ioNODE Series LoRa End Device RF Module

MicroMOD-20

Datasheet

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1. Brief Description

MicroMOD-20 is a compact, low cost, low power wide area network (LPWAN) wireless module that supports the Semtech LoRaWAN® long range wireless protocol.

This new stand-alone module measures just 21x18 mm, is constructed in a metal shielded package and comprises a Semtech SX1272 ultra-long range spread spectrum wireless transceiver and STM32 series ARM Cortex-M0 + 32 Bit microcontroller (MCU). The MicroMOD-20 module complies with the latest LoRaWAN® Class A & C protocol specifications; it is simple to access LoRaWAN® IoT platforms.

1.1 Features

- RF output power up-to +20 dBm.
- It supports LoRa® Point to Point communications as well as LoRaWAN® protocol. Different Firmware required.
- Built-in EEPROM, data kept unchanged even powered off.
- Small size (21*18 mm)
- Wide range of working voltage 3V to 3.7 V
- Sensitivity -137dBm
- Wide range of temperatures -40°C to +85°C.

1.2 Applications

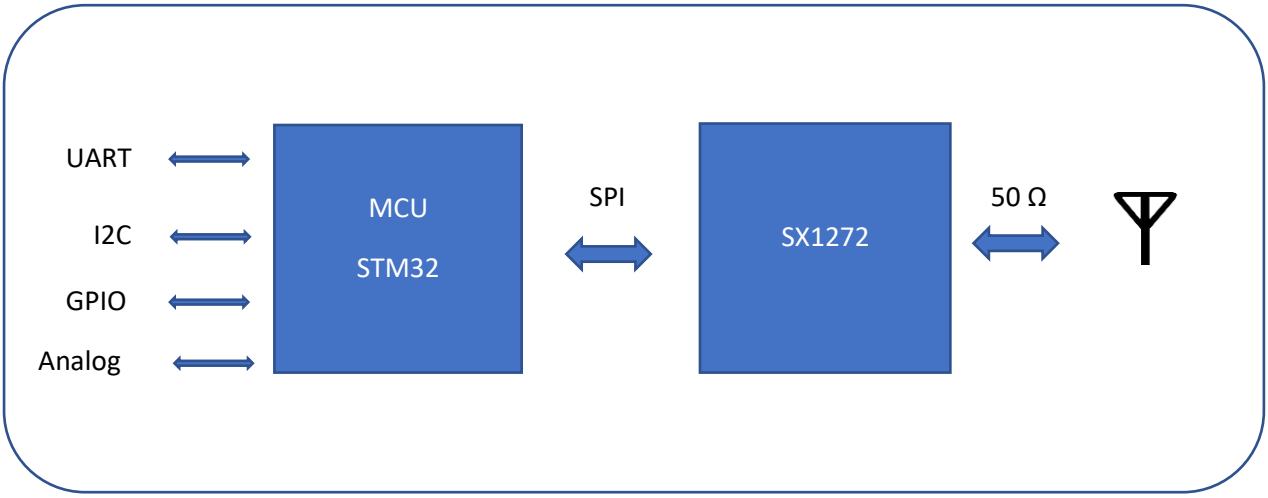
Typical applications for this module include smart metering, wearables, tracking, M2M and internet of things (IoT) edge nodes.

The module's applications are as following -

- Automated Meters Reading
- Home and Building Automation
- Wireless Alarm and Security Systems
- Industrial Monitoring and Control
- Long Range Irrigation Systems

2. Module Overview:

MicroMOD-20 is an ultra-long range, high-performance, RF module for wireless communication. It operates in the license free 865-867 MHz ISM frequency band and includes all necessary passive components for wireless communication as depicted in the following figure.



Frequency range	865 to 867 MHz
Modulation	LoRa® Spread-Spectrum
RF output power	Up to 20 dBm
Receiver sensitivity	-137 dBm (SF 12; SB 125 kHz, CR 4/6)
RF data rate	0.24 to 5 kbps
RF range	up to 5000 m (line of sight)
Operating voltage	3 V to 3.7 V
Current consumption	< 10 µA (module in sleep, RTC running) 23 mA (Rx) 123 mA (Tx mode)
Interfaces	UART, I2C
IO's	Digital IOs Analog Inputs
Dimension	21x18 mm

3. Electrical Characteristics

3.1 Maximum Ratings

Condition	Min	Typ.	Max	Unit
Supply Voltage (VDD)	3.0	3.5	3.7	V
Storage Temperature	-40	+25	+85	°C
Operating Temperature	-40	+25	+85	°C
RF Input Power	+10			dBm
ESD (Human Body Model)	2000			V
ESD (Charge Device Model)	500			V
Notes: 1) Unless otherwise noted, all voltages are with respect to GND				

3.2 General Electrical Characteristics

T = 25°C, VDD = 3.5 V (typ.) if nothing else stated					
Parameter	Condition	Min	Typ.	Max	Unit
Supply Voltage (VDD)		3	3.5	3.7	V
Current Consumption System IDLE	RF idle mode, MCU idle mode		10		µA
Current Consumption RECEIVE LoRa	RF receive mode, MCU sleep mode		23		mA
Current Consumption TRANSMIT	RF transmit mode, MCU Active mode, all MCU units on, max. RF power level		123		mA
MCU operation frequency		32 MHz & 32.768 KHz			

3.3 Module Interface Characteristics

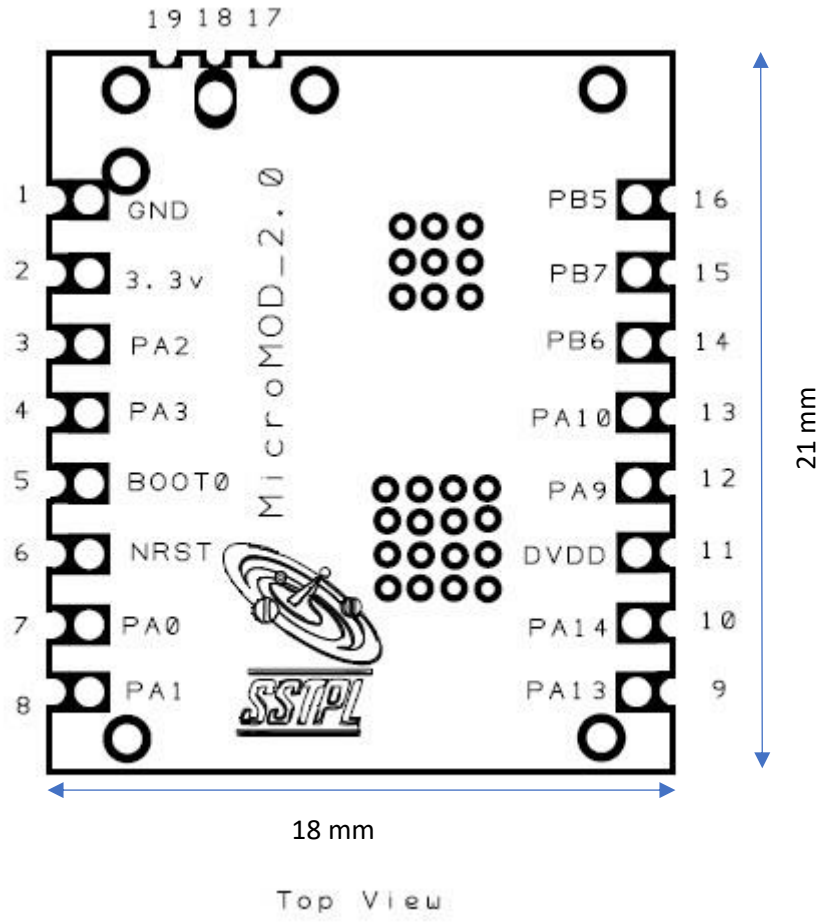
Symbol	Parameter	Conditions	Min.	Max.	Unit
VOL	Output Low level voltage for an I/O pin	CMOS port, IIO = +8 mA 2.8V ≤ VDD ≤ 3.7V	-	0.4	V
VOH	Output High level voltage for an I/O pin		VDD - 0.4	-	
VOL	Output Low level voltage for an I/O pin	TTL port, IIO = +8 mA 2.8V ≤ VDD ≤ 3.7V	-	0.4	V
VOH	Output High level voltage for an I/O pin	TTL port IIO = -6 mA 2.8V ≤ VDD ≤ 3.7V	2.4	-	V
VOL	Output Low level voltage for an I/O pin	IIO = +15 mA 2.8V ≤ VDD ≤ 3.7V	-	1.3	V
VOH	Output High level voltage for an I/O pin	IIO = -15 mA 2.8V ≤ VDD ≤ 3.7V	VDD-1.3	-	V
VOL	Output Low level voltage for an I/O pin	IIO = +4 mA 1.65V ≤ VDD ≤ 3.7V	-	0.45	V
VOH	Output High level voltage for an I/O pin	IIO = -4 mA 1.65V ≤ VDD ≤ 3.7V	VDD-0.45	-	V
VOLFM+	Output low level voltage for an FTf I/O pin in FM+ mode	IIO = 20 mA 2.8V ≤ VDD ≤ 3.7V	-	0.4	V
		I_{IO} = 10mA 1.65V ≤ V_{DD} ≤ 3.7V	-	0.4	

3.4 Transmitter RF Characteristics

T = 25°C, VDD = 3.5 V (typ.), 866 MHz if nothing else stated					
Parameter	Condition	Min	Typ.	Max	Unit
Frequency Range		865	-	867	MHz
RF Output Power - 865 MHz Band		18.5	19	20	dBm
Modulation Techniques			LoRa™		
TX Frequency Variation vs. Temperature	-40 to +85°C	-	±10	-	kHz
TX Power Variation vs. Temperature		-	±0.5	-	dB

4. Module Package

4.1 Module Dimension



4.2 Pinout Description

PIN	PIN Name	PIN Type	Primary Function	5 V Tolerance	Alternate Function
1	GND	Supply			Supply Ground
2	3.3V	Input Supply	3 to 3.7V DC Input		Input DC Supply
3	PA2	D I/O	USART2_TX /LPUART1_TX	Yes	ADC IN2
4	PA3	D I/O	USART2_RX/LPUART1_RX	Yes	ADC IN3
5	BOOT0	Supply	Bootloader	No	
6	NRST	D IN	Module Reset	No	
7	PA0	D I/O	USART4_TX	No	ADC_IN0/WKUP1
8	PA1	D I/O	USART4_RX	Yes	ADC_IN1
9	PA13	D I/O	SWDIO -Module Program Pin	Yes	LPUART1_RX
10	PA14	D I/O	SWCLK - Module Program Pin	Yes	LPUART1_TX
11	DVDD	Supply Output (Vin - 0.3 V)	Digital Supply Output, max 80 mA	No	N/A
12	PA9	D I/O	USART1_TX	Yes	I2C1_SCL (Ext. 3.3V pullup required)

13	PA10	D I/O	USART1_RX	Yes	I2C1_SDA (Ext. 3.3V pullup required)
14	PB6	D I/O	I2C1_SCL	Yes	Internal Pulled up
15	PB7	D I/O	I2C1_SDA	Yes	Internal Pulled up
16	PB5	D I/O	General I/O	Yes	
17	GND	Analog GND	Ground connection		
18	RF	ANT IN/OUT	External 50Ω port for antenna		
19	GND	Analog GND	Ground connection		

5. RF Test Report (Conducted Measurement)

EUT Test Configuration: - Transmit on Max power on each 125 KHz Channel, Transmission on 1st, Mid and Last channel in each 15 minutes.

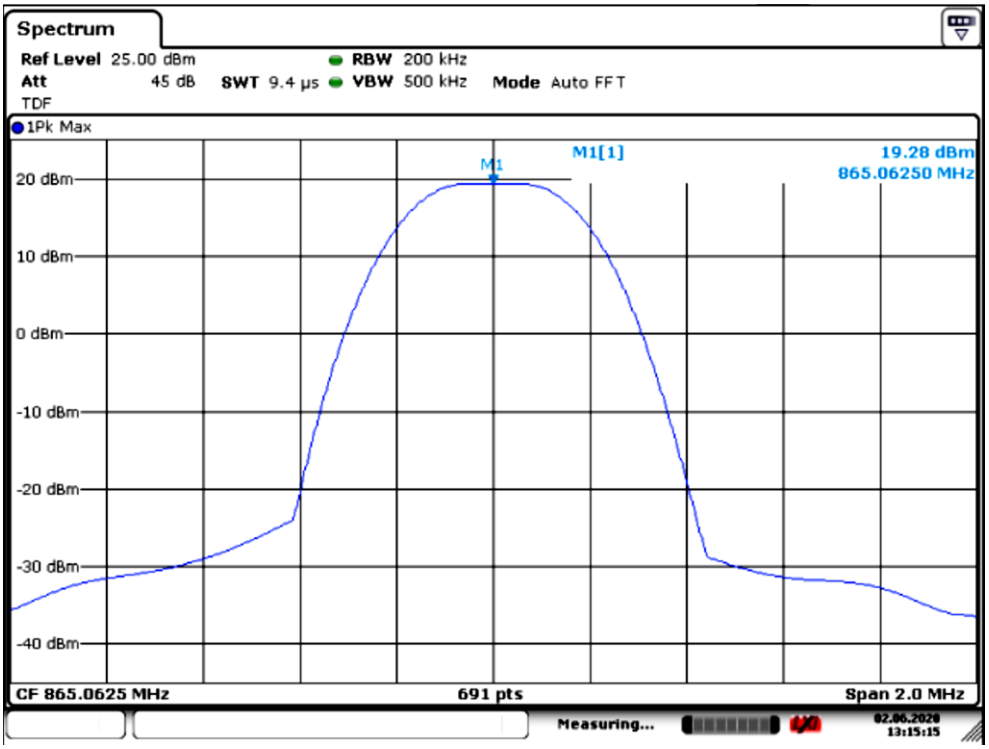
EUT Height: - 0.8m from Ground (EUT placed on nonconductive table).

Voltage: - **+** 3.5V DC

EUT antenna port connected to RF connector.

5.1 Max Conducted RF Power

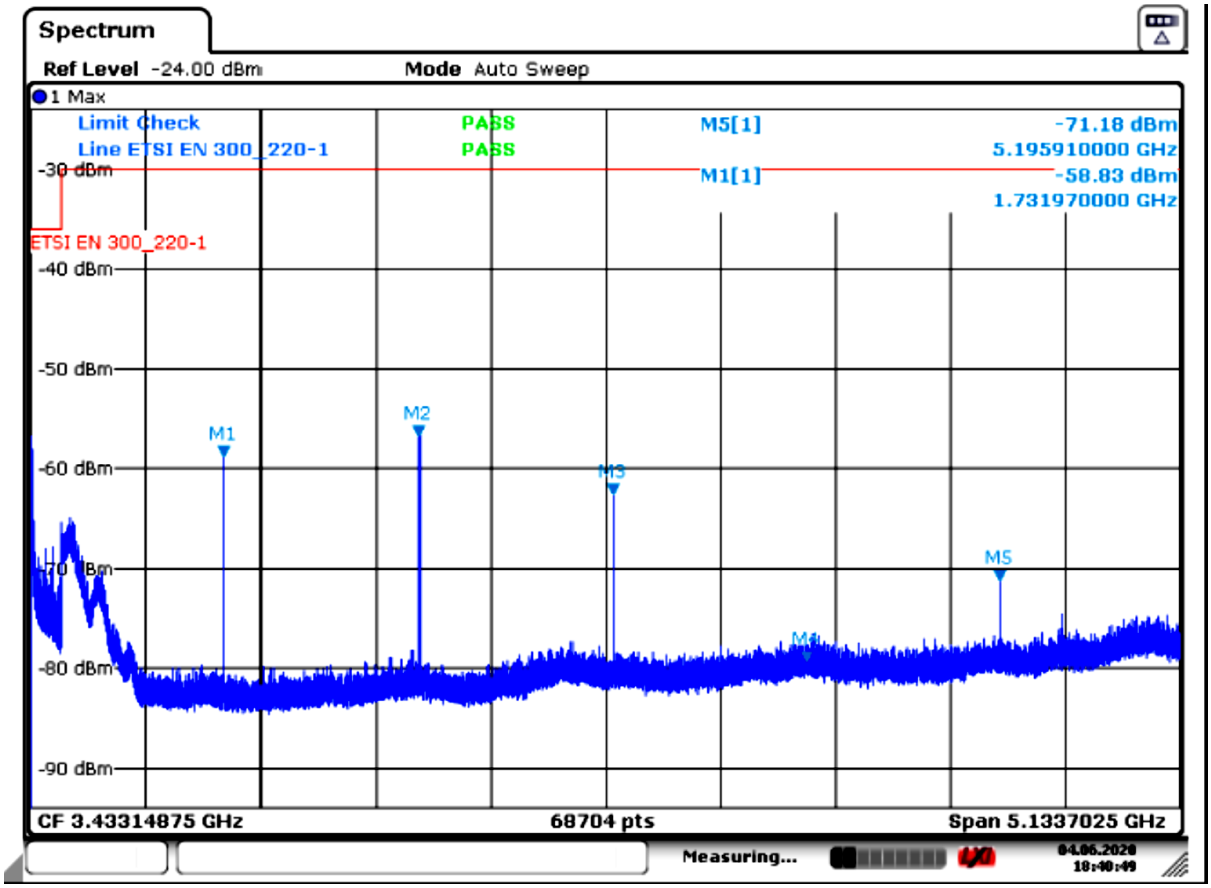
Observation Graph: - Channel 1 (865.06250 MHz)



Observation Table: -

Channel Frequency (MHz)	Conducted Power Measured (dBm) (A)	Correction Factor (dB) (B)	Max Conducted Power (dBm)	EIRP Test Status
865.0625	19.28	0.22	19.5	Pass

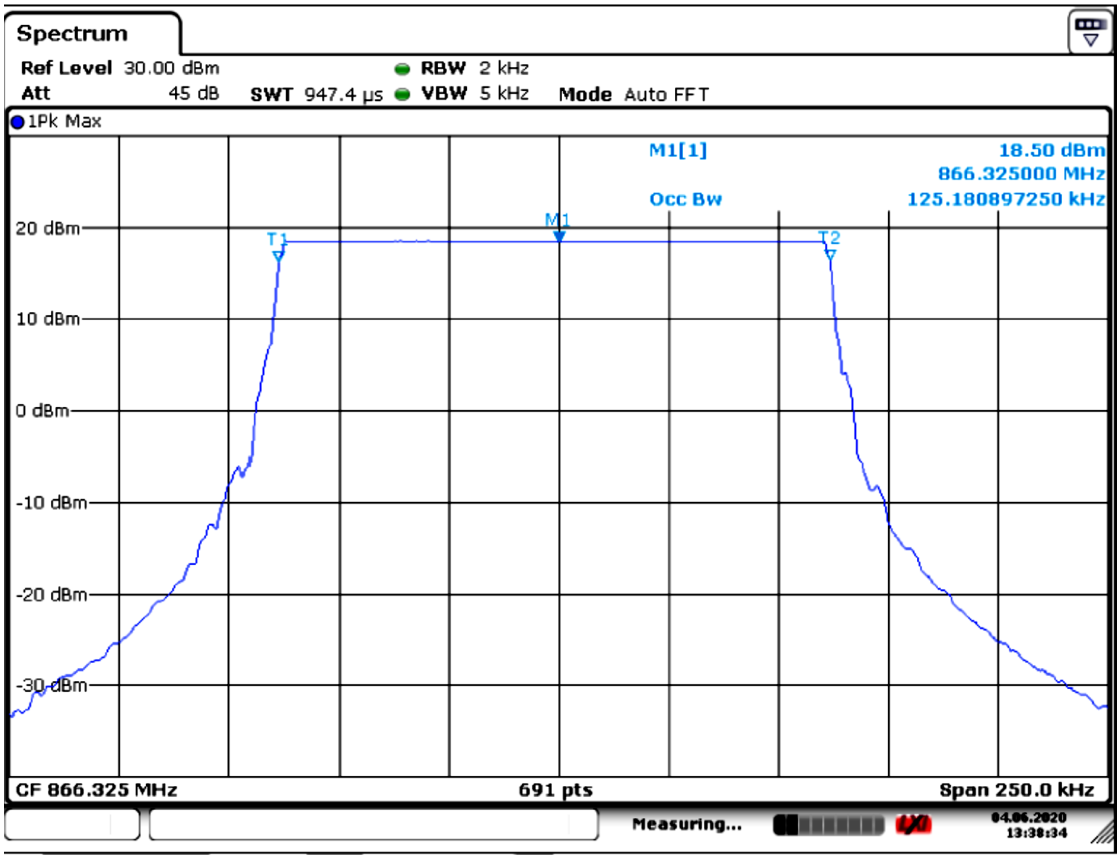
5.2 Unwanted emissions in the spurious domain for Tx mode



Observation Table: - Unwanted emission in the spurious domain of Mid Channel (865.9850 MHz)

Serial No.	Frequency (MHz)	Spurious Level Measured(A) (dBm)	Correction Factors(B) (dB)	Standard Limit (dBm)	Spurious level Including correction factors: A+B+C (dBm)	Result
1	1731.970	-58.83	0.94	-30	-57.89	Pass
2	2597.955	-56.80	9.3	-30	-47.50	Pass
3	3463.940	-62.62	4.51	-30	-58.11	Pass
4	4329.925	-79.34	16.30	-30	-63.04	Pass
5	5195.910	-71.18	5.95	-30	-65.23	Pass

5.3 Occupied Bandwidth



Observation Table: -

Channel Frequency (MHz)	Occupied bandwidth Measured (KHz)	Standard Limit (KHz)	Result
866.3250	125.18	< 200	Pass

6. Antenna Mounting Options

To serve the propose of multiple antenna requirement, MicroMOD-20 comes with multiple options. Below are the MicroMOD-20 Antenna options:

1. Connect an external antenna thru the UFL connector mounted on PCB. It can be Simply connected thru a UFL Pigtail to antenna of your choice. Here 50Ω impedance matched antenna will work.
2. Through Hole Spring Helical antenna can also be used if antenna needs to be integral part of module. Just unmount the UFL connector and used through hole beneath the UFL connector pad to connect Spring Helical or other wire antenna. The recommend thick ness of wire is 0.7 to 0.9 mm to get it mounted in the PCB hole.
3. MicroMOD-20 has edge half cut pads to extend the RF signals on Daughter Board PCB and antenna can be mounted separately on DB PCB. Here needs to take care the 50Ω impedance characteristics of the RF track.

7. Important Notice

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6.2 Contact Information

Sehaj Synergy Technologies Pvt. Ltd. (SSTPL)
Indu Bhawan, J-9/J-7/3, Bhagwan Marg, Swage Farm,
New Sanganer Road, Sodala, Jaipur-302019, Rajasthan, India

T: +911414017908 M: +91 8890200333 E: info@sstpl.net.in Web: www.sstpl.in