

SY288 LTE Cat.1 bis Module Specification

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1. Overview

SY288 is a low-power LTE CAT1 module supporting mainstream frequency bands worldwide. It can be widely used in POS terminals, cloud speakers, IPC cameras, trackers, shared devices, and other IoT product fields.

2. Specifications

Item	Specification
Chip Model	EC718PM
Frequency Bands	FDD BAND: 1/2/3/4/5/7/8/12/13/14/17/18/19/20/25/26/28/66/71 TDD BAND: 34/38/39/40/41
Interface	USB, UART, I2C, SPI
SIM Interface	Dual SIM single standby USIM1: 1.8V/3V cards; USIM2: 1.8V cards
Dimensions	17.7 x 15.8 x 2.4 mm
Operating Temperature	-30C to +75C
Operating Voltage	3.3V to 4.3V, typical 3.8V
Protocol Standard	Max 3GPP Rel-14 Cat 1 bis FDD and TDD
Antenna	1T1R
Physical Layer Max Data Rate	LTE-FDD: 10 Mbps (DL) / 5 Mbps (UL) LTE-TDD: 8.96 Mbps (DL) / 3.1 Mbps (UL)
Bandwidth	1.4/3/5/10/15/20 MHz
Protocols	TCP/UDP/NITZ/FILE/MQTT/PING/NTP/HTTP/HTTPS/SSL

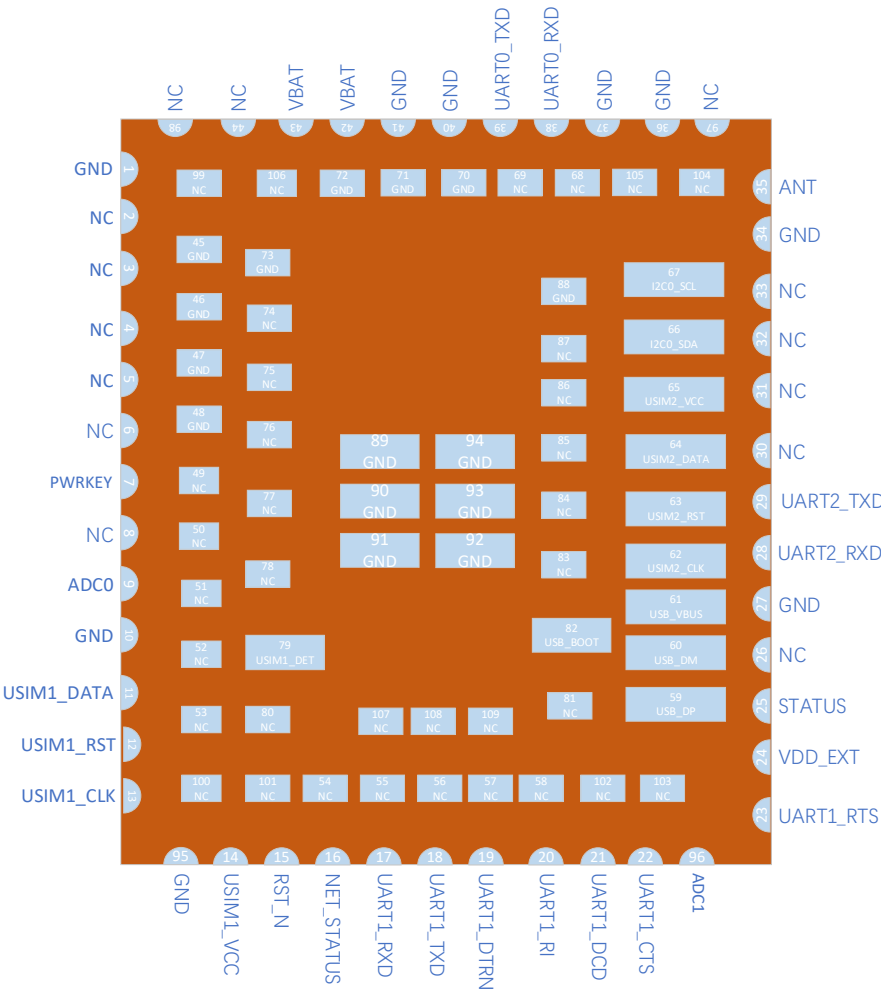
3. RF Parameters

Test Conditions: 3.8V / 25C / 10MHz

Parameter	Value
Max Transmit Power	23dBm +/- 2.7dB
Min Sensitivity	-97dBm

4. Pin Definition

4.1 Pin Layout



4.2 Pin Description

No.	Name	Type	Description
1	GND	GND	Ground
2	NC	-	Not connected
3	NC	-	Not connected
4	NC	-	Not connected
5	NC	-	Not connected
6	NC	-	Not connected

7	PWRKEY	DI	Module power on: Pull low for >=500ms or ground; Module power off: Pull low for >=650ms
8	NC	-	Not connected
9	ADC0	AI	0~1.2V, 12-bit
10	GND	GND	Ground
11	USIM1_DATA	DIO	USIM1 card data
12	USIM1_RST	DO	USIM1 card reset
13	USIM1_CLK	DO	USIM1 card clock
14	USIM1_VDD	PO	USIM1 card power supply
15	RESET_N	DI	Module reset: Pull low for >=300ms
16	NET_STATUS	DO	Network search: Slow flash (200ms H / 1800ms L); Standby: Slow flash (1800ms H / 200ms L); Data transfer: Fast flash (125ms H / 125ms L); Note: Connected to USB_BOOT internally
17	UART1_RXD	DI	Main UART receive
18	UART1_TXD	DO	Main UART transmit
19	UART1_DTR	DI	Main UART data terminal ready
20	UART1_RI	DO	Main UART ring indicator output
21	UART1_DCD	DO	Main UART carrier detect output
22	UART1_CTS	DO	Clear to send
23	UART1_RTS	DI	Request to send
24	VDD_EXT	PO	Test point reserved. Requires 1uF capacitor + TVS. For external pull-up only (>=4.7kohm)
25	STATUS	DO	Module power on indicator (high level output)
26	NC	-	Not connected
27	GND	GND	Ground
28	UART2_RXD	DI	UART2 receive
29	UART2_TXD	DO	UART2 transmit
30	NC	-	Not connected
31	NC	-	Not connected
32	NC	-	Not connected
33	NC	-	Not connected
34	GND	GND	Ground
35	ANT_MAIN	ANT	Antenna port, 50ohm characteristic impedance

36	GND	GND	Ground
37	GND	GND	Ground
38	UART0_RXD	DI	DEBUG UART receive
39	UART0_TXD	DO	DEBUG UART transmit
40	GND	GND	Ground
41	GND	GND	Ground
42	VBAT	PI	External power, 1.2A required. TVS recommended. Test point reserved.
43	VBAT	PI	External power, 1.2A required. TVS recommended. Test point reserved.
44	NC	-	Not connected
45	GND	GND	Ground
46	GND	GND	Ground
47	GND	GND	Ground
48	GND	GND	Ground
59	USB_DP	AIO	USB positive, 90ohm differential impedance required
60	USB_DM	AIO	USB negative, 90ohm differential impedance required
61	USB_VBUS	AI	3.0V~5.25V, test point reserved
62	USIM2_CLK	DO	USIM2 card clock
63	USIM2_RST	DO	USIM2 card reset
64	USIM2_DATA	DIO	USIM2 card data
65	USIM2_VDD	PO	USIM2 card power supply
66	I2C0_SDA	-	I2C0 data
67	I2C0_SCL	-	I2C0 clock
68	NC	-	Not connected
69	NC	-	Not connected
70	GND	GND	Ground
71	GND	GND	Ground
72	GND	GND	Ground
73	GND	GND	Ground
74	NC	-	Not connected
75	NC	-	Not connected
76	NC	-	Not connected
77	NC	-	Not connected
78	NC	-	Not connected
79	USIM1_DET	DI	USIM1 card hot-swap detection
80	NC	-	Not connected
81	NC	-	Not connected
82	USB_BOOT	DI	Test point reserved. Pull up to VDD_EXT before power on for

			forced download mode.
83	NC	-	Not connected
84	NC	-	Not connected
85	NC	-	Not connected
86	NC	-	Not connected
87	NC	-	Not connected
88	GND	GND	Ground
89	GND	GND	Ground
90	GND	GND	Ground
91	GND	GND	Ground
92	GND	GND	Ground
93	GND	GND	Ground
94	GND	GND	Ground
95	GND	GND	Ground
96	ADC1	AI	0~1.2V, 12-bit
97	NC	-	Not connected
98	NC	-	Not connected
99	NC	-	Not connected
100	NC	-	Not connected
101	NC	-	Not connected
102	NC	-	Not connected
103	NC	-	Not connected
104	NC	-	Not connected
105	NC	-	Not connected
106	NC	-	Not connected
107	NC	-	Not connected
108	NC	-	Not connected
109	NC	-	Not connected

Pin Type Legend

Type	Description
GND	Ground
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
AI	Analog Input
AO	Analog Output
AIO	Analog Input/Output
PI	Power Input
PO	Power Output
ANT	Antenna
NC	Not Connected

FCC 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.

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

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

Any company of the host which install this modular with Single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C : 15.247 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement, then the host can be sold legally.

FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

Note: 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:

- 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.

OEM INTEGRATION INSTRUCTIONS:

This device is intended only for OEM integrators under the following conditions:

The module must be installed in the host equipment 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. The module shall be only used with the internal on-board antenna that has been originally tested and certified with this module. External antennas are not supported. As long as these 3 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 (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve a FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:

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 for this module in combination with the host equipment is no longer considered valid and the FCC ID/IC of the module 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 authorization. In such cases, please involve a FCC/IC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:

The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC for this module, in order to prevent compliance issues.

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 Transmitter Module FCC ID: 2BS8J-SY288 Or Contains FCC ID: 2BS8J-SY288"

Information that must be placed in the end user manual:

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.

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.

Explanation: This module meets the requirements of FCC Part 2,22H,24E,27,90.

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT only FPC antenna.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The Module is not a limited module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency,

the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered); c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;

d) Appropriate parts by manufacturer and specifications;

e) Test procedures for design verification; and

f) Production test procedures for ensuring compliance.

The module grantee shall provide a 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 the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes, The module with Snap fastener port designs, and this EUT has been shown the layout of trace design, antenna, connectors requirements.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – 20cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID/IC (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, "Contains Transmitter Module FCC ID: 2BS8J-SY288 Or Contains FCC ID: 2BS8J-SY288".

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type")).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a FPC antenna, and the antenna use a antenna which is unique.

Model: itp024005-EX5G0-1

Type: FPC Antenna

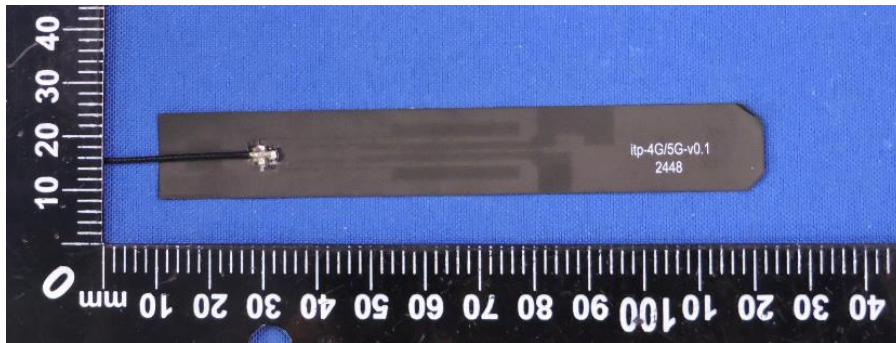
Manufacturer: Hangzhou Vision Link Intelligence Technology Co., Ltd

Antenna gain:

LTE 2:0.35 dBi, LTE 4:1.71 dBi, LTE 5:1.4 dBi, LTE 7:0.75 dBi, LTE 12:2.17 dBi

LTE 13:2.15 dBi, LTE 14:0.69 dBi, LTE 17:2.17 dBi, LTE 25:0.35 dBi

LTE 26:1.4 dBi, LTE 38:-0.12 dBi, LTE 41:0.75 dBi, LTE 66:1.71 dBi, LTE 71:1.77 dBi



2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC/IC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: “Contains Transmitter Module FCC ID: 2BS8J-SY288 Or Contains FCC ID: 2BS8J-SY288”.

2.9 Information on test modes and additional testing requirements

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that 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 circuitry), 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.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.