Reference 4.0 LE | |

Referenced specifications are listed below:

| No. | Document |
|-----|--|
| 1 | Bluetooth Radio Frequency TSS and TP Specification 1.2/2.0/2.0 + EDR/2.1/2.1+ EDR/3.0/3.0 + HS, August 6, 2009 |
| 2 | Bluetooth Low Energy RF PHY Test Specification, RF-PHY.TS/4.0.0, December 15, 2009 |

4.2.1. BT Performance

The following table lists the BT transmitting and receiving performance of SC20 module.

Table 4: BT Transmitting and Receiving Performance

Transmitter Performance

| | | | |
|-----------------------------|--------|--------|--------|
| Packet Types | DH5 | 2-DH5 | 3-DH5 |
| Transmitting Power | 10dBm | 8dBm | 8dBm |
| Receiver Performance | | | |
| Packet Types | DH5 | 2-DH5 | 3-DH5 |
| Receiving Sensitivity | -92dBm | -91dBm | -86dBm |

5 GNSS

SC20 module integrates a Qualcomm IZat™ GNSS engine (GEN 8C) which supports multiple positioning and navigation systems including GPS, GLONASS and BeiDou. With an embedded LNA, the module provides greatly improved positioning accuracy.

5.1. GNSS Performance

The following table lists the GNSS performance of SC20 module in conduction mode.

Table 5: GNSS Performance

| Parameter | Description | Typ. | Unit |
|---------------------|---------------|------|------|
| Sensitivity (GNSS) | Cold start | -146 | dBm |
| | Reacquisition | -158 | dBm |
| | Tracking | -160 | dBm |
| TTFF (GNSS) | Cold start | 32 | s |
| | Warm start | 30 | s |
| | Hot start | 2 | s |
| Static Drift (GNSS) | CEP-50 | 6 | m |

6 Antenna Interface

SC20 antenna interface includes a main antenna, an Rx-diversity/MIMO antenna, a GNSS antenna and a Wi-Fi/BT antenna. The antenna interface has an impedance of 50Ω.

6.1. Main/Rx-diversity Antenna Interface

6.1.1. Pin Definition

The main antenna and Rx-diversity antenna pins' definition are shown below.

Table 6: Pin Definition of the Main/Rx-diversity Antenna

| Pin Name | Pin No. | I/O | Description | Comment |
|----------|---------|-----|-------------------|---------------|
| ANT_MAIN | 87 | IO | Main antenna | 50Ω impedance |
| ANT_DRX | 131 | AI | Diversity antenna | 50Ω impedance |

6.1.2. Operating Frequency

Table 7: SC20 Module Operating Frequencies

| 3GPP Band | Receive | Transmit | Unit |
|--------------|-----------|-----------|------|
| GSM850 | 869-894 | 824-849 | MHz |
| EGSM900 | 925-960 | 880-915 | MHz |
| DCS1800 | 1805-1880 | 1710-1785 | MHz |
| PCS1900 | 1930-1990 | 1850-1910 | MHz |
| WCDMA Band 1 | 2110-2170 | 1920-1980 | MHz |
| WCDMA Band 2 | 1930-1990 | 1850-1910 | MHz |

| | | | |
|------------------|-----------|-----------|-----|
| WCDMA Band 4 | 2110-2155 | 1710-1755 | MHz |
| WCDMA Band 5 | 869-894 | 824-849 | MHz |
| WCDMA Band 6 | 875-885 | 830-840 | MHz |
| WCDMA Band 8 | 925-960 | 880-915 | MHz |
| WCDMA Band 19 | 875-890 | 830-845 | MHz |
| CDMA BC0 | 869-894 | 824-849 | MHz |
| TD-SCDMA Band 34 | 2010-2025 | 2010-2025 | MHz |
| TD-SCDMA Band 39 | 1880-1920 | 1880-1920 | MHz |
| LTE-FDD Band 1 | 2110-2170 | 1920-1980 | MHz |
| LTE-FDD Band 2 | 1930-1990 | 1850-1910 | MHz |
| LTE-FDD Band 3 | 1805-1880 | 1710-1785 | MHz |
| LTE-FDD Band 4 | 2110-2155 | 1710-1755 | MHz |
| LTE-FDD Band 5 | 869-894 | 824-849 | MHz |
| LTE-FDD Band 8 | 925-960 | 880-915 | MHz |
| LTE-FDD Band 12 | 729-746 | 699-716 | MHz |
| LTE-FDD Band 13 | 746-756 | 777-787 | MHz |
| LTE-FDD Band 18 | 860-875 | 815-830 | MHz |
| LTE-FDD Band 19 | 875-890 | 830-845 | MHz |
| LTE-FDD Band 20 | 791-821 | 832-862 | MHz |
| LTE-FDD Band 25 | 1930-1995 | 1850-1915 | MHz |
| LTE-FDD Band 26 | 859-894 | 814-849 | MHz |
| LTE-FDD Band 28 | 758-803 | 703-748 | MHz |
| LTE-TDD Band 38 | 2570-2620 | 2570-2620 | MHz |
| LTE-TDD Band 39 | 1880-1920 | 1880-1920 | MHz |
| LTE-TDD Band 40 | 2300-2400 | 2300-2400 | MHz |

| | | | |
|-----------------|-----------|-----------|-----|
| LTE-TDD Band 41 | 2555-2655 | 2555-2655 | MHz |
|-----------------|-----------|-----------|-----|

NOTE

The bandwidth of LTE-TDD Band 41 for SC20 module is 100MHz (2555 MHz - 2655 MHz), and the corresponding channel range is from 40240 up to 41240.

6.2. Wi-Fi/BT Antenna Interface

The following tables show the Wi-Fi/BT antenna pin's definition and frequency specification.

Table 8: Pin Definition of Wi-Fi/BT Antenna

| Pin Name | Pin No. | I/O | Description | Comment |
|-------------|---------|-----|------------------|---------------|
| ANT_WIFI/BT | 77 | IO | Wi-Fi/BT antenna | 50Ω impedance |

Table 9: Wi-Fi/BT Frequency

| Type | Frequency | Unit |
|---------------------|-------------------------------|------|
| Wi-Fi 802.11a/b/g/n | 2412-2472MHz; 5180-5825MHz | MHz |
| BT4.1 LE | 2402-2480MHz | MHz |

6.3. GNSS Antenna Interface

The following tables show the GNSS antenna pin's definition and frequency specification.

Table 10: Pin Definition of GNSS Antenna

| Pin Name | Pin No. | I/O | Description | Comment |
|----------|---------|-----|--------------|---------------|
| ANT_GNSS | 121 | AI | GNSS antenna | 50Ω impedance |

Table 11: GNSS Frequency

| Type | Frequency | Unit |
|---------|------------------|------|
| GPS | 1575.42 ± 1.023 | MHz |
| GLONASS | 1597.5 - 1605.8 | MHz |
| BeiDou | 1561.098 ± 2.046 | MHz |

6.4. Antenna Installation

6.4.1. Antenna Requirement

The following table shows the requirement on main antenna, RX-diversity antenna, Wi-Fi/BT antenna and GNSS antenna.

Table 12: Antenna Requirements

| Type | Requirements |
|------------------------|---|
| GSM/WCDMA/TD-SCDMA/LTE | VSWR: ≤ 2 Max Input Power (W): 50 Input Impedance (Ω): 50 Polarization Type: Vertical Cable Insertion Loss: < 1dB (GSM850,EGSM900,WCDMA B5/B6/B8/B19,CDMA BC0,LTE-FDD B5/B8/B12/B13/B18/B19/B20/B26/B28) Cable Insertion Loss: < 1.5dB (DCS1800, PCS1900,WCDMA B1/B2/B4, TD-SCDMA B34/B39, LTE-FDD B1/B2/B3/B4/B25,LTE-TDD B39) Cable Insertion Loss: < 2dB (LTE-FDD B7,LTE-TDD B38/B40/B41) |
| Wi-Fi/BT | VSWR: ≤ 2 Max Input Power (W): 50 Input Impedance (Ω): 50 Polarization Type: Vertical Cable Insertion Loss: < 1dB |
| GNSS | Frequency range: 1565 - 1607MHz Polarization: RHCP or linear VSWR: < 2 (Typ.) Passive Antenna Gain: > 0dBi Active Antenna Noise Figure: < 1.5dB |

Active Antenna Gain: > -2dBi
Active Antenna Embedded LNA Gain: 20dB (Typ.)
Active Antenna Total Gain: > 18dBi (Typ.)

Table 13: Antenna Gain

Conclusion:

The analysis concludes that this product when transmitting in standalone within a host device, is compliant with the RF exposure requirements in mobile exposure condition, provided the conducted power and antenna gain do not exceed the limits for each given frequency band per wireless technology as follow table:

| Technology | Band | Maximum Conducted Power (dBm) | Maximum Antenna Gain (dBi) |
|------------|---------|-------------------------------|----------------------------|
| GSM | GSM850 | 33.0 | 3.0 |
| | GSM1900 | 30.5 | 2.5 |
| WCDMA | Band II | 24.0 | 2.5 |
| | Band IV | 24.0 | 5.0 |
| | Band V | 24.0 | 3.0 |
| LTE | Band 2 | 24.0 | 2.5 |
| | Band 4 | 24.5 | 5.0 |
| | Band 5 | 24.5 | 3.0 |
| | Band 7 | 24.5 | 8.5 |
| | Band 12 | 24.0 | 6.0 |
| | Band 13 | 24.0 | 6.0 |
| | Band 25 | 24.0 | 2.5 |
| | Band 26 | 24.0 | 3.0 |

Note: The WiFi2.4GHz/WiFi5GHz/Bluetooth dipole antenna information as below:

| Manufacturer | Model | Peak gain |
|---------------------------|-----------------------|-------------------------------|
| INPAQ TECHNOLOGY CO., LTD | DAM-L0-H-N0-000-08-13 | WiFi2.4GHz/Bluetooth: 3.0 dBi |
| | | WiFi5GHz: 4.0 dBi |

7 Electrical, Reliability and Radio Characteristics

7.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital and analog pins of the module are listed in the following table.

Table 14: Absolute Maximum Ratings

| Parameter | Min. | Max. | Unit |
|-------------------------|------|------|------|
| VBAT | -0.5 | 6 | V |
| USB_VBUS | -0.5 | 16 | V |
| Peak Current of VBAT | 0 | 3 | A |
| Voltage on Digital Pins | -0.3 | 2.3 | V |

7.2. Power Supply Ratings

Table 15: SC20 Module Power Supply Ratings

| Parameter | Description | Conditions | Min. | Typ. | Max. | Unit |
|-------------------|--|---|------|------|------|------|
| VBAT | VBAT | Voltage must stay within the min/max values, including voltage drop, ripple and spikes. | 3.5 | 3.8 | 4.2 | V |
| | Voltage drop during transmitting burst | Maximum power control level on EGSM900. | | | 400 | mV |
| I _{VBAT} | Peak supply current (during transmission slot) | Maximum power control level on EGSM900. | | 1.8 | 3.0 | A |

| Parameter | Description | Conditions | Min. | Typ. | Max. | Unit |
|-----------|---|------------|------|------|------|------|
| USB_VBUS | USB detection | | 4.35 | 5.0 | 6.3 | V |
| VRTC | Power supply voltage of backup battery. | | 2.0 | 3.0 | 3.25 | V |

7.3. Charging Performance Specifications

Table 16: Charging Performance Specifications

| Parameter | Min. | Typ. | Max. | Unit |
|--|------|-------|-------|------|
| Trickle charging current | 81 | 90 | 99 | mA |
| Trickle charging threshold voltage range (15.62mV steps) | 2.5 | 2.796 | 2.984 | V |
| Weak battery threshold voltage range (18.75mV steps) | 3.0 | 3.2 | 3.581 | V |
| Charge voltage range (25mV steps) | 4 | 4.2 | 4.775 | V |
| Charge voltage accuracy | | | +/-2 | % |
| Charge current range (90mA steps) | 90 | | 1440 | mA |
| Charge current accuracy | | | +/-10 | % |
| Charge termination current: when charge current is from 90 to 450mA; | | 7 | | % |
| Charge termination current: when charge current is from 450 to 1440mA; | | 7.4 | | % |

7.4. Operating Temperature

The operating temperature is listed in the following table.

Table 17: Operating Temperature

| Parameter | Min. | Typ. | Max. | Unit |
|---|------|------|------|------|
| Operating temperature range ¹⁾ | -35 | +25 | +65 | °C |
| Extended temperature range ²⁾ | -40 | | +75 | °C |

NOTES

1. ¹⁾ Operating temperature range ---- 3GPP compliant.
- 2) Within extended temperature range, the module remains the ability to establish and maintain a voice, SMS, data transmission, emergency call, etc. There is no unrecoverable malfunction. There are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like P_{out} might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet 3GPP compliant again.

7.5. Current Consumption

The values of current consumption are shown below.

Table 18: SC20-CE Current Consumption

| Parameter | Description | Conditions | Typ. | Unit |
|------------|-------------------------|--------------|------|------|
| I_{VBAT} | OFF state | Power down | 80 | uA |
| | GSM/GPRS supply current | Sleep @DRX=2 | 3.85 | mA |
| | | Sleep @DRX=5 | 3.01 | mA |
| | | Sleep @DRX=9 | 2.91 | mA |
| | WCDMA supply current | Sleep @DRX=6 | 3.30 | mA |
| | | Sleep @DRX=7 | 2.79 | mA |
| | | Sleep @DRX=8 | 2.49 | mA |
| | | Sleep @DRX=9 | 2.33 | mA |
| | LTE-FDD supply current | Sleep @DRX=5 | 5.60 | mA |
| | | Sleep @DRX=6 | 3.83 | mA |
| | | Sleep @DRX=7 | 3.02 | mA |
| | | Sleep @DRX=8 | 2.65 | mA |

| Parameter | Description | Conditions | Typ. | Unit |
|--------------------|-------------|--------------------------------|-------|------|
| LTE-TDD current | supply | Sleep @DRX=5 | 5.49 | mA |
| | | Sleep @DRX=6 | 3.87 | mA |
| | | Sleep @DRX=7 | 3.05 | mA |
| | | Sleep @DRX=8 | 2.67 | mA |
| GSM voice call | | GSM900 PCL=5@31.84dBm | 253.6 | mA |
| | | GSM900 PCL=12@18.49dBm | 142.9 | mA |
| | | GSM900 PCL=19@4.95dBm | 117.8 | mA |
| | | DCS1800 PCL=0@28.91dBm | 200.9 | mA |
| | | DCS1800 PCL=7@15.35dBm | 157 | mA |
| | | DCS1800 PCL=15@-0.21dBm | 138.1 | mA |
| CDMA voice call | | BC0(max power) @23.91dBm | 619.8 | mA |
| | | BC0(min power) @-60.28dBm | 128.7 | mA |
| WCDMA voice call | | Band1(max power) @22.61dBm | 430 | mA |
| | | Band8(max power) @22.74dBm | 392.2 | mA |
| EDGE data transfer | | EDGE900 (1UL/4DL) @26.29dBm | 193 | mA |
| | | EDGE900 (2UL/3DL) @26.15dBm | 277.9 | mA |
| | | EDGE900 (3UL/2DL) @26.06dBm | 362.2 | mA |
| | | EDGE900 (4UL/1DL) @25.92dBm | 450.5 | mA |
| | | DCS1800 (1UL/4DL) @24.89dBm | 183.5 | mA |
| | | DCS1800 (2UL/3DL) @24.74dBm | 275.2 | mA |

| Parameter | Description | Conditions | Typ. | Unit |
|-----------|--------------------|--------------------------------|--------|------|
| | CDMA data transfer | DCS1800 (3UL/2DL) @24.54dBm | 355.9 | mA |
| | | DCS1800 (4UL/1DL) @24.44dBm | 440.3 | mA |
| | | BC0(max power) @23.68dBm | 602.5 | mA |
| | | Band 1(HSDPA) @21.64dBm | 461.5 | mA |
| WCDMA | data transfer | Band 8(HSDPA) @21.61dBm | 423.8 | mA |
| | | Band 1(HSUPA) @21.36dBm | 452.5 | mA |
| | | Band 8(HSUPA) @21.56dBm | 436 | mA |
| | | LTE-FDD Band1 @22.96dBm | 631.2 | mA |
| LTE | data transfer | LTE-FDD Band3@22.95dBm | 639.6 | mA |
| | | LTE-FDD Band8 @23.17dBm | 542 | mA |
| | | LTE-TDD Band38 @22.02dBm | 422.89 | mA |
| | | LTE-TDD Band39 @22.13dBm | 458 | mA |
| | | LTE-TDD Band40 @22.01dBm | 392.9 | mA |
| | | LTE-TDD Band41 @22.31dBm | 441.4 | mA |

Table 19: SC20-E Current Consumption

| Parameter | Description | Conditions | Typ. | Unit |
|------------------|-------------------------|-----------------|------|------|
| I _{BAT} | OFF state | Power down | 80 | uA |
| | GSM/GPRS supply current | Sleep @DRX=2 | 3.38 | mA |
| | | Sleep @DRX=5 | 2.31 | mA |
| | | Sleep @DRX=9 | 1.98 | mA |
| | WCDMA supply current | Sleep @DRX=6 | 2.77 | mA |

| Parameter | Description | Conditions | Typ. | Unit |
|-----------|------------------------|----------------------------|------|------|
| | LTE-FDD supply current | Sleep @DRX=7 | 2.17 | mA |
| | | Sleep @DRX=8 | 1.90 | mA |
| | | Sleep @DRX=9 | 1.72 | mA |
| | | Sleep @DRX=5 | 5.49 | mA |
| | | Sleep @DRX=6 | 3.06 | mA |
| | | Sleep @DRX=7 | 2.37 | mA |
| | | Sleep @DRX=8 | 1.91 | mA |
| | LTE-TDD supply current | Sleep @DRX=5 | 5.51 | mA |
| | | Sleep @DRX=6 | 3.45 | mA |
| | | Sleep @DRX=7 | 2.40 | mA |
| | | Sleep @DRX=8 | 1.85 | mA |
| | GSM voice call | Sleep PCL=5@32.79dBm | 255 | mA |
| | | GSM850 PCL=12@19.04dBm | 135 | mA |
| | | GSM850 PCL=19@5.37dBm | 108 | mA |
| | | EGSM900 PCL=5@32.95dBm | 264 | mA |
| | | EGSM900 PCL=12@19.23dBm | 137 | mA |
| | | EGSM900 PCL=19@5.71dBm | 109 | mA |
| | | DCS1800 PCL=0@29.74dBm | 197 | mA |
| | | DCS1800 PCL=7@16.31dBm | 153 | mA |
| | | DCS1800 PCL=15@0.48dBm | 131 | mA |
| | | | | |

| Parameter | Description | Conditions | Typ. | Unit |
|-----------|--------------------|--------------------------------|------|------|
| | WCDMA voice call | PCS1900 PCL=0@29.78dBm | 192 | mA |
| | | PCS1900 PCL=7@16.73dBm | 152 | mA |
| | | PCS1900 PCL=15@0.66dBm | 130 | mA |
| | | Band 1(max power) @23.10dBm | 521 | mA |
| | | Band 5(max power) @23.32dBm | 504 | mA |
| | | Band 8(max power) @23.26dBm | 536 | mA |
| | | GPRS850 (1UL/4DL) @32.83dBm | 260 | mA |
| | | GPRS850 (2UL/3DL) @32.72dBm | 422 | mA |
| | | GPRS850 (3UL/2DL) @30.71dBm | 491 | mA |
| | | GPRS850 (4UL/1DL) @29.59dBm | 571 | mA |
| | GPRS data transfer | GPRS900 (1UL/4DL) @33.02dBm | 272 | mA |
| | | GPRS900 (2UL/3DL) @32.87dBm | 443 | mA |
| | | GPRS900 (3UL/2DL) @30.84dBm | 510 | mA |
| | | GPRS900 (4UL/1DL) @29.77dBm | 599 | mA |
| | | DCS1800 (1UL/4DL) @29.74dBm | 204 | mA |
| | | DCS1800 (2UL/3DL) @29.63dBm | 306 | mA |
| | | DCS1800 (3UL/2DL) @29.48dBm | 415 | mA |
| | | DCS1800 (4UL/1DL) @29.64dBm | 517 | mA |
| | | PCS1900 (1UL/4DL) @29.75dBm | 197 | mA |
| | | PCS1900 (2UL/3DL) @29.63dBm | 297 | mA |

| Parameter | Description | Conditions | Typ. | Unit |
|-----------|---------------------|--------------------------------|------|------|
| | EDGE data transfer | PCS1900 (3UL/2DL) @29.48dBm | 396 | mA |
| | | PCS1900 (4UL/1DL) @29.30dBm | 503 | mA |
| | | EDGE850 (1UL/4DL) @26.71dBm | 175 | mA |
| | | EDGE850 (2UL/3DL) @26.73dBm | 268 | mA |
| | | EDGE850 (3UL/2DL) @26.62dBm | 259 | mA |
| | | EDGE850 (4UL/1DL) @26.54dBm | 451 | mA |
| | | EDGE900 (1UL/4DL) @27.05dBm | 182 | mA |
| | | EDGE900 (2UL/3DL) @26.99dBm | 281 | mA |
| | | EDGE900 (3UL/2DL) @27.07dBm | 374 | mA |
| | | EDGE900 (4UL/1DL) @26.84dBm | 476 | mA |
| | | DCS1800 (1UL/4DL) @25.56dBm | 178 | mA |
| | | DCS1800 (2UL/3DL) @25.69dBm | 263 | mA |
| | | DCS1800 (3UL/2DL) @25.56dBm | 352 | mA |
| | | DCS1800 (4UL/1DL) @25.30dBm | 446 | mA |
| | | PCS1900 (1UL/4DL) @26.08dBm | 120 | mA |
| | | PCS1900 (2UL/3DL) @25.91dBm | 231 | mA |
| | | PCS1900 (3UL/2DL) @25.92dBm | 347 | mA |
| | | PCS1900 (4UL/1DL) @25.66dBm | 464 | mA |
| | WCDMA data transfer | Band 1(HSDPA) @22.23dBm | 491 | mA |
| | | Band 5(HSDPA) @22.43dBm | 476 | mA |

| Parameter | Description | Conditions | Typ. | Unit |
|-----------|-------------------|-----------------------------|------|------|
| | LTE data transfer | Band 8(HSDPA) @22.34dBm | 491 | mA |
| | | Band 1(HSUPA) @21.62dBm | 486 | mA |
| | | Band 5(HSUPA) @22.12dBm | 467 | mA |
| | | Band 8(HSUPA) @21.82dBm | 492 | mA |
| | | LTE-FDD Band1 @22.71dBm | 690 | mA |
| | | LTE-FDD Band3@23.42dBm | 699 | mA |
| | | LTE-FDD Band5@23.64dBm | 684 | mA |
| | | LTE-FDD Band7 @22.98dBm | 868 | mA |
| | | LTE-FDD Band8 @23.59dBm | 681 | mA |
| | | LTE-FDD Band20 @23.48dBm | 692 | mA |
| | | LTE-TDD Band38 @23.21dBm | 500 | mA |
| | | LTE-TDD Band40 @23.28dBm | 449 | mA |
| | | LTE-TDD Band41 @23.00dBm | 481 | mA |

Table 20: SC20-A Current Consumption

| Parameter | Description | Conditions | Typ. | Unit |
|------------------|-------------------------|--------------|------|------|
| I _{BAT} | OFF state | Power down | 16 | uA |
| | | Sleep @DRX=2 | 3.45 | mA |
| | GSM/GPRS supply current | Sleep @DRX=5 | 2.53 | mA |
| | | Sleep @DRX=9 | 2.27 | mA |
| | WCDMA supply current | Sleep @DRX=6 | 3.16 | mA |
| | | Sleep @DRX=7 | 2.27 | mA |

| Parameter | Description | Conditions | Typ. | Unit |
|-----------|--------------------|--------------------------------|--------|------|
| | GSM voice call | Sleep @DRX=8 | 1.76 | mA |
| | | Sleep @DRX=9 | 1.78 | mA |
| | | GSM850PCL=5@32.48dBm | 253.09 | mA |
| | | GSM850PCL=12@19.35dBm | 138.58 | mA |
| | | GSM850PCL=19@5.47dBm | 109.84 | mA |
| | | PCS1900 PC=L0@30.08dBm | 202.50 | mA |
| | | PCS1900 PCL=7@16.86dBm | 157.92 | mA |
| | | PCS1900 PCL=15@1.13dBm | 135.44 | mA |
| | | Band 1(max power) @23.69dBm | 547.75 | mA |
| | | Band 2(max power) @23.90dBm | 576.08 | mA |
| | WCDMA voice call | Band 4(max power) @23.65dBm | 537.20 | mA |
| | | Band 5(max power) @23.47dBm | 533.06 | mA |
| | | Band 8(max power) @23.76dBm | 557.79 | mA |
| | | GPRS850 (1UL/4DL) @32.38dBm | 254.25 | mA |
| | | GPRS850 (2UL/3DL) @32.04dBm | 411.18 | mA |
| | GPRS data transfer | GPRS850 (3UL/2DL) @30.54dBm | 493.74 | mA |
| | | GPRS850 (4UL/1DL) @29.54dBm | 580.68 | mA |
| | | PCS1900 (1UL/4DL) @29.99dBm | 205.51 | mA |
| | | PCS1900 (2UL/3DL) @29.84dBm | 315.56 | mA |
| | | PCS1900 (3UL/2DL) @29.16dBm | 407.30 | mA |
| | | PCS1900 (4UL/1DL) @29.24dBm | 509.25 | mA |
| | | | | |

| Parameter | Description | Conditions | Typ. | Unit |
|-----------|---------------------|--------------------------------|--------|------|
| | EDGE data transfer | EDGE850 (1UL/4DL) @26.80dBm | 173.67 | mA |
| | | EDGE850 (2UL/3DL) @26.69dBm | 268.78 | mA |
| | | EDGE850 (3UL/2DL) @26.52dBm | 360.92 | mA |
| | | EDGE850 (4UL/1DL) @26.41dBm | 459.33 | mA |
| | | PCS1900 (1UL/4DL) @25.96dBm | 174.92 | mA |
| | | PCS1900 (2UL/3DL) @25.80dBm | 269.30 | mA |
| | | PCS1900 (3UL/2DL) @25.56dBm | 360.28 | mA |
| | | PCS1900 (4UL/1DL) @25.40dBm | 462 | mA |
| | WCDMA data transfer | Band 1(HSDPA) @22.7dBm | 487.87 | mA |
| | | Band 2(HSDPA) @22.90dBm | 539 | mA |
| | | Band 4(HSDPA) @22.73dBm | 495.49 | mA |
| | | Band 5(HSDPA) @22.73dBm | 497.11 | mA |
| | | Band 8(HSDPA) @22.74dBm | 499.5 | mA |
| | | Band 1(HSUPA) @22.03dBm | 496.03 | mA |
| | | Band2(HSUPA) @22.57dBm | 534 | mA |
| | | Band 4(HSUPA) @22.24dBm | 495.66 | mA |
| | | Band 5(HSUPA) @22.1dBm | 494.12 | mA |
| | LTE data transfer | Band 8(HSUPA) @22.02dBm | 489.2 | mA |
| | | LTE-FDD Band2 @23.06dBm | 765 | mA |
| | | LTE-FDD Band4 @23.12dBm | 758 | mA |
| | | LTE-FDD Band5@23.5dBm | 673.55 | mA |
| | | LTE-FDD Band7@22.59dBm | 790.28 | mA |
| | | LTE-FDD Band12 @23.3dBm | 674.84 | mA |

| Parameter | Description | Conditions | Typ. | Unit |
|-----------|-------------|-------------------------|--------|------|
| | | LTE-FDD Band13 @23.3dBm | 674.84 | mA |
| | | LTE-FDD Band25 @23.1dBm | 760 | mA |
| | | LTE-FDD Band26 @23.2dBm | 731 | mA |

7.6. Electrostatic Discharge

The module is not protected against electrostatic discharge (ESD) in general. Consequently, it should be subject to ESD handling precautions that are typically applied to ESD sensitive components. Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the module.

The following table shows the module electrostatic discharge characteristics.

Table 21: Electrostatic Discharge Characteristics (Temperature: 25℃, Humidity: 45%)

| Tested Points | Contact Discharge | Air Discharge | Unit |
|------------------------|-------------------|---------------|------|
| VBAT, GND | +/-5 | +/-10 | KV |
| All Antenna Interfaces | +/-5 | +/-10 | KV |
| USB Interfaces | +/-0.5 | +/-1 | KV |
| Other Interfaces | +/-0.5 | +/-1 | KV |

8 Technical Dimensions

This chapter describes the mechanical dimensions of the module. All dimensions are measured in mm.

8.1. Mechanical Dimensions of the Module

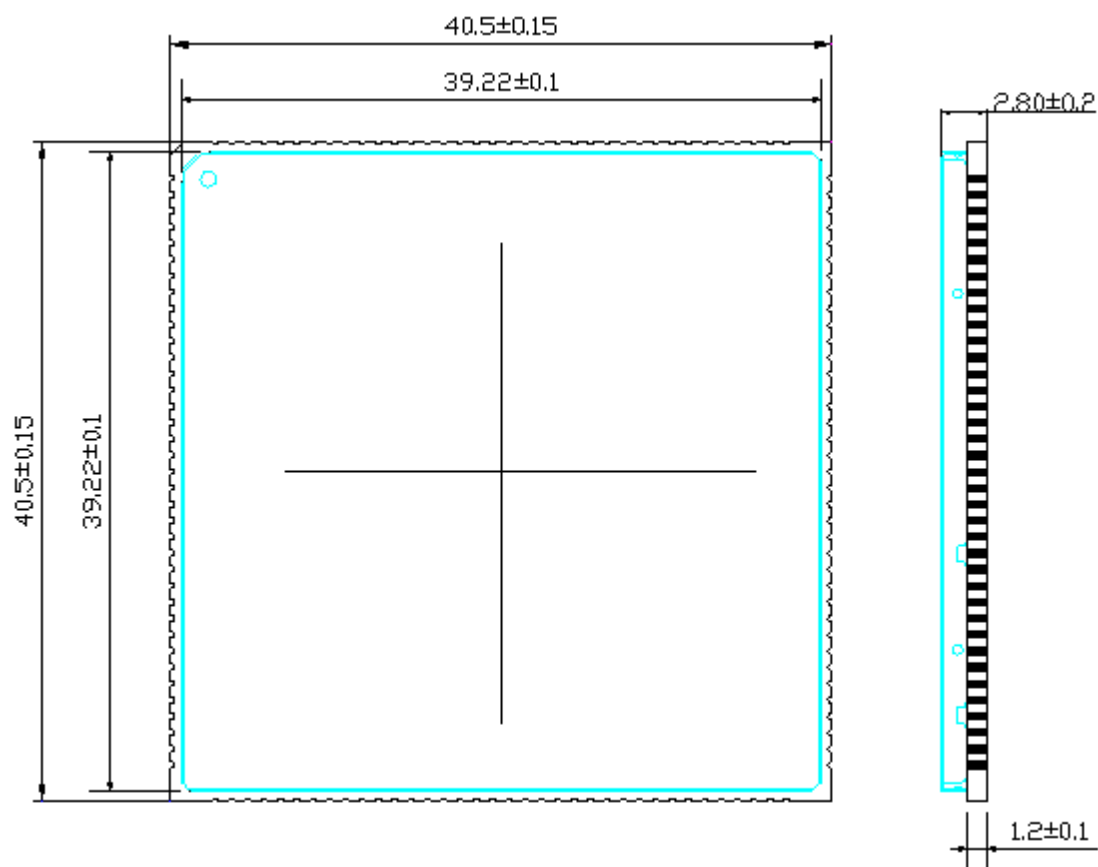


Figure 3: Module Top and Side Dimensions

8.3. Top and Bottom View of the Module



Figure 6: Top View of the Module

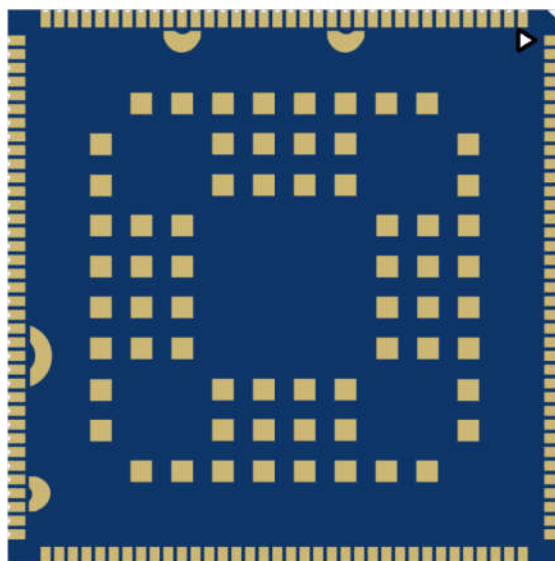


Figure 7: Bottom View of the Module

NOTE

These are design effect drawings of SC20 module. For more accurate pictures, please refer to the module that you get from Quectel.

9 Storage, Manufacturing and Packaging

9.1. Storage

SC20 is stored in a vacuum-sealed bag. The restrictions of storage condition are shown as below.

1. Shelf life in sealed bag is 12 months at $< 40^{\circ}\text{C}/90\%\text{RH}$.
2. After this bag is opened, devices that will be subjected to reflow soldering or other high temperature process must be:
 - Mounted within 72 hours at factory conditions of $\leq 30^{\circ}\text{C}/60\%\text{RH}$.
 - Stored at $< 10\% \text{ RH}$.
3. Devices require baking before mounting, if:
 - Humidity indicator card is $> 10\%$ when ambient temperature is $23^{\circ}\text{C}\pm 5^{\circ}\text{C}$.
 - Mounting cannot be finished within 72 hours at factory conditions of $\leq 30^{\circ}\text{C}/60\% \text{ RH}$.
4. If baking is required, devices may be baked for 48 hours at $125^{\circ}\text{C}\pm 5^{\circ}\text{C}$.

NOTE

As plastic package cannot be subjected to high temperatures, the package must be removed from devices before high temperature (125°C) baking. If shorter baking time is desired, please refer to IPC/JEDECJ-STD-033 for baking procedure.

9.2. Manufacturing and Welding

Push the squeegee to apply the solder paste on the surface of stencil, thus making the paste fill the stencil openings and then penetrate to the PCB. The force on the squeegee should be adjusted properly so as to produce a clean stencil surface on a single pass. To ensure the module soldering quality, the thickness of stencil at the hole of the module pads should be 0.18mm. For details, please refer to *document [3]*.

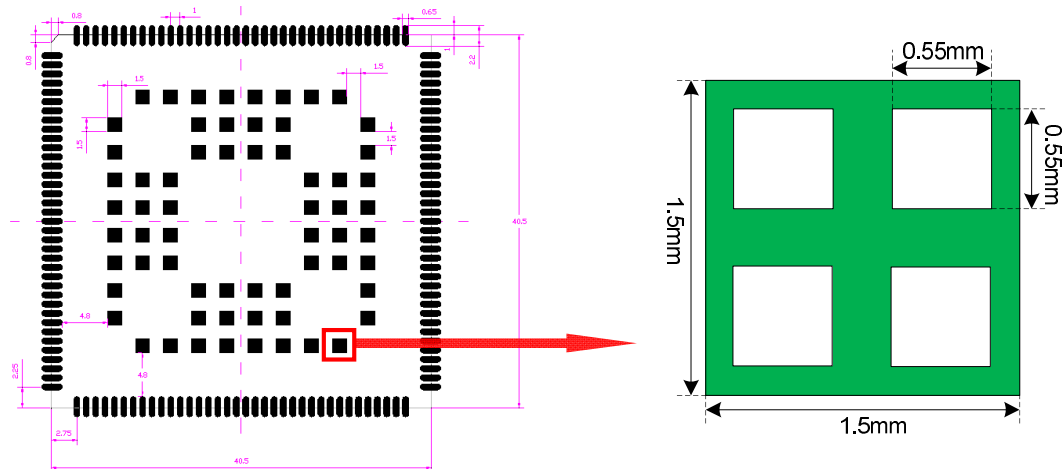


Figure 8: Recommended Stencil Design for LGA Pads

It is suggested that the peak reflow temperature is from 235 to 245°C (for SnAg3.0Cu0.5 alloy). The absolute maximum reflow temperature is 260°C. To avoid damage to the module caused by repeated heating, it is suggested that the module should be mounted after reflow soldering for the other side of PCB has been completed. Recommended reflow soldering thermal profile is shown below:

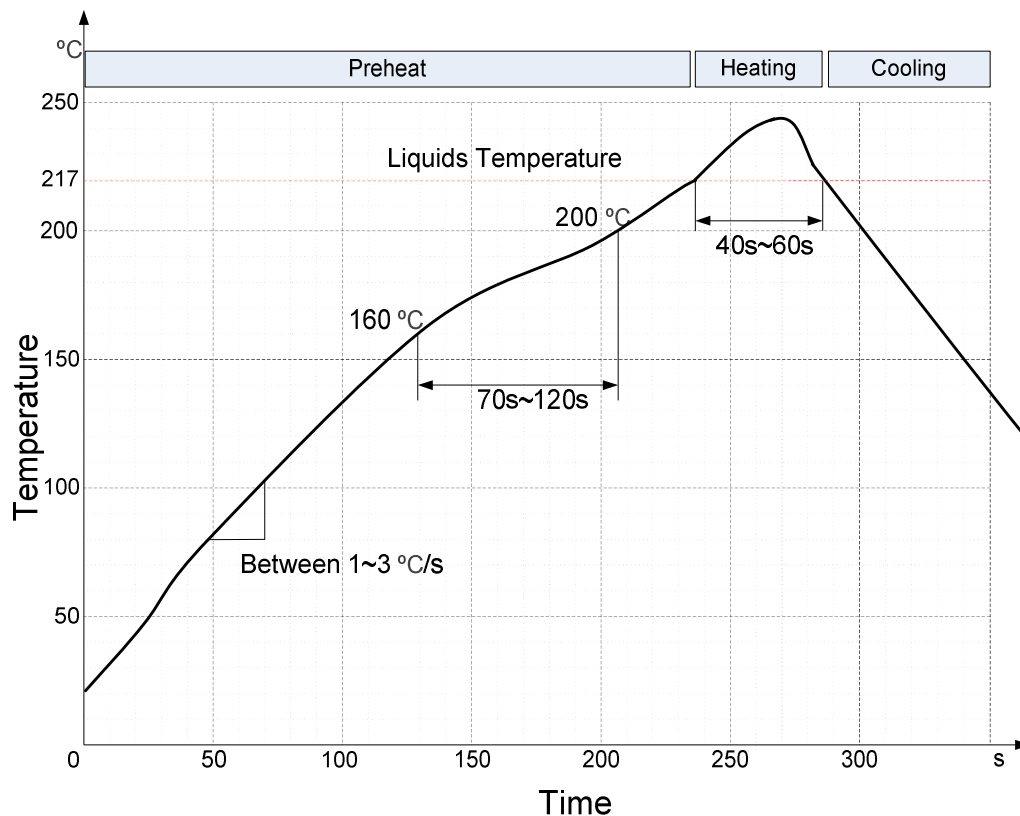


Figure 9: Reflow Soldering Thermal Profile

9.3. Packaging

SC20 is packaged in tape and reel carriers. One reel is 12.32 meters long and contains 200pcs modules. The following figures show the package details, measured in mm.

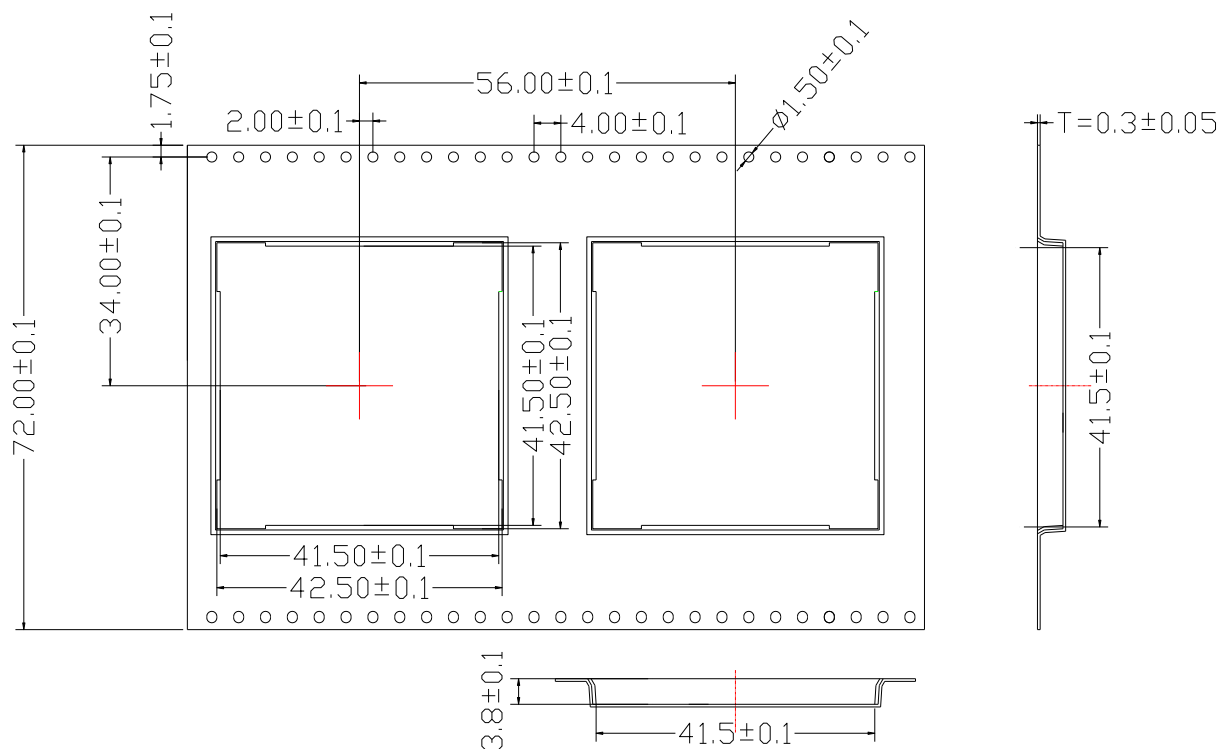


Figure 10: Tape Dimensions

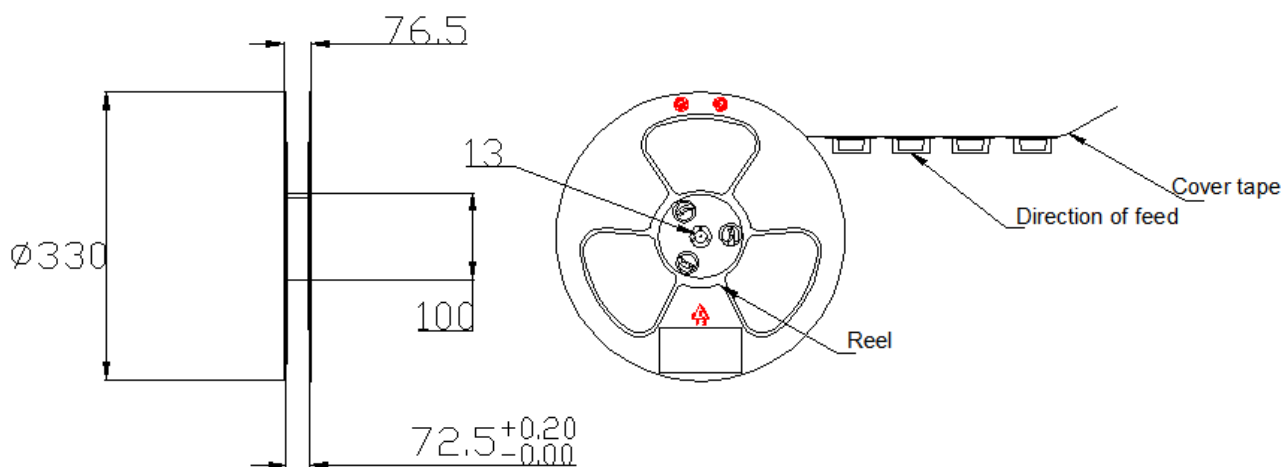


Figure 11: Reel Dimensions

Table 22: Reel Packaging

| Model Name | MOQ for MP | Minimum Package: 200pcs | Minimum Package×4=800pcs |
|------------|------------|--|--|
| SC20 | 200 | Size: 370mm*350mm*85mm N.W: 1.92kg G.W: 3.17kg | Size: 380mm*365mm*365mm N.W:7.68 kg G.W:13.63 kg |

10 Appendix A GPRS Coding Schemes

Table 23: Description of Different Coding Schemes

| Scheme | CS-1 | CS-2 | CS-3 | C4-4 |
|------------------------------|------|------|------|------|
| Code Rate | 1/2 | 2/3 | 3/4 | 1 |
| USF | 3 | 3 | 3 | 3 |
| Pre-coded USF | 3 | 6 | 6 | 12 |
| Radio Block excl.USF and BCS | 181 | 268 | 312 | 428 |
| BCS | 40 | 16 | 16 | 16 |
| Tail | 4 | 4 | 4 | - |
| Coded Bits | 456 | 588 | 676 | 456 |
| Punctured Bits | 0 | 132 | 220 | - |
| Data Rate Kb/s | 9.05 | 13.4 | 15.6 | 21.4 |

11 Appendix B GPRS Multi-slot Classes

Twenty-nine classes of GPRS multi-slot modes are defined for MS in GPRS specification. Multi-slot classes are product dependent, and determine the maximum achievable data rates in both the uplink and downlink directions. Written as 3+1 or 2+2, the first number indicates the amount of downlink timeslots, while the second number indicates the amount of uplink timeslots. The active slots determine the total number of slots the GPRS device can use simultaneously for both uplink and downlink communications.

The description of different multi-slot classes is shown in the following table.

3. Table 24: GPRS Multi-slot Classes

| Multislot Class | Downlink Slots | Uplink Slots | Active Slots |
|-----------------|----------------|--------------|--------------|
| 1 | 1 | 1 | 2 |
| 2 | 2 | 1 | 3 |
| 3 | 2 | 2 | 3 |
| 4 | 3 | 1 | 4 |
| 5 | 2 | 2 | 4 |
| 6 | 3 | 2 | 4 |
| 7 | 3 | 3 | 4 |
| 8 | 4 | 1 | 5 |
| 9 | 3 | 2 | 5 |
| 10 | 4 | 2 | 5 |
| 11 | 4 | 3 | 5 |
| 12 | 4 | 4 | 5 |

12 Appendix C EDGE Modulation and Coding Schemes

Table 25: EDGE Modulation and Coding Schemes

| Coding Scheme | Modulation | Coding Family | 1 Timeslot | 2 Timeslot | 4 Timeslot |
|---------------|------------|---------------|------------|------------|------------|
| CS-1 | GMSK | / | 9.05kbps | 18.1kbps | 36.2kbps |
| CS-2 | GMSK | / | 13.4kbps | 26.8kbps | 53.6kbps |
| CS-3 | GMSK | / | 15.6kbps | 31.2kbps | 62.4kbps |
| CS-4 | GMSK | / | 21.4kbps | 42.8kbps | 85.6kbps |
| MCS-1 | GMSK | C | 8.80kbps | 17.60kbps | 35.20kbps |
| MCS-2 | GMSK | B | 11.2kbps | 22.4kbps | 44.8kbps |
| MCS-3 | GMSK | A | 14.8kbps | 29.6kbps | 59.2kbps |
| MCS-4 | GMSK | C | 17.6kbps | 35.2kbps | 70.4kbps |
| MCS-5 | 8-PSK | B | 22.4kbps | 44.8kbps | 89.6kbps |
| MCS-6 | 8-PSK | A | 29.6kbps | 59.2kbps | 118.4kbps |
| MCS-7 | 8-PSK | B | 44.8kbps | 89.6kbps | 179.2kbps |
| MCS-8 | 8-PSK | A | 54.4kbps | 108.8kbps | 217.6kbps |
| MCS-9 | 8-PSK | A | 59.2kbps | 118.4kbps | 236.8kbps |

13 CE Requirement

The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20cm.

Hereby, Quectel Wireless Solutions Co., Ltd. declares that the radio equipment type SC20-E is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address:

7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

<http://www.quectel.com/support/downloadb/TechnicalDocuments.htm>

This SC20-E operates with the following frequency bands and maximum radio-frequency power:

GSM850/900 : 35dBm

GSM1800/1900: 32dBm

UMTS Band 1/5/8: 25 dBm

LTE Band 1/3/5/7/8/20/38/40/41: 25.7 dBm

Bluetooth: <20 dBm

WiFi 2.4GHz <20 dBm;

WiFi 5GHz band 1/2/3 <23 dBm

14 IC & FCC Requirement

14.1. FCC Regulations:

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.

This device 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:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

14.2. RF Exposure Information

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.

14.3. ISED Notice

This device complies with Innovation, Science and Economic Development Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

14.4. ISED Radiation Exposure Statement

This device complies with RSS-102 radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the ISED radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.

Cet appareil est conforme aux limites d'exposition aux rayonnements de la CNR-102 définies pour un environnement non contrôlé. Afin d'éviter la possibilité de dépasser les limites d'exposition aux fréquences radio de la CNR-102, la proximité humaine à l'antenne ne doit pas être inférieure à 20 cm (8 pouces) pendant le fonctionnement normal.

14.5. IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module. 20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

14.6. USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

14.7. LABEL OF THE END PRODUCT:

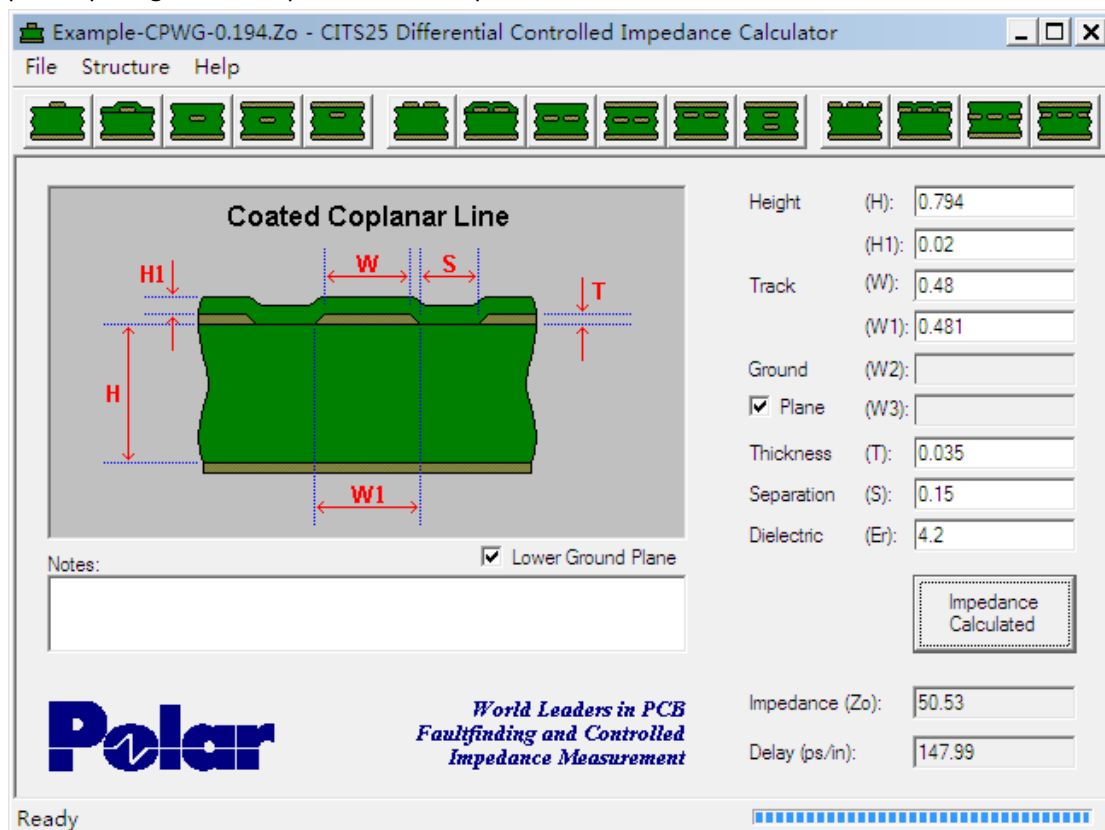
The final end product must be labeled in a visible area with the following " Contains Transmitter Module FCC ID: XMR201706SC20A". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

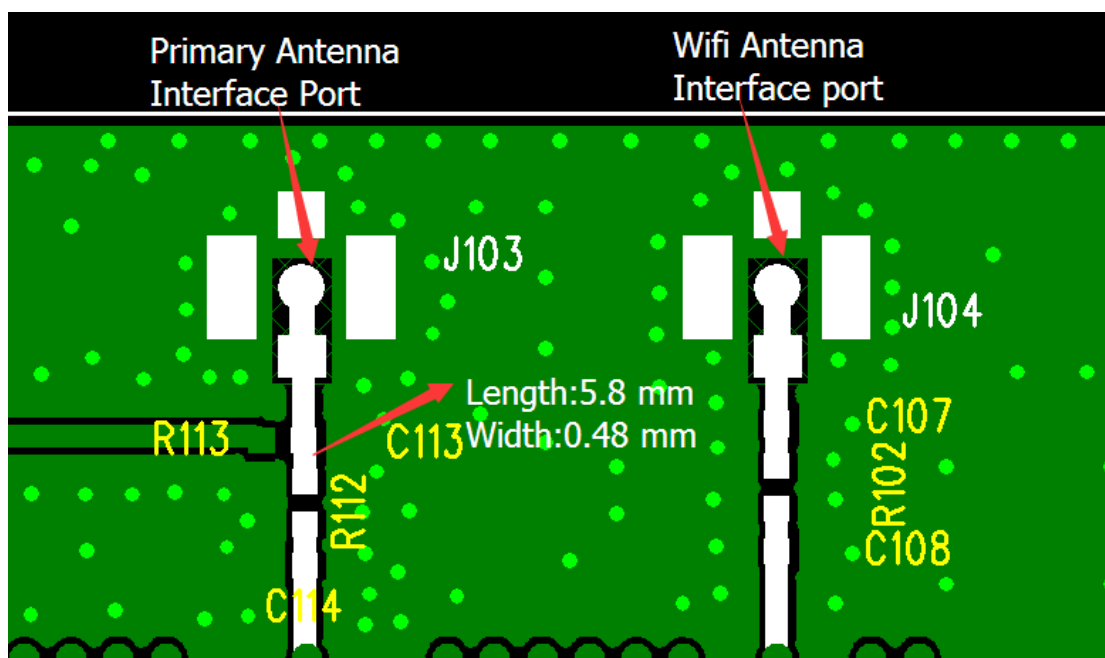
The Innovation, Science and Economic Development Canada certification label of a module shall be clearly visible at all times when installed in the host device; otherwise, the host device must be labeled to display the Innovation, Science and Economic Development Canada certification number for the module, preceded by the words "Contains transmitter module IC: 10224A-201707SC20A".

The device is going on be operated in 5150~5250 frequency range. It is restricted indoor environment only in Canada.

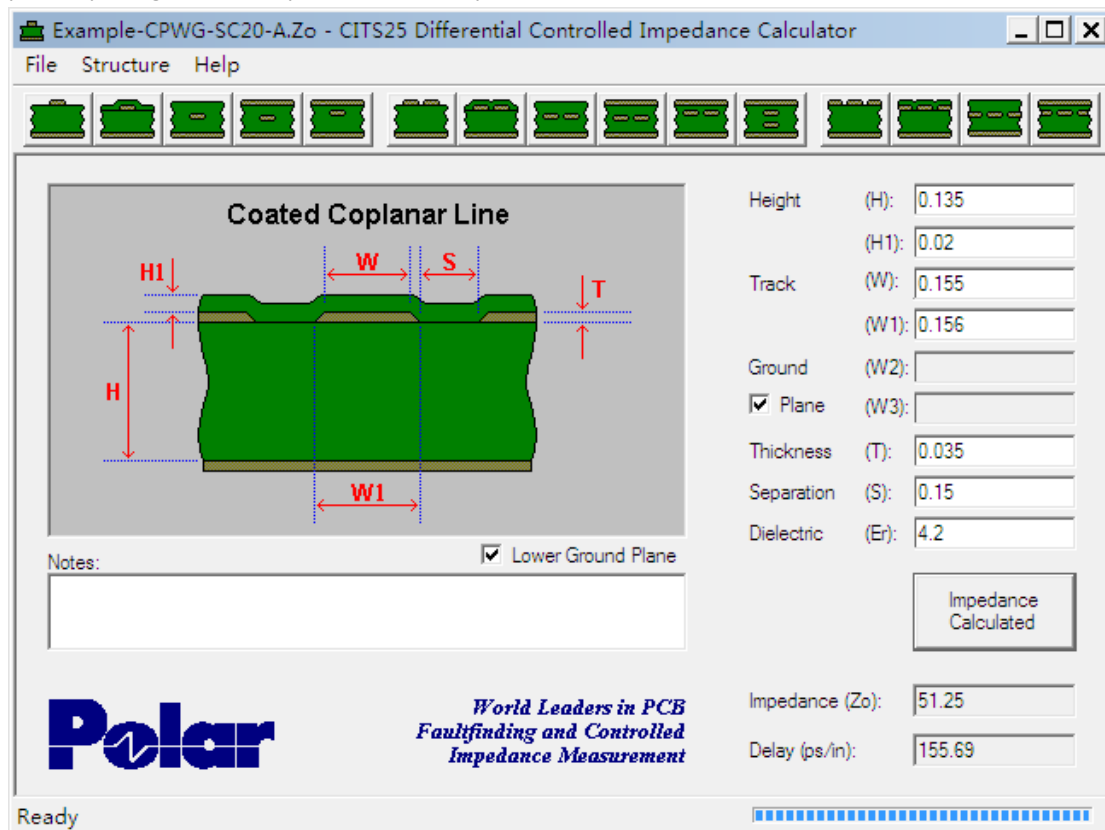
1、the characteristic impedance depends on the dielectric of PCB, the trace width and the grand plane spacing, Coated Coplanar Line is required. the detail simulation as below.



2、the RF trace of the test board which was used in the FCC test is defined as below.



3、the characteristic impedance depends on the dielectric of PCB, the trace width and the grand plane spacing, Coated Coplanar Line is required. the detail simulation as below.



4、the RF trace of the test board which was used in the FCC test is defined as below.

