



COMPAL

5G RXL-N3 Module User Manual

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Notice

The document is subject to update from time to time owing to the product version upgrade or other reasons.

Unless otherwise specified, the document only serves as the user guide. All the statements, information and suggestions contained in the document do not constitute any explicit or implicit guarantee.



Revision History

Version	Date	Name	Major Changes
AA	May. 9, 2024	HW V01	First release
AB	Aug. 7, 2024	HW V02	1. Table 2-1 Platform/memory and GNSS add comment[3] 2. Table 2-1 5G sub6 Downlink and Uplink. 3. Table 2-1 Function Interface delete SDIO. 4. Update 5.7.4 Requirements on PCB Layout. 5. Update Figure 5-9, Table 5-2 6. Update Table 3-24 antenna port mapping. 7. Update Figure 2-2 8. Modify DownLink LTE CAT20.
AC	Sep. 12, 2024	HW V03	1. Update Table 4-8 NR band, n2, n25, n29, n30. 2. Update Table 2-1 LGA module features, Downlink LTE Category 20/18. 3. Update Table 4-6 NR-FR1 TDD n77 power class PC1.5 4. Update Pin define and GND pin table.

Applicability Table

No.	Product model	Description
1	ZYN1	5G RXL-N3: All relevant LGA HW spec figures and design guidelines in this document are common specification for All 5G LGA model.



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1 Foreword

1.1 Introduction

This document describes the hardware of the COMPAL® 5G LGA Module product. It helps you quickly retrieve interface specifications, electrical and mechanical details, and information on the requirements to be considered for integrating further components. **All relevant LGA HW spec、figures and design guidelines in this document are common specification for All 5G LGA mode.**

1.2 Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating with 5G LGA module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, we assume no liability for customers' failure to comply with these precautions.



Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.



Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If the device offers an Airplane Mode, then it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on boarding the aircraft.



Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.



Cellular terminals or mobiles operating over radio signals and cellular network cannot be guaranteed to connect in all possible conditions (for example, with unpaid bills or with an invalid SIM card). When emergent help is needed in such conditions, please remember using emergency call. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength.



The cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV set, radio, computer or other electric- equipment.



In locations with potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially explosive atmospheres include fueling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders, etc.



Safety of Children

Do not allow children to use the wireless device without guidance. Small and sharp components of the wireless device may cause danger to children or cause suffocation if children swallow the components.

Environment Protection

Observe the local regulations regarding the disposal of your packaging materials, used wireless device and accessories, and promote their recycling.

WEEE Approval

The wireless device is in compliance with the essential requirements and other relevant provisions of the Waste Electrical and Electronic Equipment Directive 2012/19/EU (WEEE Directive).

RoHS Approval

The wireless device is in compliance with the restriction of the use of certain hazardous substances in electrical and electronic equipment Directive 2011/65/EU (RoHS Directive).



1. Overview

1.3 Introduction

RXL-N3 MODULE is a highly integrated 5G NR wireless communication module that adopts standard PCIe interface and backward supports with LTE/WCDMA system. It is applicable to most broadband communication networks of the mobile operator across the world. **All relevant LGA HW spec、figures and design guidelines in this document are common specification for All 5G LGA mode.**

1.4 Specification

Table 2-1 LGA module features

Specification		
Platform [3]	QCT SDX72 / SDX75 Quad core Arm Cortex A55 processor at up to 2.2 GHz	
Memory [3]	8GB eMMC Flash, 2GB LPDDR4X	
Operating Band	5G: n2,n5 ,n12,n13,n25 ,n30,n38,n41,n48,n66 ,n71,n77,n78	
	LTE FDD: B2,B4,B5,B12,B13,B25,B26,B66,B71	
	LTE TDD: B38,B41,42,43,B48	
	WCDMA/HSPA+: NA	
	GNSS [3]: GPS, GLONASS(GLO), Galileo(GAL) and BeiDou(BDS) L1	
Network option	SA	Option 2
	NSA	Option 3x/3a
Downlink	LTE	LTE CAT20
	5G sub-6	SA 3xCA; TDD Max BW 300MHz, SA 4xCA FDD Max BW 100MHz; MIMO 4x4
Uplink	LTE	LTE CAT18
	5G sub-6	SA 2CC;Max BW 100MHz(TDD), 40MHz(FDD); MIMO 2x2
HPUE (Class 2)	- PC2: n41	



HPUE (Class 1.5)	- PC1.5: n77
UL 2x2 MIMO (Option)	n41/n77
DL 4x4 MIMO	n2,n7,n25,n30,n41,n48,n66,n77,n78. B2,B4,B7,B25,B30,B38,B41,B42,B43,B48,B66
SRS	n41/n77 : 1T4R(NSA) + 2T4R(SA)
Carrier aggregation	ULCA, DLCA and NRDC
Power Supply	DC 3.4V ~ 4.4V(Typical value is 3.8V)
Temperature	Operating temperature[1]: -30°C ~ +75°C
	Extended temperature[2] : -40°C ~ +85°C
	Storage temperature: -40°C ~ +85°C
Physical characteristics	Dimension: 49x50mm, Thickness=2.75mm(typ.)
	Weight: 17.5±0.2g
Interface	
Antenna Port	Sub-6: Antenna x 4, GPS: 1xAntenna (Optional)
	Support 4x4 MIMO
	USIM
	I2S/PCM for Audio x 1
	USB 2.0 HS or USB 3.1 Gen2 SS
	BLSP2 4-wire UART for Bluetooth command BLSP3 2-wire UART for Debug
	GPIO (General-Purpose I/O) x 140(Overall CPU GPIO Pin)
	Power on/off switch key pin Support Auto Power On
	Hardware reset pin
	SPI interface x 2



Function Interface	EBI2/LCD(9 bit)
	LED/PWM control pin (up to 10 mA) x 2
	I2C Interface reserve x2
	Tunable antenna(2xMIPI)
	PCIe Gen3 × 3 (Two lane *2 + one lane *1)
	Power supply : (Reserve) a. Dual Voltage Support LV 1.8V/HV 2.95 IF for SIM Card Power. b. 1.8V Support for Audio Codec Power. c. 3.1V Support for USB3.1 MUX Switch Power.
	Power supply : (Reserve) a. Dual Voltage Support LV 1.8V/HV 2.95 IF for SIM Card Power. b. 1.8V Support for Audio Codec Power. c. 3.1V Support for USB3.1 MUX Switch Power.
Software (Windows 19H1 and later, Linux kernel v4.4)	
Driver	IPV4/IPV6
Protocol Stack	3GPP TS 27.007 and 27.005
AT commands	FOTA
Firmware update	Windows MBIM support
Others feature	Windows update
	Support 5G NR NSA and SA
	Multiple carrier aggregation
	AGNSS



NOTE:

[1] To meet this operating temperature range, you need to ensure effective thermal dissipation, for example, by adding passive or active heatsinks, heat pipes, vapor chambers, etc. Within this range, the module can meet 3GPP.

[2] To meet this extended temperature range, you need to ensure effective thermal dissipation, for example, by adding passive or active heatsinks, heat pipes, vapor chambers, etc. When the LGA module works at this temperature, the module remains the ability to establish and maintain functions such as voice, SMS, emergency call, etc.

Radio spectrum and radio network are not influenced, while one or more specifications, such as Pout, may undergo a reduction in value, exceeding the specified tolerances of 3GPP.

[3] Please contact Compal sales and TAM for SKU option.



2 Application Interface

2.1 LGA Interface

The RXL-N3 module uses a 412-pin LGA as its external interface. For details about the module and dimensions, see 5.4 Dimensions and Interfaces.

2.2 Pin Map

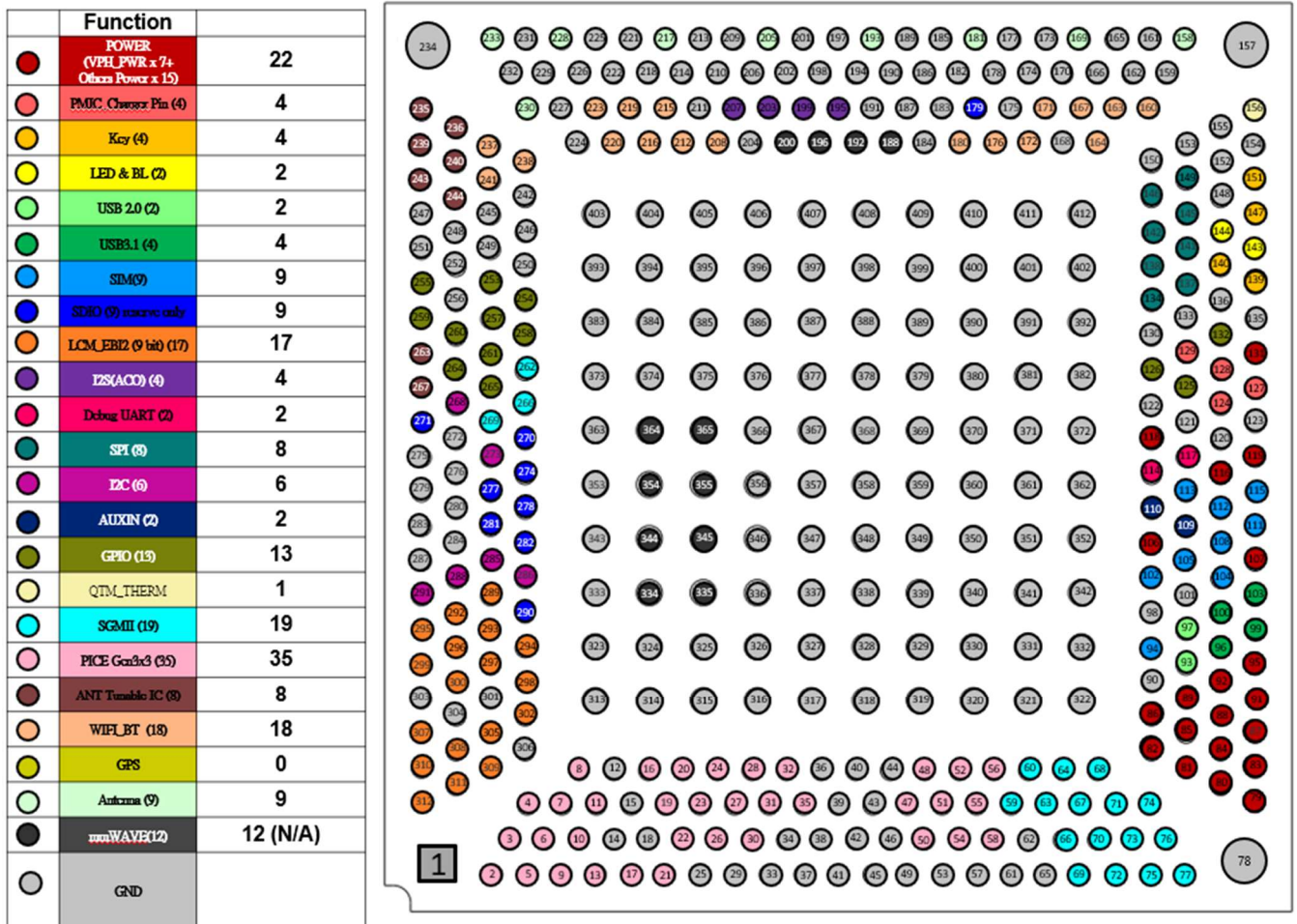


Figure 3-1 PAD Sequence of LGA module (Perspective View from TOP Side)



2.2.1 Pin Definition

The pin definition is as follows Table 3-1:

Table 3-1 Pin definition

Pin NO.	Pin Name	I/O	Pin Description	Type(V)
81	VPH_PWR_1	PI	1. For LGA Module power	3.4~4.3
88	VPH_PWR_2	PI	1. For LGA Module power	3.4~4.3
84	VPH_PWR_3	PI	1. For LGA Module power	3.4~4.3
85	VPH_PWR_4	PI	1. For LGA Module power	3.4~4.3
83	VPH_PWR_5	PI	1. For LGA Module power	3.4~4.3
79	VPH_PWR_6	PI	1. For LGA Module power	3.4~4.3
80	VPH_PWR_7	PI	1. For LGA Module power	3.4~4.3
82	SIM1_VCC	PO	For SIM1 Power	1.8/2.95
86	VREG_L13_UIM2_NU_1P8	PO	For SIM2 Power	1.8/2.95
118	VREGV_L12_1P2	PO	Reserve power supply for ANT tuner (1.2V)	1.2
131	USB_VBUS	PI	For USB detection	4.5~5.5
107	VREG_1P8_SYS	PO	Power supply output for WIFI	1.8
116	VREG_1P2_SYS	PO	Power supply output for WIFI	1.2
119	VREG_L6_1P8	PO	Power supply output for WIFI	1.8
91	VREG_S7_0P974_1	PO	Power supply output for WIFI	0.974
87	VREG_S7_0P974_2	PO	Power supply output for WIFI	0.974
89	VREG_S2_1P224	PO	Power supply output for WIFI	1.2
92	VREG_S4_1P904_1	PO	Power supply output for WIFI	1.9
95	VREG_S4_1P904_2	PO	Power supply output for WIFI	1.9
106	VREG_L15_1P2	PO	Power supply output for WIFI	1.2



128	PMX_FAULT_N	DIO	PMIC fault communication signal (bidirectional)	1.8
129	SLEEP_CLK	AO	32.7645 kHz sleep clock output to WLAN	1.2
124	SPMI_CLK	DI	Slave and PBUS interface for PMICs – clock	1.2/1.8
127	SPMI_DATA	DIO	Slave and PBUS interface for PMICs – data	1.2/1.8
139	KPD_PWR_N	DI	Power-on key ground switch,(Act_lo)	1.2/1.8
147	FORCED_USB_BOOT	DI	For Forces boot DL from HS USB	1.8V as triggered
151	PMK_RESIN_N	DI	Reset input to PMK75.	1.2/1.8
140	AUTO_ON_N	DI	GPIO_03.(PMX75)	1.8
144	PMX75_ISINK1	DI	Current sink.(up to 10mA)	
143	PMX75_ISINK2	DI	Current sink.(up to 10mA)	
93	USB_HS_DP	AIO	USB high-speed data – positive	1.8
97	USB_HS_DM	AIO	USB high-speed data – negative	1.8
96	USB_SS_TX_P	AIO	USB super-speed transmit – plus	1.8
100	USB_SS_TX_M	AIO	USB super-speed transmit – minus	1.8
99	USB_SS_RX_P	AIO	USB super-speed receive – plus	1.8
103	USB_SS_RX_M	AIO	USB super-speed receive – minus	1.8
113	CARD_UIM1_CLK	DO	For UIM1 clock.	1.8/2.95
112	CARD_UIM1_DATA	DIO	For UIM1 data	1.8/2.95
105	SDX_UIM1_PRESENT	B	For UIM presence detection	1.8
115	CARD_UIM1_RESET_N	DO	For UIM1 reset	1.8/2.95
108	UIM2_CLK	DO	For UIM2 clock	1.8/1.2
104	UIM2_DATA	DIO	1. Internal Pull-up (20Kohm) to VREG_L13_1P8 2. for UIM data	1.8/1.2
94	UIM2_PRESENT	B	For UIM2 presence detection	1.8



102	UIM2_RESET	DO	For UIM2 reset	1.8/1.2
111	UIM2_LS_EN	DI	Enable PIN for ESIM level shift.(1.8 to 1.2)	1.2
278	MSDC1_CLK	DO	SDC clock (Reserved only)	1.8/2.95
277	MSDC1_DAT0	DO	SDC data bit 0 (Reserved only)	1.8/2.95
282	MSDC1_DAT1	DIO	SDC data bit 1 (Reserved only)	1.8/2.95
270	MSDC1_DAT2	DIO	SDC data bit 2 (Reserved only)	1.8/2.95
271	MSDC1_DAT3	DIO	SDC data bit 3 (Reserved only)	1.8/2.95
281	MSDC1_CMD	DIO	SDC command (Reserved only)	1.8/2.95
274	SDC1_PWR_EN	B	1. SDC Power Enable (Reserved only) 2. 1.8V GPIO Reserved	1.8
290	SDC1_DET_N	B	1. SDC detect (Reserved only) 2. 1.8V GPIO Reserved	1.8
179	SDC1_VSEL	B	1. SDC VSEL (Reserved only) 2. 1.8V GPIO Reserved	1.8
297	EBI2_A_D0	DO	EBI2 multiplexed address and data - bit 0	1.8
293	EBI2_A_D1	DO	EBI2 multiplexed address and data - bit 1	1.8
296	EBI2_A_D2	DO	EBI2 multiplexed address and data - bit 2	1.8
295	EBI2_A_D3	DO	EBI2 multiplexed address and data - bit 3	1.8
289	EBI2_A_D4	DO	EBI2 multiplexed address and data - bit 4	1.8
292	EBI2_A_D5	DO	EBI2 multiplexed address and data - bit 5	1.8
299	EBI2_A_D6	DO	EBI2 multiplexed address and data - bit 6	1.8
300	EBI2_A_D7	DO	EBI2 multiplexed address and data - bit 7	1.8
294	EBI2_A_D_8	DO	EBI2 multiplexed address and data - bit 8	1.8
298	EBI2_OE_N	DO	EBI2 output enable	1.8
309	EBI2_CLE_UB_N	DO	EBI2 command latch enable	1.8
311	EBI2_BUSY_N	DO	EBI2 busy signal	1.8
312	EBI2_ALE_N	DO	EBI2 address latch enable	1.8
307	EBI2_WE_N	DP	EBI2 write enable	1.8
310	EBI2_LCD_TE	DO	EBI2 LCD tearing effect	1.8
302	EBI2_LCD_RESET_N	DO	EBI2 LCD reset	1.8



305	EBI2_LCD_CS_N	DO	EBI2 LCD chip select	1.8
117	DBG_UART_TX	DO	UART transmit data – (used for debug)	1.8
114	DBG_UART_RX	DI	UART receive data (used for debug)	1.8
142	SPI_MISO	DI	SPI master in, slave out	1.8
138	SPI_MOSI	DO	SPI master out, slave in	1.8
146	SPI_SCLK	B	SPI clock	1.8
134	SPI_CS_0	B	SPI chip select	1.8
141	SENSOR_MOSI	DO	Sensor master in, slave out	1.8
145	SENSOR_CLK	DO	Sensor clock	1.8
149	SENSOR_CS_N	DO	Sensor chip select	1.8
137	SENSOR_MISO	DI	SPI master in, slave out6	1.8
286	SENSOR_I2C_SCL	B	I2C clock for sensor	1.8
291	SENSOR_I2C_SDA	B	I2C data for sensor	1.8
285	I2C_SCL	B	I2C clock	1.8
288	I2C_SDA	B	I2C data	1.8
268	MU_INT	DI	Interrupt pin for I2C	1.8
273	ALSP_INT	DI	Interrupt pin for I2C	1.8
109	PMX75_AMUX1	AI	AUXIN(PMX75 GPIO_05)	0~1.875
110	PMX75_AMUX2	AI	AUXIN(PMX75 GPIO_12)	0~1.875
261	SDX_GPIO_18	DIO	General purpose input or output	1.8
264	SDX_GPIO_19	DIO	General purpose input or output	1.8
253	SDX_GPIO_69	DIO	General purpose input or output	1.8
255	SDX_GPIO_74	DIO	General purpose input or output	1.8
258	SDX_GPIO_75	DIO	General purpose input or output	1.8
254	SDX_GPIO_77	DIO	General purpose input or output	1.8
259	SDX_GPIO_78	DIO	General purpose input or output	1.8
260	SDX_GPIO_79	DIO	General purpose input or output	1.8
257	SDX_GPIO_64	DIO	General purpose input or output	1.8
265	SDX_GPIO_65	DIO	General purpose input or output	1.8
125	PMX75_GPIO_2	DIO	Configurable; default digital input with 10 μ A pull-down	1.2/1.8
126	PMX75_GPIO_15	DIO	Configurable; default digital input with 10 μ A pull-down	1.2/1.8



132	PMX75_GPIO_16	DIO	Configurable; default digital input with 10 μ A pull-down	1.2/1.8
156	QTM_THERM	AI	Analog multiplexer (AMUX) input 5 for QTM565_THERM detection	0~1.875
72	SDX_USXGMII_TX_M	AO	USXGMII interface 0 serial data Tx - minus	
70	SDX_USXGMII_TX_P	AO	USXGMII interface 0 serial data Tx - plus	
69	AQR_USXGMII_TX_M	AI	USXGMII interface 0 serial data Rx - minus	
66	AQR_USXGMII_TX_P	AI	USXGMII interface 0 serial data Rx - plus	
76	SDX_USXGMII_1_TX_M	AO	USXGMII interface 1 serial data Tx - minus	
77	SDX_USXGMII_1_TX_P	AO	USXGMII interface 1 serial data Tx - plus	
73	RTL_USXGMII_TX_M	AI	USXGMII interface 1 serial data Rx - minus	
75	RTL_USXGMII_TX_P	AI	USXGMII interface 1 serial data Rx - plus	
67	USXGMII_0_MD_CLK	B	MDIO interface clock signal(USXGMII)	1.8
64	USXGMII_0_MD_DATA	B	MDIO interface data signal(USXGMII)	1.8
63	USXGMII_0_RESET_N	DO	Reset signal for Ethernet PHY(USXGMII)	1.8
59	USXGMII_0_INT_N	DO	SGMII 0 PHY interrupt(USXGMII)	1.8
74	USXGMII_1_MD_CLK	B	MDIO interface clock signal(USXGMII_1)	1.8
71	USXGMII_1_MD_DATA	B	MDIO interface data signal(USXGMII_1)	1.8
60	USXGMII_1_RESET_N	DO	Reset signal for ethernet PHY(USXGMII_1)	1.8
68	USXGMII_1_INT_N	DO	SGMII 1 PHY interrupt(USXGMII_1)	1.8
266	ETH0_AQR_PWR_EN	DO	Power enable signal for ethernet PHY(USXGMII)	1.8
269	ETH1_RTL_PWR_EN	DO	Power enable signal for ethernet PHY(USXGMII_1)	1.8
262	SDX_SYNC_1558	DIO	General purpose input or output	1.8
28	SDX_PCIE0_RX0_P	AI	PCIe 0 Gen 3 receive 0 - plus	
31	SDX_PCIE0_RX0_M	AI	PCIe 0 Gen 3 receive 0 - minus	
27	WK_5G_PCIE0_RX0_P	AO	PCIe 0 Gen 3 transmit 0 - plus	
24	WK_5G_PCIE0_RX0_M	AO	PCIe 0 Gen 3 transmit 0 - minus	
20	SDX_PCIE0_RX1_P	AI	PCIe 0 Gen 3 receive 1 - plus	
23	SDX_PCIE0_RX1_M	AI	PCIe 0 Gen 3 receive 1 - minus	
19	WK_5G_PCIE0_RX1_P	AO	PCIe 0 Gen 3 transmit 1 - plus	



16	WK_5G_PCIE0_RX1_M	AO	PCIe 0 Gen 3 transmit 1 - minus	
32	SDX_PCIE0_REFCLK_P	AO	PCIe 0 Gen 3 reference clock - plus	
35	SDX_PCIE0_REFCLK_M	AO	PCIe 0 Gen 3 reference clock - minus	
22	SDX_PCIE0_WAKE_N	B	PCIe0 wake up signal	1.8
26	SDX_PCIE0_CLKREQ_N	DO	PCIe0 clock request	1.8
30	SDX_PCIE0_RESET_N	DO	PCIe0 reset signal	1.8
11	SDX_PCIE1_RX0_P	AI	WLAN PCIe transmit output differential signals lane 0 - plus	0.88
8	SDX_PCIE1_RX0_M	AI	WLAN PCIe transmit output differential signals lane 0 - minus	0.88
9	WK_6G_PCIE1_RX0_P	AO	WLAN PCIe receive input differential signals lane 0 - plus	0.88
10	WK_6G_PCIE1_RX0_M	AO	WLAN PCIe receive input differential signals lane 0 - minus	0.88
3	SDX_PCIE1_RX1_P	AI	WLAN PCIe transmit output differential signals lane 1 - plus	0.88
2	SDX_PCIE1_RX1_M	AI	WLAN PCIe transmit output differential signals lane 1 - minus	0.88
6	WK_6G_PCIE1_RX1_P	AO	WLAN PCIe receive input differential signals lane 1 - plus	0.88
5	WK_6G_PCIE1_RX1_M	AO	WLAN PCIe receive input differential signals lane 1 - minus	0.88
7	SDX_PCIE1_REFCLK_P	AO	WLAN PCIe reference clock input differential signals - plus	0.88
4	SDX_PCIE1_REFCLK_M	AO	WLAN PCIe reference clock input differential signals - minus	0.88
21	SDX_PCIE1_WAKE_N	DI	WLAN PCIe wake-up signal. It is an open-drain signal that requires an external pull-up resistor. (4.7K PU)	1.8
13	SDX_PCIE1_CLKREQ_N	B	WLAN PCIe clock request signal. It is an open-drain signal that requires an external pull-up resistor. (4.7K PU)	1.8
17	SDX_PCIE1_RESET_N	DO	WLAN PCIe reset	1.8
55	SDX_PCIE2_RX0_P	AI	PCIe 2 Gen 3 receive - plus	
58	SDX_PCIE2_RX0_M	AI	PCIe 2 Gen 3 receive - minus	
47	WK_2G_PCIE2_RX0_P	AO	PCIe 2 Gen 3 transmit - plus	
50	WK_2G_PCIE2_RX0_M	AO	PCIe 2 Gen 3 transmit - minus	



51	SDX_PCIE2_REFCLK_P	AO	PCIe 2 Gen 3 reference clock - plus	
54	SDX_PCIE2_REFCLK_M	AO	PCIe 2 Gen 3 reference clock - minus	
56	SDX_PCIE2_WAKE_N	B	PCIe2 wake up signal	1.8
52	SDX_PCIE2_CLKREQ_N	DO	PCIe2 clock request	1.8
48	SDX_PCIE2_RESET_N	DO	PCIe2 reset signal	1.8
235	SDR_RFFE1_CLK	DO	ANT tuner MIPI_1_CLK (52HMz) form SDR	-
236	SDR_RFFE1_DATA	DO	ANT tuner MIPI_1_DATA form SDR	-
243	SDR_RFFE3_CLK	DO	ANT tuner MIPI_3_CLK (52HMz) form SDR	-
244	SDR_RFFE3_DATA	DO	ANT tuner MIPI_3_DATA form SDR	-
239	SDR_RFFE7_CLK	DO	ANT tuner MIPI_7_CLK (52HMz) form SDR	-
240	SDR_RFFE7_DATA	DO	ANT tuner MIPI_7_DATA form SDR	-
263	SDX_GPIO_29	DIO	1. ANT tuner MIPI_0_DATA form SDX 2. 1.8V SDX GPIO_29 reserved	- 1.8V
267	SDX_GPIO_30	DIO	1. ANT tuner MIPI_0_CLK (38.4HMz) form SDX 2. 1.8V SDX GPIO_30 reserved	- 1.8V
220	DEV_SOL	DIO	Device sign of life (WCN or QFW to HOST sign of life indicator)	1.8
216	WCN_HOST_SOL	DIO	Host sign of life (HOST to WCN or QFW sign of life indicator)	1.8
212	WLAN_LTE_COXM_TXD	DO	WSI interface for WLAN/LTE Co-ex algorithms	1.8
208	WLAN_LTE_COXM_RXD	DI	WSI interface for WLAN/LTE Co-ex algorithms	1.8
160	BT_UART_TXD	DO	BT_UART_RXD	1.8
171	BT_UART_RXD	DI	BT_UART_TXD	1.8
167	BT_UART_CTS_N	DI	BT_UART_RTS	1.8
163	BT_UART_RFR_N	DO	BT_UART_CTS	1.8
207	BT_SEC_I2S_WS	B	BT_I2S_Word Select	1.8
195	BT_SEC_I2S_SCK	B	BT_I2S_SCK	1.8
199	BT_SEC_I2S_D1	B	BT_I2S_SDI	1.8



203	BT_SEC_I2S_D0	B	BT_I2S_SDO	1.8
164	RF_CLK1_WLAN	AO	76.8 MHz RF clock to WLAN	-
172	BT_EN	DO	Bluetooth enable signal. It is an active high to enable Bluetooth operation.	1.2 or 1.8
176	N79_TX_EN_TO_WLAN	DO	WL_XFEM_CTRL_N79_TXEN form SDR GRFC_14	1.2 or 1.8
219	WK_2G_WLAN_DIS	DO	WLAN enable signal. It is an active high to enable WLAN operation	1.8
215	WK_2G_PWR_EN	DI	Switch request to external PMU between active and sleep mode for WLAN.	1.8
223	WK_6G_WLAN_DIS	DI	Switch request to external PMU between active and sleep mode	1.8
237	WK_5G_PWR_EN	DI/DO	Reserve SDX GPIO_82 for QFW	1.8
241	WK_6G_PWR_EN	DI/DO	Reserve SDX GPIO_17 for QFW	1.8
238	WK_5G_WLAN_DIS	DI/DO	Reserve SDX GPIO_16 for QFW	1.8
1,12,14,15,18,25,29,33,34,36,37,38,39,40,41,42,43,44,45,46,49,53,57,61,62,65,78,90,98,101,120,121,122,123,130,133,135,136,148,150,152,153,155,157,159,161,162,204,165,166,168,170,224,173,174,175,177,178,182,183	GND_1~GND_60			
185,186,187,189,190,191,184,194,227,197,198,201,202,206,209	GND_61~75			
210,213,214,211,218,221,222,225,226,229,231,232,234,247,248,301,303,304,	GND76~135			



306,313,314, 315,316,317, 318,319,320, 321,322,323, 324,325,326, 327,328,329, 330,331,332, 333,283,287, 284,337,338, 339,340,341, 342,343,279, 336,280,347, 348,349,350, 351,352,353				
275,272,276, 357~363,356 ,346,366~36 8,250,246,24 2,249,252,24 5,251,256,15 4	GND136~150 GND195~GND203			
369,370~412	GND151~194			

AI : Analog input

AO : Analog output

B : Bidirectional digital with CMOS input

PD: Pull-Down

PU: Pull-Up

T: Tristate

OD: Open Drain

PP: Push-Pull

PI: Power Input

PO: Power Output

Z: High-impedance (Hi-Z) output



2.3 RF Antenna Interface

The LGA module provides five antenna pads (four:ANT0~ANT3 and one GNSS) for connecting the external antennas.

The RF pad difference is the most important difference between LGA modules; please refer to 49 mm x 50 mm LGA Module Hardware Migration Guide.

Route the antenna pad as close as possible to antenna connector. In addition, the impedance of RF signal traces must be 50 Ω .

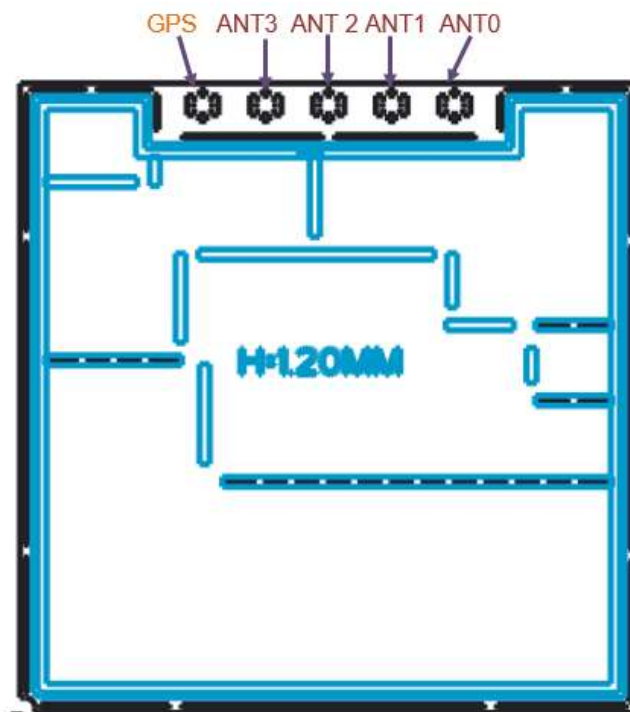


Figure 3-22 Definition of the antenna pinout location (Perspective View from TOP Side)



Table 3-24 Definition of the antenna port mapping

Frequency		Ant_0	Ant_1	Ant_2	Ant_3	Ant_4
LB	600-960 MHz	Tx0/PRx	DRx	DRx2	Tx0/PRx2	
MB	1710-2200 MHz	Tx0/PRx	PRx2	DRx2	Tx1/DRx	
HB	2300-2700 MHz	Tx1/DRx	DRx2	PRx2	Tx0/PRx	
N77/78	3300-4200 MHz	Tx0/PRx2	PRx	DRx2	Tx1/DRx	
GPS L1	1575-1610 MHz					Rx

Supported air Interfaces for each of band groups are listed in the following table 3-24-1.

Table 3-24-1

Band Group	Fmin (MHz)	Fmax (MHz)	Air Interface
LB	600	960	LTE FDD: B5/12/13/14/17/26/29/71 5G NR FR1 FDD: n5/12/13/14/26/29/71
MB	1427.9	2170	LTE FDD: B2/4/25/66 5G NR FR1 FDD: n2/25/66/70
HB	2300	2690	LTE FDD: B7/30 LTE TDD: B38/41 5G NR FR1 FDD: n7/30 5G NR FR1 TDD: n38/41
UHB	3000	6000	LTE TDD: B42/43/48 5G NR FR1 TDD: n48/77/78





3 Radio Frequency

3.1 Overview

This chapter describes the RF specifications of the LGA module, including:

- Operating Frequencies
- Conducted Rx Sensitivity and Tx Power
- Antenna Design Requirements

3.2 Operating Band

The 5G LGA Module operating bands of the antennas are as follows table 4-1:

Table 4-1

Band name	Tx (MHz)	Rx (MHz)	LTE	UMTS	5G NR
PCS (1900)	1850 - 1910	1930 - 1990	B2		n2
AWS	1710 - 1755	2110 - 2155	B4		-
Cell (850)	824 - 849	869 - 894	B5		n5
700 lower A-C	699 - 716	729 - 746	B12		n12
700 upper C	777 - 787	746 - 756	B13		
PCS + G	1850 - 1915	1930 - 1995	B25		n25
B26	814 - 849	859 - 894	B26		-
WCS	2305 - 2315	2350 - 2360	-		n30
B38	2570 - 2620		B38		n38
B41/B41-XGP	2496 - 2690		B41		n41
B42	3400 - 3600		B42		-
B43	3600 - 3800		B43		-
B48	3550 - 3700		B48		n48
B66	1710 - 1780	2110 - 2200	B66		n66
B71	663 - 698	617 - 652	B71		n71
n77	3300 - 4200		-		n77
n78	3300 - 3800		-		n78



3.3 Transmitting Power

The transmitting power for each band of the LGA module as shown in the following table:

Table 4-3 LTE FDD

Mode	Band	Typical Value (dBm)	Tolerance
LTE FDD	Band 2	23	+1/-2
	Band 4	23	+1.5/-2
	Band 5	23	+1.5/-2
	Band 12	23	+1/-2
	Band 13	23	+1/-2
	Band 25	23	+1.5/-2
	Band 26	23	+1.5/-2
	Band 66	23	+1/-2
	Band 71	23	+2/-2

Table 4-4 LTE TDD

Mode	Band	Typical Value (dBm)	Tolerance
LTE TDD	Band 38	23	+1/-2
	Band 41(HPUE) for ISCED	26	+1/-2
	Band 41 for FCC	23	+1/-2
	Band 42	23	+1/-2
	Band 43	23	+1/-2
	Band 48 for FCC	22	+1/-2
	Band 48 for ISCED	23	+1/-2



Table 4-5 NR-FR1 FDD

Mode	Band	Typical Value (dBm)	Note
NR-FR1 FDD	n2	23	+1/-2
	n5	23	+1/-2
	n12	23	+1/-2
	n25	23	+1/-2
	n30	23	+1/-2
	n66	23	+1/-2
	n71	23	+1/-2

Table 4-6 NR-FR1 TDD

Mode	Band	Typical Value (dBm)	Note
NR-FR1 TDD	SISO		
	n38 for ISED	23	+1/-2
	n41 (HPUE)	26	+2/-2
	n41	23	+1/-2
	n48 for FCC	22	+1/-2
	n48 for ISED	23	+1/-2
	n77 (PC1.5)	29	+1/-2
	n77	23	+1.5/-2
	n78 (HPUE)	26	+1/-2
	n78	23	+1.5/-2
	MIMO		
	n38 MIMO for ISED	23	+1/-2
	n41 MIMO	26	+2/-2
	n48 MIMO for FCC	22	+1/-2
	n77 MIMO	29	+1.5/-2
	n78 MIMO	26	+1.5/-2



NOTE:

If device is operated in EN-DC mode, total TX power would be “LTE + NR $\cong 23 \pm 2$ ” due to power sharing algorithm.



3.4 Receiver Sensitivity

The receiver sensitivity for each band of the 5G LGA Module as shown in the following table:

Table 4-7 LTE band

Mode (10MHz)	Band	Single Port				Combined Port
		PRx	DRx	PRx MIMO	DRx MIMO	3GPP spec
LTE	B2	-96	-96	-96	-96	-97.7
	B4	-96	-96	-96	-96	-99.7
	B5	-98	-98			-95
	B12	-98	-98			-94
	B13	-98	-98			-94
	B25	-96	-96	-96	-96	-96.2
	B26	-98	-98			-94.5
	B38	-96	-96	-96	-96	-99.7
	B41	-96	-96	-96	-96	-97.7
	B42	-97	-97	-97	-97	-98.2
	B43	-97	-97	-97	-97	-98.2
	B48	-97	-97	-97	-97	-98.2
	B66	-96	-96	-96	-96	-99.2
	B71	-98	-98			-94.2



Table 4-8 NR band

Mode (10MHZ,15K)	Band	Single Port				Combined Port	
		PRx_0	DRx_0	PRx_1	DRx_1	RX	3GPP spec
NR	n2	-96	-96	-96	-96	-102.5	-97.1
	n5	-98	-98			-100.5	-94.8
	n12	-98	-98			-100.5	-93.8
	n25	-96	-96	-96	-96	-102.5	-96
	n30	-96	-96	-96	-96	-102.5	-98.5
	n48	-97	-97	-97	-97	-102.5	-98.7
	n66	-96	-96	-96	-96	-102.5	-99
	n71	-98	-98	-98	-98	-103.5	-96.7

Mode (100MHZ,30K)	Band	Single Port				Combined Port	
		PRx_0	DRx_0	PRx_1	DRx_1	4-RX	3GPP spec
NR	n41	-83	-83	-83	-83	-88	-84.7
	n77	-85	-85	-85	-85	-90	-85.1
	n78	-85	-85	-85	-85	-90	-85.6



NOTE:

The above values are measured in one antenna situation.



3.5 GNSS

5G LGA Module supports GNSS/BeiDou and AGNSS functions, and adopts RF

Diversity and GNSS/Beidou integrated antenna.

Table 4-9

	Condition		Test Result
GPS	TTFF	Cold start	50s@-130dBm
		Hot Start	2s@-130dBm
	Receive Sensitivity	Tracking	-160 dBm
		Acquisition	-155 dBm



NOTE:

Please note that GPS current is tested with RF disabled.



4. FCC Notice

Model: RXL-N3

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.
4. 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 compliant with the transmitter(s) rule(s).

Antenna Installation

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users.
- (2) The transmitter module may not be co-located with any other transmitter or antenna.
- (3) To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile exposure condition must not **exceed the values under Section 5 of this manual.**

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

Module Warning statements

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
- (2) This device must accept any interference received, including interference that may cause undesired operation.

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

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.

FCC Caution: 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.



RF Exposure

FOR MOBILE DEVICE USAGE (>20cm/low power)

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.

2.10 Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment.

As long as all 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.

2.11 Note EMI Considerations

Please follow the guidance provided for host manufacturers in KDB publications 996369 D02 and D04.

2.12 How to make changes

Only Grantees are permitted to make permissive changes. Please contact us should the host integrator expect the module to be used differently than as granted:

Contact: Miranda Wu

Email: Miranda_wu@compal.com

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

Label requirements

Any device incorporating this module must include an external, visible, permanent marking or label which states:

“Contains FCC ID: GKRRXLN3”



Industry Canada statement

This device complies with ISSED's licence-exempt RSSs. 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.

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

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

1) The antenna must be installed and operated with greater than 20cm between the antenna and users, and **(if EUT is portable device, please delete this item)**

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.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

1) L'antenne doit être installée et exploitée avec plus de 20 cm entre l'antenne et les utilisateurs, et

2) 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 co-location 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 re-evaluating 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 FOR MOBILE DEVICE USAGE (>20cm/low power)

This transmitter module is authorized only for use in device where the antenna may be installed and operated with greater than 20cm between the antenna and users. The final end product must be labeled in a visible area with the following:

"Contains IC: 2533B-RXLN3".

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un appareil où l'antenne peut être installée et utilisée à plus de 20cm entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: **"Contient des IC: 2533B-RXLN3".**

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.

End Product Labeling

When the module is installed in the host device, the 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 IC: 2533B-RXLN3"

5. Antenna Gain



Max Gain
3.20 dBi@B2 (Tx:1850-1910 MHz, Rx:1930-1990 MHz)
3.31 dBi@B4 (Tx: 1710-1755MHz, Rx:2110-2155 MHz)
1.25 dBi@B5 (Tx:824-849 MHz, Rx:869-894 MHz)
0.78 dBi@B12 (Tx:699-716 MHz, Rx:729-746 MHz)
0.91 dBi@B13 (Tx:777-787 MHz, Rx:746-756 MHz)
3.20 dBi@B25 (Tx:1850-1915 MHz, Rx:1930-1995 MHz)
1.25 dBi@B26 (Tx:814-849 MHz, Rx:859-894 MHz)
0.00 dBi@B30 (Tx:2305-2314 MHz, Rx:2350-2359 MHz)
2.75 dBi@B38 (Tx/Rx:2570-2620 MHz)
2.75 dBi@B41 (Tx/Rx:2490-2690 MHz)
-0.30 dBi@B42 (Tx/Rx:3400-3600 MHz)
-0.30 dBi@B43 (Tx/Rx:3600-3800 MHz)
0.00 dBi@B48 (Tx/Rx:3550-3700 MHz)
3.31 dBi@B66 (Tx:1710-1780 MHz, Rx:2110-2200 MHz)
0.53 dBi@B71 (Tx:663-698 MHz, Rx:617-652 MHz)
-0.30 dBi@B77 (Tx/Rx:3300-4200 MHz)
-0.30 dBi@B78 (Tx/Rx:3300-3800 MHz)
4.20 dBi@GNSS (1575.42MHz)

6. Antenna trace Design

PCB thickness:1.0mm	Ant4	Ant3	Ant2	Ant1	Ant0
Antenna Connector: 20449-001E-03 I-PEX	Width:10.2mil Length:165mil	Width:10.2mil Length:298mil	Width:10.2mil Length:266mil	Width:10.2mil Length:242mil	Width:10.2mil Length:227mil

Trace design

The trace from module transmitter to antenna connector must be maintained identical as the above specification with i-pex connector. Only trace designs approved by the module original grantee or through permissive change can be used by an host manufacturer. Any changes are deemed as antenna type change and should be reviewed to ensure compliance with the FCC regulation rules.



Verification must be conducted and the results shall not exceed below ranges to ensure identical antenna design is applied to subsequent integration and end product production.

Test procedures of Verification

1. Set Transmission in the supported modulation mode, band and Channel.
2. Verify RF tuned-up power through conducted measurement with appropriate cable loss. The KDB guidance 971168 D01 can be followed to obtain the measurement results.
3. Verify the RF output power results obtained if it's accordance with the datasheet and test reports.