

**User Manual**

**1. Product Introduction**

**TN1R23NR supports GSM, WCDMA, LTE and 5G NR for vehicle telecommunication.**

Host ID: TN1R23NR, TN1R23NE

FCC ID: BEJTN1R23NR

Major functions of BMW Wave

Multi-mode RAT communication GSM, WCDMA, LTE and 5G NR.

The RF platform of TN1R23NR supports highly integrated RF transceiver, with all necessary features to enable multi mode, multi band car telematics applications. It incorporates a fully integrated dual mode receiver, multi band TX outputs, TCVCXO control, a measurement interface and DSDA (Dual SIM Dual Active). TN1R23NR module compliant high speed data and control interface, a multi mode timer unit and all necessary front end signals for the complete RF Engine control. Overall the TN1R23NR directly supports RF engines with up to 5G bands.

**1.1 TN1R23NR Block Diagram**

Confidential

**1.2 Environmental Specifications**

The environmental specification for operating and storage of the TN1R23NR are defined in the table below.

Table 2. Environmental Specifications

Parameter	Temperature Range
Operating Temperature	-40°C to 90°C (ecall 95°C)
Storage Temperature	-40°C to +90°C
Humidity	95% or less

**1.3 Electrical Specifications**

This section provides details for some of the key electrical specifications of the TN1R23NR embedded modules.

Recommend Operating voltage

Parameter		Min	Typical	Units
VBATT	Power Supply Input	-	12	V
VIN	Voltage on any digital input or output pin	-	12	V

1.3.1 Absolute Maximum Rating and ESD Ratings

This section defines the Absolute Maximum and Electrostatic Discharge (ESD) Ratings of the TN1R23NR embedded modules.

**Warning:** If these parameters are exceeded, even momentarily, damage may occur to the device.

Table 3. Absolute Maximum Ratings

Parameter		Min	Max	Units
VBATT	Power Supply Input	-	18	V
VIN	Voltage on any digital input or output pin	-	18	V
ESD Ratings				
ESD1)	Primary, Diversity antenna pads - Contact		10	kV

1) The ESD Simulator configured with 330pF, 2000Ω.

Caution: The TN1R23NR embedded modules are sensitive to Electrostatic Discharge. ESD countermeasures and handling methods must be used when handling the TN1R23NR devices.

1.3.2 Current Consumption

Table 4. TN1R23NR Current Consumption (12.5V)

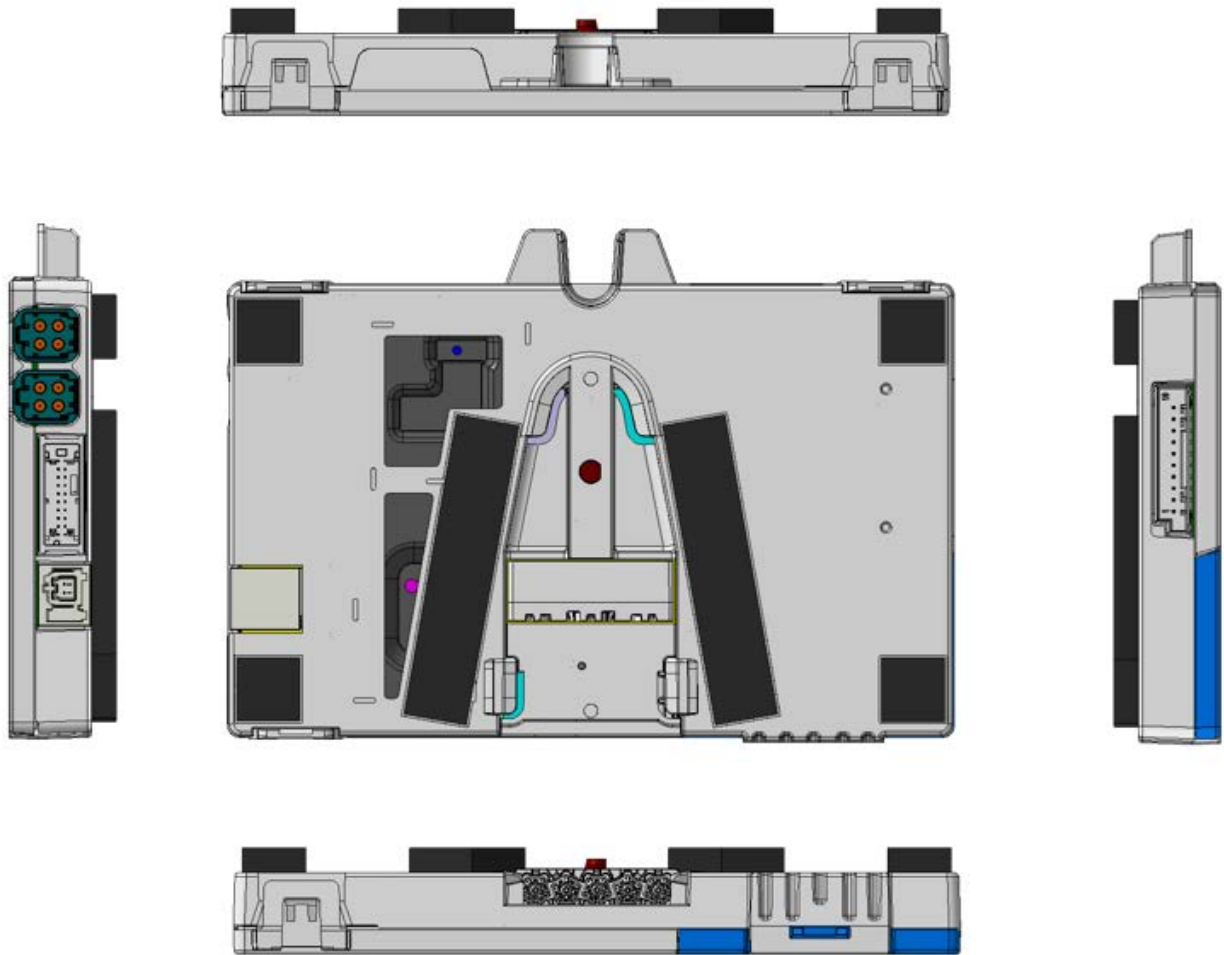
Mode	Parameter	Typical	Max	Units
Active	SIM1 only operation (Tx max output)	600	1000	mA
Active	DSDA operation (Tx max output)	1000	2000	mA
Sleep	Sleep Mode, Average Current	0.03		mA

2. Mechanical Specifications

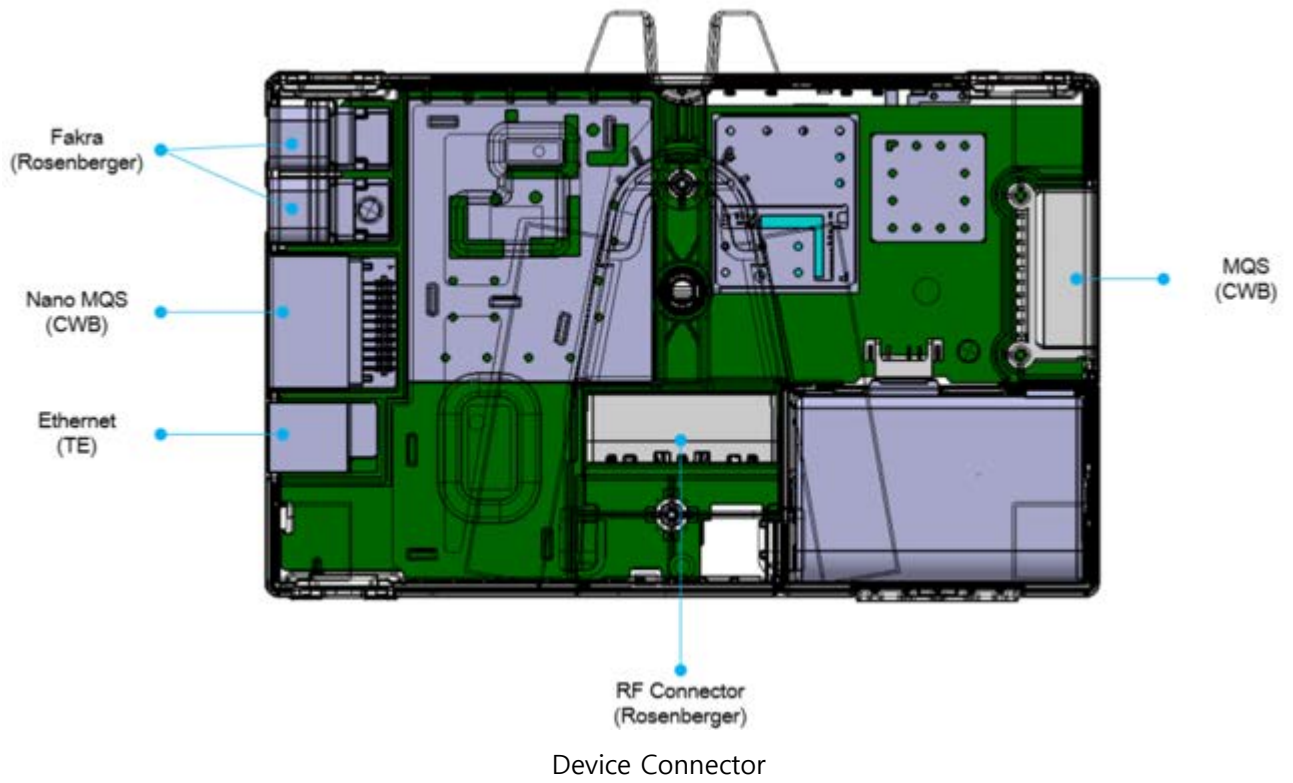
2.1 Physical Dimensions

Size : 160 x 100 x 18mm

Weight : 311.9g (316.8g for US variant)



Mechanical Design



### 3. TN1R23NR RF Specification

#### SIM1 (OEM SIM) Support Band

Band	Tx	Rx	FDD/TDD	Band	TN1R23NR	TN1R23NE
B2	1850~1910	1930~1990	FDD	Mid	G, W, L	W, L
B4	1710~1755	2110~2155	FDD	Mid	W, L	W, L
B5	824~849	869~894	FDD	Low	G, W, L	W, L
B7	2500~2570	2620~2690	FDD	High	L	L
B12(B17)	699~716	729~746	FDD	Low	L	L
B13	777~787	746~756	FDD	Low		
B25	1850~1915	1930~1995	FDD	Mid		
B26	814~849	859~894	FDD	Low	L	
B41	2496~2690	2496~2690	TDD	High	L, 5G(N,S)	

- G(GSM), W(WCDMA), T(TD-SCDMA), L(LTE), 5G(N)-NSA, 5G(S)-SA

#### SIM2 (Consumer SIM) Support Band

Band	Tx	Rx	FDD/TDD	Band	TN1R23NR	TN1R23NE
B2	1850~1910	1930~1990	FDD	Mid	G, L	
B4	1710~1755	2110~2155	FDD	Mid	L	
B5	824~849	869~894	FDD	Low	G, L	
B7	2500~2570	2620~2690	FDD	High	L	L
B26	814~849	859~894	FDD	Low	L	
B41	2496~2690	2496~2690	TDD	High	L, 5G(S)	

- G(GSM), W(WCDMA), T(TD-SCDMA), L(LTE), 5G(N)-NSA, 5G(S)-SA

### 4. Notice

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.

Changes or modifications not expressly approved by the manufacturer (or party responsible) for compliance could void the user’s authority to operate the equipment

This equipment complies with FCC and IC RF Radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.

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