Fibocom
PERFECT WIRELESS EXPERIENCE

SC228-GL Hardware Guide

V1.2

Disclaimer

Any action you take in the course of using this document is at your own risk, and Fibocom shall not be liable for any damages or losses under any circumstances. Due to product version upgrade or other reasons, Fibocom reserves the right to modify any information in this document at any time without prior notice and any responsibility. Unless otherwise agreed, all statements, information and suggestions in this document do not constitute any express or implied guarantee.

This document may include the third-party information covering products, services, software, data, and so on. Fibocom does not control and assumes no responsibility for the third-party content, including but not limited to the accuracy, compatibility, reliability, availability, legitimacy, appropriateness, performance, non-infringement, and status update, unless otherwise specified in this document. Fibocom does not provide any guarantee or authorization for the third-party content mentioned or referenced in this document. If you need a third-party license, obtain it in an authorized or legal way, unless otherwise specified in this document.

Copyright Notice

Unless specially authorized by Fibocom, the recipient of the documents shall keep the documents and information received confidential, and shall not use them for any purpose other than the implementation and development of this project. Without the written permission of Fibocom, no unit or individual shall extract or copy part or all of the contents of this document without authorization, or transmit them in any form. Fibocom has the right to investigate legal liabilities for any offense and tort in connection with violation of confidentiality obligations, or unauthorized use or malicious use of the said documents and information in other illegal forms.

Trademark Statement

Fibocom The trademark is registered and owned by Fibocom Wireless Inc.

Other trademarks, product names, service names and company names appearing in this document are owned by their respective owners.

Contact Information

Website: https://www.fibocom.com

Address: 10/F-14/F, Block A, Building 6, Shenzhen International Innovation Valley, Dashi First Road, Xili Community, Xili Subdistrict, Nanshan District, Shenzhen

Tel: 0755-26733555

Contents

Applicable Models

No.	Applicable Model	Description
1	SC228-GL-20	4GB+64GB memory, suitable for Global

1 Foreword

1.1 Description

This document describes the electrical characteristics, RF performance, structure size, application environment, etc. of the SC228 module. With the assistance of the document and other instructions, the developers can quickly understand the hardware functions of the module and develop products.

1.2 Reference Standards

This product is designed with reference to the following standards:

- 3GPP TS 51.010-1 V10.5.0: Mobile Station（MS）conformance specification; Part 1： Conformance specification
- 3GPP TS 34.121-1 V10.8.0: User Equipment （UE）conformance specification; Radio transmission and reception（FDD）;Part 1: Conformance specification
- 3GPP TS 34.122 V10.1.0: Technical Specification Group Radio Access Network; Radio transmission and reception（TDD）
- 3GPP TS 36.521-1 V15.0.0: User Equipment （UE） conformance specification; Radio transmission and reception; Part 1: Conformance testing
- 3GPP TS 38.300 V15.5.0: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; NR and NG-RAN Overall Description; Stage 2
- 3GPP TS 38.521-1 V15.2.0: User Equipment （UE） conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone;
- 3GPP TS 38.521-3 V15.2.0: User Equipment （UE） conformance specification; Radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios;
- IEEE 802.11n WLAN MAC and PHY, October 2009+ IEEE 802.11-2007 WLAN MAC and PHY, June 2007
- IEEE Std 802.11b, IEEE Std 802.11a, IEEE Std 802.11g, IEEE Std 802.11n, IEEE Std 802.11ac, IEEE Std 802.11ax；
- IEEE 802.11-2007 WLAN MAC and PHY, June 2007
- 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
- Bluetooth Low Energy RF PHY Test Specification, RF-PHY.TS/4.0.0, December 15, 2009
- Bluetooth Low Energy RF PHY Test Specification, RF-PHY.TS/4.2.0, November 7, 2014
- Bluetooth Low Energy RF PHY Test Specification, RF-PHY.TS/5.0.2, December 07,2017
- Bluetooth Low Energy RF PHY Test Specification, RF-PHY.TS/5.1.1, August 07,2019
- Bluetooth Low Energy RF PHY Test Specification, RF-PHY.TS/5.2
- 3GPP TS 36.124V10.3.0: Electro Magnetic Compatibility（EMC）requirements for mobile terminals and ancillary equipment
- 3GPP TS 21.111 V10.0.0: USIM and IC card requirements
- 3GPP TS 51.011 V4.15.0: Specification of the Subscriber Identity Module -Mobile Equipment （SIM-ME） interface

- 3GPP TS 31.102 V10.11.0: Characteristics of the Universal Subscriber Identity Module （USIM） application
- 3GPP TS 31.11 V10.16.0: Universal Subscriber Identity Module（USIM）Application Toolkit（USAT）
- 3GPP TS 27.007 V10.0.8: AT command set for User Equipment（UE）
- 3GPPTS27.005 V10.0.1: Use of Data Terminal Equipment -Data Circuit terminating Equipment （DTE - DCE）interface for Short Message Service（SMS）and Cell Broadcast Service （CBS）
- PCI_Express_M.2_Specification_Rev1.1_TS_12092016_NCB
- Universal Serial Bus Specification 2.0
- Universal Serial Bus Specification 3.0

2 Product Overview

2.1 Product Introduction

The module integrates core components such as Baseband, Memory, PMU, Transceiver, PA; it supports long distance multi-mode communication such as FDD/TDD-LTE, WCDMA, GSM and WIFI/BT short-distance radio transmission technology, as well as GNSS wireless positioning technology. The module is embedded with Android operating system and supports various interfaces such as MIPI/USB/UART/SPI/I2C. It is the optimal solution for the core system of wireless smart products. Its corresponding network modes and frequency bands are as follows:

Table 1. Introduction to bands of SC228-GL

Mode	Band
GSM/GPRS/EDGE	GSM850/EGSM900/PCS1900/DCS1800
WCDMA	Band 1/2/4/5/6/8/9/19
FDD-LTE	Band 1/2/3/4/5/7/8/12/13/14/17/18/19/20/25/26/28/66/71
TDD-LTE	Band 34/38/39/40/41
WIFI802.11a/b/g/n/ac	2412MHz to2472MHz 5150MHzto 5850MHz
BT5.0	2402MHz to 2480MHz
GNSS	GPS(L1+L5)/Beidou/GLONASS/Galileo/QZSS

Table 2. Introduction to bands of SC228-W

Mode	Band
WIFI802.11a/b/g/n/ac	2412MHz to 2472MHz 5150MHz to 5850MHz
BT5.0	2402MHz to 2480MHz

SC228-W series does not support GNSS.

2.2 Key Features

Table 3. Key features

Feature	Description

Power Supply	DC: 3.5–4.35V, typical: 3.8 V
Application processor	Quad Cortex-A73＆Quad Cortex-A53 processor
Memory	4GB + 64GB
	8GB + 128GB
Power class	Class 4 (33dBm±2dB) for GSM850/900 Class 1 (30dBm±2dB) for DCS1800/1900 Class E2 (27dBm±3dB) for GSM850/900 8-PSK Class E2 (26dBm+3/-4dB) for DCS1800/1900 8-PSK Class 3 (24dBm+1/-3dB) for WCDMA bands Class 3 (23dBm±2dB) for LTE FDD bands Class 3 (23dBm±2dB) for LTE TDD bands
WCDMA features	Support 3GPP R8 DC-HSPA+ Support 16-QAM, 64-QAM and QPSK modulation CAT6 HSUPA: Maximum uplink rate 5.76Mbps CAT24 HSDPA: Maximum downlink rate 42Mbps
LTE features	Support FDD/TDD R10 Support FDD/TDD cat4 16QAM for UL, 64 QAM for DL Support DL 2×2 MIMO The maximum uplink rate of FDD is 50Mbps, and the maximum downlink rate is 150Mbps The maximum uplink rate of TDD is 30Mbps, and the maximum downlink rate is 130Mbps
WLAN features	Support 2.4G and 5G WLAN wireless communication. Support 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac. Maximum rate up to 433Mbps
Bluetooth features	BT5.0
Satellite positioning	GPS(L1+L5)/BeiDou/GLONASS/Galileo/QZSS
SMS	Text and PDU modes Point-to-Point MO and MT SMS cell broadcast SMS storage: stored in the module by default
LCD interface	One 4-Lane MIPI_DSI D-PHY 1.2 interface Maximum rate 1.5Gbps/lane

Camera interface	Three 4-Lane MIPI_CSI D-PHY 1.2 interfaces Maximum rate 2.5Gbps/lane, configurable as 4+4+2+1
Audio interface	Audio input: 3 analog microphone inputs with integrated internal bias Audio output: A set of differential earphone output

	A set of stereo handset output A set of differential Lineout output, requiring external audio PA
USB interface	One USB interface USB conforms to the 3.1 Gen 1 specification and is downward compatible with USB2.0. It can be used for data transmission and software debugging.
UIM interface	Two UIM card interfaces supporting 1.8V or 2.95V UIM card adaptation Support dual UIM dual standby single pass, support hot plug
UART interface	Two UART serial interfaces, with the maximum rate up to 4Mbps A set of debugging UART serial ports A set of four-wire serial ports supporting RTS and CTS hardware flow control
SD interface	Support 4-bit SD3.0, 1.8V/2.95V SD cards and hot plug
I2C interface	Multiple I2C interfaces can be used for peripherals such as TP, camera, sensor etc.
ADC interface	One channel universal ADC
RTC	Supported
Antenna interface	TRX, DRX, GNSS, WIFI/BT antenna interfaces.
Physical characteristics	Dimensions: (41.0±0.15) mm × (41.0±0.15) mm × (2.8+0.05/-0.2) mm Package: 148 LCC+128 LGA Weight: About 11.2 g
Temperature range	Operating temperature[1]: -30°C~75°C[1)] Storage temperature: -40°C~85°C
Software update	USB/OTA/SD
RoHS	Comply with RoHS standard

[1)] When the module is operating within this temperature range, the functions of it are normal and the relevant performance meets the 3GPP standard.

3 Antenna Interfaces

3.1 Definition of Antenna Interfaces

Table 30. Definition of antenna interfaces

Pin No.	Pin Name	Function Description	TX	RX	Frequency Range
94	ANT_MAIN	GSM&WCDMA&LTE(LB/MB/HB TRX)	GSM: 850/900/1800/1900 WCDMA: B1/B2/B4/B5/B6/B8/B9/B19 LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B66/B71 LTE-TDD: B34/B38/B39/B40/B41	GSM: 850/900/1800/1900 WCDMA: B1/B2/B4/B5/B6/B8/B9/B19 LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B66/B71 LTE-TDD: B34/B38/B39/B40/B41	617MHz-2689.9MHz
132	ANT_DRX	LTE(LB/MB/HB DRX)	LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B66/B71 LTE-TDD: B34/B38/B39/B40/B41	LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B66/B71 LTE-TDD: B34/B38/B39/B40/B41	617MHz-2689.9MHz
120	ANT_GNSS	GNSS antenna	--	GNSS	--
78	ANT_WIFI/BT	WI-FI/BT antenna	2.4G/5G/BT	2.4G/5G/BT	--

3.2 Operating Frequency

3.2.1 Cellular

Tables 31. Reference table of cellular frequency

Mode	Band	TX (MHz)	RX (MHz)
GSM	850	824.2-848.8	869.2-893.8
	900	880.2-914.8	925.2-959.8
	1800	1710.2-1784.8	1805.2-1879.8
	1900	1850.2-1909.8	1930.2-1989.8
WCDMA	Band 1	1922.4-1977.6	2112.4-2167.6
	Band 2	1852.4-1907.6	1932.4-1987.6
	Band 4	1712.4-1752.6	2112.4-2152.6
	Band 5	826.4-846.6	871.4-891.6
	Band 6	832.4-837.6	877.4-882.6
	Band 8	882.4-912.6	927.4-957.6
	Band 9	1752.4-1782.4	1847.4-1877.4
	Band 19	832.4-842.6	877.4-887.6
LTE FDD	Band 1	1920-1979.9	2110-2169.9
	Band 2	1850-1909.9	1930-1989.9
	Band 3	1710-1784.9	1805-1879.9
	Band 4	1710-1754.9	2110-2154.9
	Band 5	824-848.9	869-893.9
	Band 7	2500-2569.9	2620-2689.9
	Band 8	880-914.9	925-959.9
	Band 12	699-715.9	729-745.9
	Band 13	777-786.9	746-755.9
	Band 14	788-797.9	758-767.9

Mode	Band	TX (MHz)	RX (MHz)
	Band 17	704-715.9	734-745.9
	Band 18	815-829.9	860-874.9
	Band 19	830-844.9	875-889.9
	Band 20	832-861.9	791-820.9
	Band 25	1850-1914.9	1930-1994.9
	Band 26	814-848.9	859-893.9
	Band 28	703-747.9	758-802.9
	Band 66	1710-1779.9	2110-2179.9
	Band 71	663-697.9	617-651.9
LTE TDD	Band 34	2010-2024.9	2010-2024.9
	Band 38	2570-2619.9	2570-2619.9
	Band 39	1880-1919.9	1880-1919.9
	Band 40	2300-2399.9	2300-2399.9
	Band 41	2496-2689.9	2496-2689.9

3.2.2 WIFI

The module supports 2.4G/5G WLAN wireless communication, and supports 802.11a, 802.11b, 802.11g, 802.11n and 802.11ac. The maximum throughput is 433Mbps with the following characteristics:

- Support Wake-on-WLAN (WoWLAN)
- Support ad hoc mode
- Support WAPI
- Support AP mode
- Support Wi-Fi Direct
- 2.4G band supports CCK, OFDM, HT20 and HT40
- 5G band supports OFDM, VHT20, VHT40, VHT80

Test condition: 3.8V power supply, environment temperature of 25°C

Table 32. WIFI transmitting power

Frequency	Mode	Date Rate	Bandwidth (MHz)	TX Power (dBm)
2.4G	802.11b	1Mbps	20	17 ±3

Frequency	Mode	Date Rate	Bandwidth (MHz)	TX Power (dBm)
		11Mbps	20	17 ±3
	802.11g	6Mbps	20	16 ±3
		54Mbps	20	13 ±3
	802.11n	MCS0	20	15 ±3
		MCS7	20	13 ±3
		MCS0	40	14 ±3
		MCS7	40	12 ±3
5G	802.11a	6Mbps	20	16 ±3
		54Mbps	20	14 ±3
	802.11n	MCS0	20	15 ±3
		MCS7	20	12 ±3
		MCS0	40	14 ±3
		MCS7	40	12 ±3
	802.11ac	MCS0	20	15 ±3
		MCS8	20	12 ±3
		MCS0	40	14 ±3
		MCS9	40	11 ±3
		MCS0	80	13 ±3
		MCS9	80	10 ±3

Table 33. WIFI receiving sensitivity

Frequency	Mode	Date Rate	Bandwidth (MHz)	Sensitivity (dBm)
2.4G	802.11b	1Mbps	20	-91
		11Mbps	20	-87
	802.11g	6Mbps	20	-87
		54Mbps	20	-72

Frequency	Mode	Date Rate	Bandwidth (MHz)	Sensitivity (dBm)
	802.11n	MCS0	20	-88
		MCS7	20	-64
		MCS0	40	-86
		MCS7	40	-62
5G	802.11a	6Mbps	20	-90
		54Mbps	20	-74
	802.11n	MCS0	20	-89
		MCS7	20	-70
		MCS0	40	-86
		MCS7	40	-67
	802.11ac	MCS0	20	-90
		MCS8	20	-67
		MCS0	40	-87
		MCS9	40	-62
		MCS0	80	-83
		MCS9	80	-58

Microstrip line is recommended for RF routing of WIFI antenna. The insertion loss of 2.4G band is controlled within 0.2dB, the insertion loss of 5G band is controlled within 0.8dB, and the impedance is controlled within 50Ω.

Table 34. WIFI operating frequency

Mode	Frequency	Unit
2.4G	2412 to 2472	MHz
5G	5150 to 5850	MHz

3.2.3 Bluetooth

The module supports BT5.0 (BR/EDR+BLE) standard. The modulation method supports GFSK, 8-DPSK and π/4-DQPSK. The BR/EDR channel bandwidth is 1MHz and can accommodate 79 channels. The BLE can accommodate 40 channels. Its main features are as follows:

- BT 4.2+BR/EDR+BLE
- Support for ANT protocol
- Support for BT-WLAN coexistence operation, including optional concurrent receive
- Up to 3.5 piconets (master, slave and page scanning)

Table 35. BT rate and version information

Version	Date Rate	Throughput	Note
BT1.2	1Mbit/s	> 80Kbit/s	- -
BT2.0+EDR	3Mbit/s	> 80Kbit/s	- -
BT3.0+HS	24Mbit/s	Refer to 3.0+HS	- -
BT4.2 LE	24Mbit/s	Refer to 4.2 LE	- -
BT5.0 LE	24Mbit/s	Refer to 5.0 LE	- -

Test condition: 3.8V power supply, environment temperature of 25°C

Table 36. BT performance indicator

Type	DH-5	2-DH5	3-DH5	BLE	Unit
Transmitter	9 ±2.5	9 ±2.5	9 ±2.5	6 ±2.5	dBm
Sensitivity	-88	-86	-84	-92	dBm

The sensitivity here is a typical value. Microstrip line is recommended for the RF routing of Bluetooth antenna, with insertion loss within 0.2dB and impedance at 50Ω.

Table 37. BT operating frequency

Mode	Frequency	Unit
Bluetooth	2402 to 2480	MHz

3.2.4 GNSS

The module supports multiple positioning systems including GPS/Beidou/GLONASS/Galileo/QZSS. The module is embedded with LNA, which can effectively improve the sensitivity of GNSS. LNA is embedded in the module, which can effectively improve the sensitivity of GNSS.

Test condition: 3.8V power supply, environment temperature of 25°C

Table 38. GNSS positioning performance

Parameter	Description	Typical Result	Unit
Sensitivity	Acquisition	-145	dBm
	Tracking	-157	dBm
C/N	-130dBm	39	dB-Hz

Parameter	Description	Typical Result	Unit
TTFF	Cold Start	44	s
	Warm Start	40	s
	Hot Start	3	s
CEP	Static accuracy (95% @-130dBm)	5	m

Table 39. GNSS operating frequency

Mode	Frequency	Unit
GPS	L1: 1575.42 ±1.023 L5: 1176.45 ±5.11	MHz
GLONASS	L1: 1597.5-1605.9	MHz
BeiDou	B1I: 1561.098±2.046	MHz
Galileo	E1: 1575.42±2.02	MHz
QZSS	L1: 1575.42±1.023	MHz

4 Structure Specifications

7.1 Product Appearance

Figure 30. Product appearance

7.2 Structure Dimensions

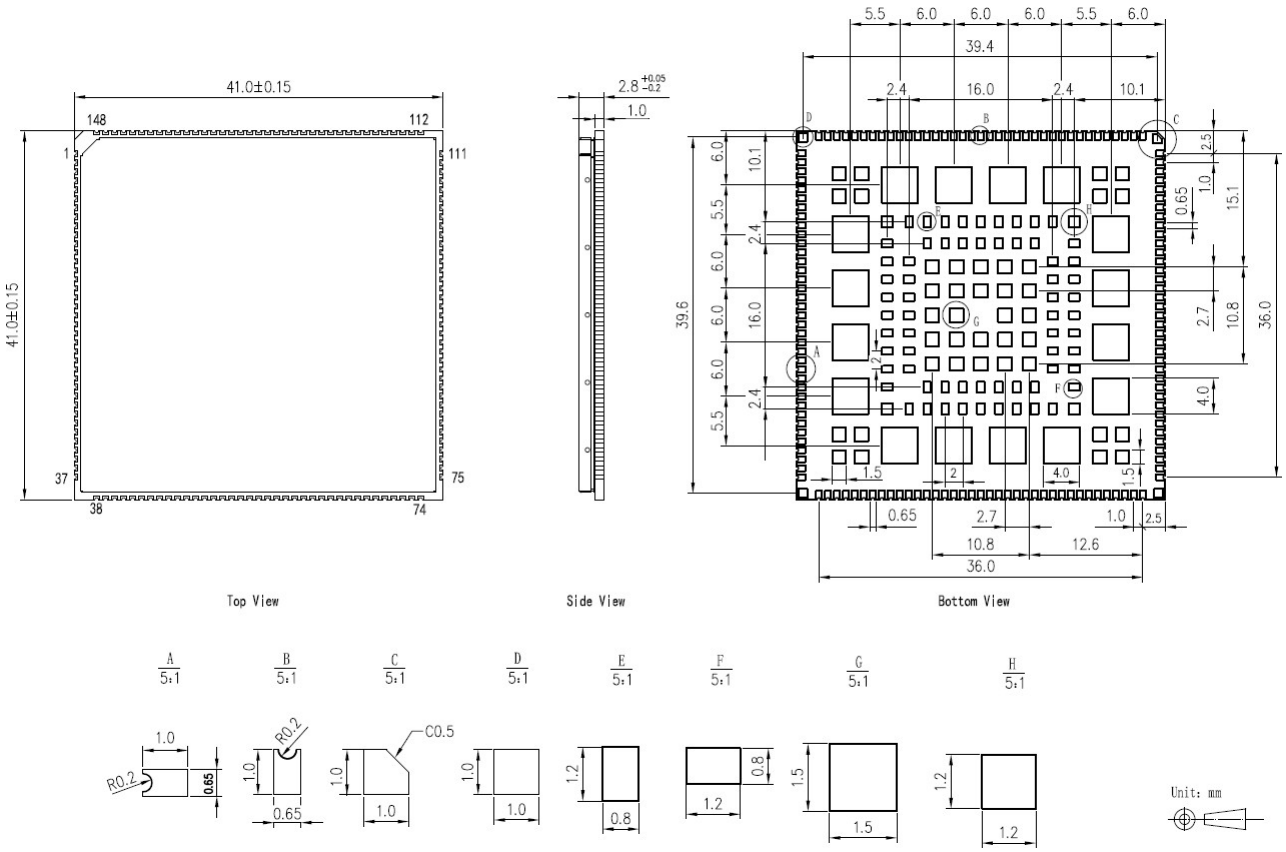

Figure 31. Structure dimensions (unit: mm)

7.3 PCB Package

The following figure shows the PCB package size of the module, and users can design the PCB package by themselves. Fibocom also provides users with a designed document *Fibocom_SC228_ Package*, which can be found in the package.

8 Regulatory Compliance statement

8.1 CE Regulatory Compliance statement

This equipment complies with CE radiation exposure limits set forth for anuncontrolled environment, This equipment should be installed and operated withminimum distance of 20 cm between the radiator and your body.

Hereby, Fibocom Wireless Inc. declares that the radio equipment type SC228-GL is in compliance with Directive 2014/53/EU as well as UK Radio Equipment Regulations SI 2017 No.1206. The full text of the EU/UK declaration of conformity is available at the following internet address: Download Center (fibocom.com) for CE.

Frequency band: 5150 - 5250 MHz:
Indoor use: Inside buildings only. Installations and use inside road vehicles and train carriages are not permitted. Limited outdoor use: If used outdoors, equipment shall not be attached to a fixed installation or to the external body of road vehicles, a fixed infrastructure or a fixed outdoor antenna. Use by unmanned aircraft systems (UAS) is limited to within the 5170 - 5250 MHz band.

Frequency band: 5250 - 5350 MHz:
Indoor use: Inside buildings only. Installations and use in road vehicles, trains and aircraft are not permitted. Outdoor use is not permitted.

Frequency band: 5470 - 5725 MHz:
Installations and use in road vehicles, trains and aircraft and use for unmanned aircraft systems (UAS) are not permitted.

	AT	BE	BG	CZ	DK	EE	FR	DE	IS	IE	IT
	EL	ES	CY	LV	LI	LT	LU	HU	MT	NL	NO
	PL	PT	RO	SI	SK	TR	FI	SE	CH	UK(NI)	HR

8.2 FCC Conformance information

Important Notice to OEM integrators

This module is limited to OEM installation ONLY.

This module is limited to installation in mobile applications, according to Part 2.1091(b).

The separate approval is required for all other operating configurations, including portable

configurations with respect to Part 2.1093 and different antenna configurations

For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify

compliance as a composite system. When testing the host device for compliance with Part 15

Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s). The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

Important Note

notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to Fibocom Wireless Inc. that they wish to change the antenna trace design. In this case, a Class II permissive chang

application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC/IC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID: ZMOSC228GL” “Contains IC: 21374-SC228GL “ The FCC ID/IC ID can be used only when all FCC/IC compliance requirements are met.

Antenna Installation

The antenna must be installed such that 20 cm is maintained between the antenna and users,

The transmitter module may not be co-located with any other transmitter or antenna. Part 15 antenna must meet the requirements of FCC Rule §15.203, which requires the use of a permanently attached antenna or of an antenna that uses a unique coupling.

Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

	Antenna Type	Gain (dBi)
BT EDR/BT LE/WLAN 2.4G	Dipole	3.02
RLAN 5G	Dipole	6.30
GSM 850	Dipole	1.32
PCS 1900	Dipole	2.85
WCDMA Band II	Dipole	2.85
WCDMA Band IV	Dipole	2.98
WCDMA Band V	Dipole	1.32
LTE Band 2	Dipole	2.85
LTE Band 4	Dipole	2.98
LTE Band 7	Dipole	2.21
LTE Band 12	Dipole	1.61
LTE Band 13	Dipole	1.83
LTE Band 17	Dipole	1.58
LTE Band 25	Dipole	2.77

LTE Band 26	Dipole	0.7
LTE Band 38	Dipole	1.71
LTE Band 41	Dipole	2.21
LTE Band 66	Dipole	2.98
LTE Band 71	Dipole	1.61

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/IC authorization is no longer considered valid and the FCC ID/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 FCC/IC authorization.

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.

Federal Communication Commission Interference Statement

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 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 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.

Any changes or modifications not expressly approved by the party responsible for

compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

List of applicable FCC rules

This module has been tested and found to comply with part 22, part 24, part 27, part 90 , part 15B requirements for Modular Approval. The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

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 co-located 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.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

8.3 ISED Conformance information

Industry Canada Statement This device complies with Industry Canada’s licence-exempt RSSs.

Operation is subject to the following two conditions:

This device may not cause interference; and

This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

l'appareil ne doit pas produire de brouillage, et

l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled

environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

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

The antenna must be installed such that 20 cm is maintained between the antenna and users, and

The transmitter module may not be co-located 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)

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

Le module émetteur peut ne pas être coïmplanté avec 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 can not 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 can not be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating 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: 21374-SC228GL”.

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: 21374-SC228GL ".

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.

Appendix A. Reference Documents

Category	Document Name
Reference design	Fibocom_SC228_Package
	Fibocom_SC228_Reference Design
Development kit	Fibocom_SC228_ADP User Guide
	Fibocom_EVB-SOC_User Guide
User Guide	Fibocom_Design Guide_RF Antenna
	Fibocom_SC228_SMT Design Guide
	Fibocom_General Thermal Design Guide for Modules

Appendix B. Acronyms and Abbreviations

Acronym and Abbreviation	Description
AMR	Adaptive Multi-rate
bps	Bits Per Second
CS	Coding Scheme
DRX	Discontinuous Reception
FDD	Frequency Division Duplexing
GMSK	Gaussian Minimum Shift Keying
HSDPA	High Speed Down Link Packet Access
IMEI	International Mobile Equipment Identity
Imax	Maximum Load Current
LED	Light Emitting Diode
LSB	Least Significant Bit
LTE	Long Term Evolution
CA	Carrier Aggregation
DLCA	Downlink Carrier Aggregation
SCell	Secondary Cell for CA
ME	Mobile Equipment
MS	Mobile Station
MT	Mobile Terminated
PCB	Printed Circuit Board
PDU	Protocol Data Unit
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RHCP	Right Hand Circularly Polarized RMS
RMS	Root Mean Square
RTC	Real Time Clock
Rx	Receive
SMS	Short Message Service

TDMA	Time Division Multiple Access
TE	Terminal Equipment
TX	Transmitting Direction
TDD	Time Division Duplexing
UART	Universal Asynchronous Receiver & Transmitter
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
(U)SIM	(Universal) Subscriber Identity Module
USSD	Unstructured Supplementary Service Data
Vmax	Maximum Voltage Value
Vnorm	Normal Voltage Value
Vmin	Minimum Voltage Value
VIHmax	Maximum Input High Level Voltage Value
VIHmi	Minimum Input High Level Voltage Valu
VILmax	Maximum Input Low Level Voltage Value
VILmin	Minimum Input Low Level Voltage Value
VImax	Absolute Maximum Input Voltage Value
VImin	Absolute Minimum Input Voltage Value
VOHmax	Maximum Output High Level Voltage Value
VOHmin	Minimum Output High Level Voltage Value
VOLmax	Maximum Output Low Level Voltage Value
VOLmin	Minimum Output Low Level Voltage Value
VSWR	Voltage Standing Wave Ratio
WCDMA	Wideband Code Division Multiple Access