SIM8200EA_M2 Antenna Port Mapping and Deign Guide

NR Module

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Version History

Date	Version	Description of change	Author
2019-09-27	1.00	Original	Feng Cunbao
2020-03-12	1.01	1. Add full name of abbreviation 2. Modify Table1 3. Modify part 1.2 4. Modify part 1.3 5. Add part 1.6 6. Document structure change	Zhong Yibo
2020-04-22	1.02	Modify document structure	Zhong Yibo
2020-05-19	1.03	Add antenna reduction design	Zhong Yibo

Contents

Table Index

Figure Index

1 Introduction

This document describes the SIM8200EA_M2 5G module antenna port mapping and Antenna design guide to customer to refer.

2 Definitions, symbols and abbreviations

Table 1: Abbreviations and description

Abbreviations	Description
LB	Low Frequency Band [1]
MHB	Middle and High Frequency Band[2]
UHB	Ultra High Frequency Band[3]
LAA	Limited Access Authorization
TRX	Transmit and Receive signal
DRX	The Diversity Receive signal
UL-MIMO	Uplink- Multiple Input Multiple Output
DL-MIMO	Downlink- Multiple Input Multiple Output
GNSS	Global Navigation Satellite System

※ NOTE

[1] Frequency is from 600MHz to 960MHz, such as LTE B5/B8/B12/B20/B28 and so on;

[2] Frequency is from 1710MHz to 2690MHz, such as LTE B1/B2/B3/B7/B25/ B38/B40/B41 and so on;

[3] Frequency is from 3300MHz to 4200MHz, such as LTE B48.

3 Antenna Interfaces

Figure1 Antenna interfaces

4 Antenna Port Mapping and Design Guide

4.1 Antenna port mapping

SIM8200EA_M2 is designed with 6 antennas, module and antenna connector is shown in figure1. the Bands and the Antenna port mapping is shown in table1.

4.1.1 Full function with 6 antennas

In this design, it can reach the maximum performance of SIM8200EA_M2——4*4 DL-MIMO——that data rate of NR Sub-6 is 4Gbps (DL) and 500Mbps(UL), data rate of TDD/FDD LTE CAT20 is 2Gbps (DL) and 200Mbps (UL).

Table 2: Frequency bands and antenna ports mapping

BANDS FUNCTIONS	ANTENNAS		ANT0	ANT1	ANT2	ANT3	ANT4	ANT5
3G/4G/5G 5G	LB[1]/MHB n41[2]	TRX UL/DL-MIMO1	⚑					
4G 5G	UHB n41[2]/n77/n78/n79[3]	TRX TRX		⚑				
3G/4G/5G 5G	LB/MHB n41	DIV DL-MIMO2			⚑			
3G/4G/5G 4G 5G	MHB UHB n41/n77/n78/n79[3]	DL-MIMO1 DIV DIV				⚑		
3G/4G/5G 4G 5G	MHB UHB n77/n78/n79[3]	DL-MIMO2 DL-MIMO1 DL-MIMO1					⚑	
4G 5G GNSS	UHB n77/n78/n79[3]	DL-MIMO2 DL-MIMO2						⚑

> ※ **NOTE**
>
> 1. 4G LB only support 2*2 DL-MIMO.
> 2. n41 can support 2*2 UL-MIMO.
> 3. For n79 and n77/n78/UHB , default design can support 5G n77/n78 without n79. Customer should submit request to SIMcom for n79 support if needed.

4.1.2 Antenna Reduction with 2 Antennas

In this design, it can support the base function of SIM8300G_M2, but with performance and function reduction:

1. no GNSS.
2. 5G n77/n78: reduce three paths of DL, data rate becomes 500Mbps (DL), 500Mbps (UL).
3. 5G n41: reduce two paths of DL, data rate becomes 1Gbps (DL), 1Gbps (UL).
4. 4G MHB: reduce three paths of DL, data rate becomes 500Mbps (DL), 200Mbps (UL).
5. 4G LB: reduce one path of DL, data rate becomes 500Mbps (DL), 200Mbps (UL).

Table 3: Frequency bands and antenna ports mapping with 2 antennas

BANDS FUNCTIONS		ANTENNAS	ANT0	ANT1	ANT2	ANT3	ANT4	ANT5
3G/4G/5G	LB/MHB	TRX	🚩					
5G	n41	UL/DL-MIMO1						
4G	UHB	TRX		🚩				
5G	n41/n77/n78/n79	TRX						
3G/4G/5G	LB/MHB	DIV			🚩			
5G	n41	DL-MIMO2						
3G/4G/5G	MHB	DL-MIMO1				🚩		
4G	UHB	DIV						
5G	n41/n77/n78/n79[2]	DIV						
3G/4G/5G	MHB	DL-MIMO2					🚩	
4G	UHB	DL-MIMO1						
5G	n77/n78/n79[2]	DL-MIMO1						
4G	UHB	DL-MIMO2						🚩
5G	n77/n78/n79[2]	DL-MIMO2						
GNSS								

4.2 reference design

The space isolation of each antenna should be larger than 15dB. The isolation between LTE and 5GNR an tennas is at least 20dB for the ENDC or UL-MIMO combo which two antennas transmit simultaneously.
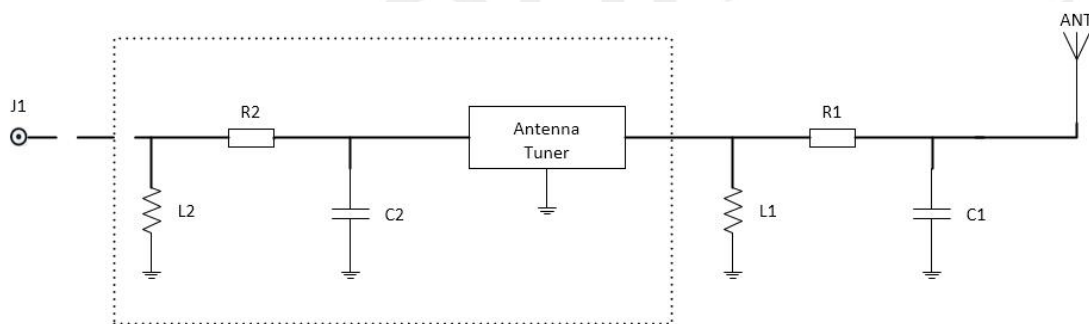

Figure2 Antenna refence design

J1 is the coaxial cable connection. For most of customers, above match-components (R1/R2,L1/L2,C1/C2 and Tuner) are not needed to meet the requirements. But for the high-level requirements or some bad antenna design conditions, it is recommended. What's more, antenna tuner design in the dotted line may be considered for some customers to enhance the low frequency band performance.

※   **NOTE**

Customer should submit request to SIMcom for tuner support if needed.

4.3 RF Plug Recommendation

When selecting antenna, customer should pay attention to the match between the antenna connector and the rf connector of the module. SIM8200EA_M2 uses Murata connectors, size is 2.0mm*2.0mm*0.6mm,

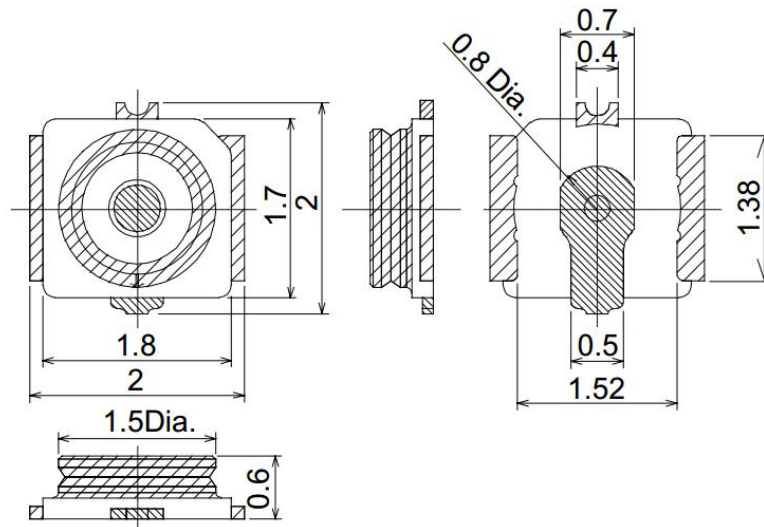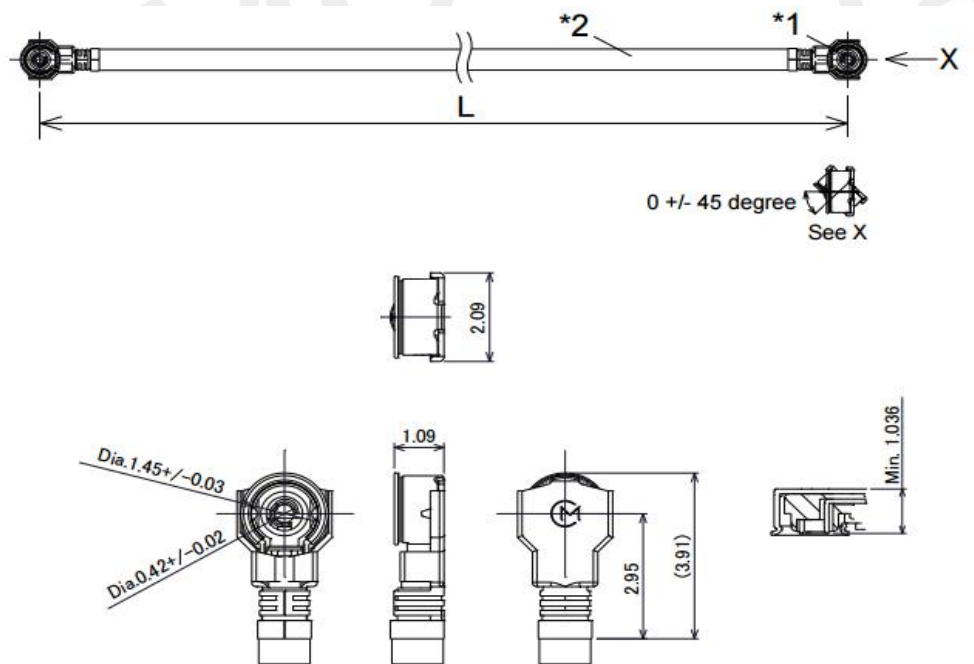model is MM4829-2702B/RA4/RB0. The size and specification are as below.

Figure3 3D view of MM4829-2702B/ RA4/ RBO

The recommended coaxial model to match is Murata's MXHJD3HJ1000. The size and specification are as below.

*1. Connector: HSC right angle plug connector
*2. Cable

Scale: Free
Tolerance Unless
Otherwise Specified: +/-0.3
Unit: mm

Figure4 3D view of MXHJD3HJ1000

5 Requirements to Antenna

Table 4: Antenna requirements

Antenna Class	Antenna Requirements
GNSS	frequency：1166.22MHz~1228.62MHz/1559MHz~1609MHz Polarization：RHCP or Linear VSWR：<2 Passive antenna Gain: >0dBi Active antenna noise: <1.5dBi Active antenna gain: >0dBi Active antenna LNA gain: <17dB
WCDMA/LTE/NR_Sub6	VSWR：<2 Efficiency：>50% Input/output impedance：50Ω Cable Loss：<1dB