



EM92XX Series

Migration Guide

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Rev. 3



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Revision History

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1	October 2023	Document creation
2	October 2023	Updated Table 2-6 (added rows—Uplink MIMO, Antennas used for Tx)
3	October 2023	Updated Table 2-1 (added antenna configuration notes to Shared connector table cells)

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>> 1: Introduction

This document provides information for developers planning to migrate to EM92XX Series modules (EM9291, EM9293) from EM91XX Series modules (EM9190, EM9191, EM7690). EM92XX modules are drop-in compatible, sharing common characteristics such as dimensions, power supply, environmental specifications, etc.

Included in this document are summaries of specific RF, interface, and regulatory features and differences between these module series.

Important: *This document summarizes only key differences between modules.*

For detailed module specifications, including module-specific current consumption and RF sensitivity measurements, refer to [1] EM92XX Product Technical Specification (Doc# 41114313) and [2] EM919X/EM7690 Product Technical Specification (Doc# 41113174).

>> 2: Module Differences

2.1 RF

2.1.1 RF Connectors

As shown in [Figure 2-1](#), EM92XX and EM91XX modules include four RF connectors for shared 5G Sub6/LTE/GNSS. EM9293 and EM9190 also include additional connectors for standalone GNSS and 5G mmW, respectively.

[Table 2-1](#) describes device support for the various RF connectors.

Note—As indicated in [Table 2-1](#), the shared 5G NR Sub-6G/LTE/WCDMA/GNSS connectors for EM91XX have distinct names reflecting their function, and the connectors for EM92XX do not:

- EM92XX—Antenna function (Tx and Rx antenna assignment) is RAT/ band-dependent.
- EM91XX—Antenna function is static.

For series-specific antenna assignment details, refer to the RF Specifications chapters of [\[1\] EM92XX Product Technical Specification \(Doc# 41114313\)](#) and [\[2\] EM919X/EM7690 Product Technical Specification \(Doc# 41113174\)](#).

Table 2-1: RF Connectors—EM92XX, EM91XX

Device	Shared 5G Sub6/LTE/GNSS [Connector type: MHF 4]	Standalone GNSS [Connector type: MHF 7S]	mmWave [Connector type: MHF 7S]
EM9291	Y (ANT0, ANT1, ANT2, ANT3)	—	—
EM9293	<i>Note: EM92XX only supports a platform configuration with 4 antennas connected.</i>	Y ^a (GNSS)	—
EM9190	Y (MAIN, MIMO, MIMO2, AUX)	—	Y (8)
EM9191	<i>Note: EM91XX has software configurations supporting platforms with either 2 or 4 antennas connected (commercial operation).</i>		—
EM7690			—

a. EM9293 standalone GNSS connector supports an active antenna with a 3.15 V power supply.

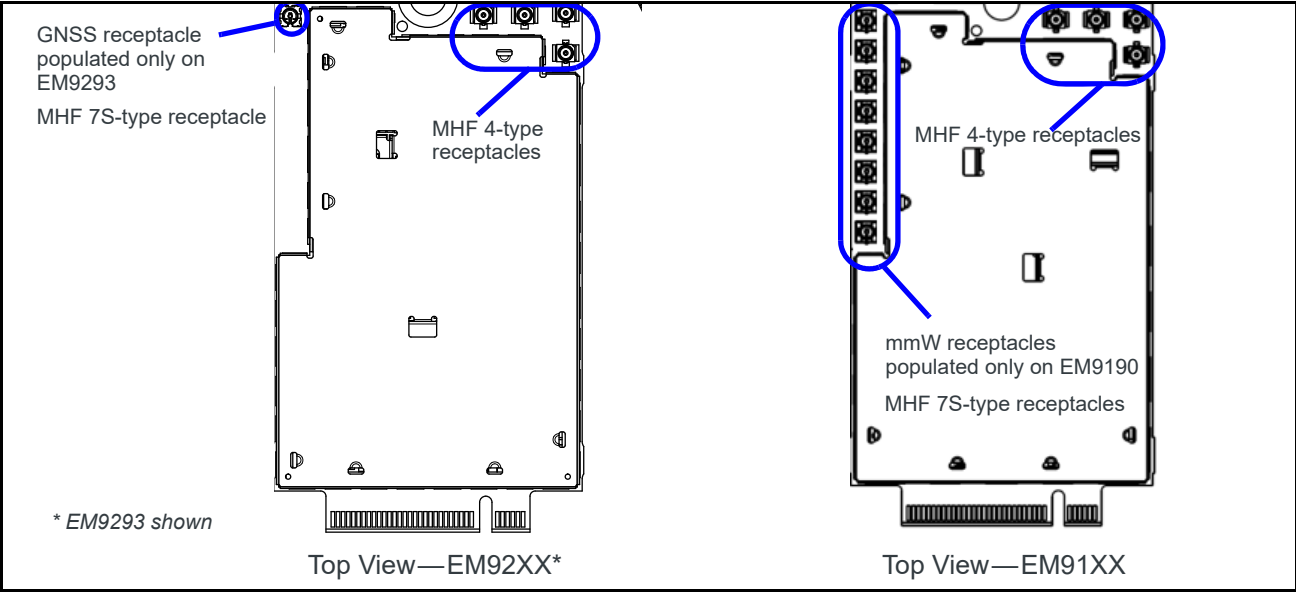


Figure 2-1: RF Connectors—EM92XX, EM91XX

2.1.2 Supported Bands

Table 2-2, Table 2-3, Table 2-4 and Table 2-5 indicate all supported RF bands for each module.

Note—Each 5G NR Sub-6G/LTE/WCDMA/GNSS band’s Tx and Rx paths are linked to specific antennas. For antenna assignments, refer to the RF Specifications chapters of [1] EM92XX Product Technical Specification (Doc# 41114313) and [2] EM919X/EM7690 Product Technical Specification (Doc# 41113174).

Table 2-2: Supported 5G NR Bands^a

Device	n1	n2	n3	n5	n7	n8	n12	n13	n14	n18	n20	n25	n26	n28	n29	n30	n38	n40	n41	n48	n66	n70	n71	n75	n76	n77	n78	n79	n257	n258	n260	n261
EM9291 EM9293	F	F	F	F	F	F	F	F	F	F	F	F	F	F	S	F	T	T	T	T	F	F	F	S	S	T	T	T	—	—	—	—
EM9190	F	F	F	F	F	F	—	—	—	F	F	—	F	—	—	T	T	T	T	F	—	F	—	—	T	T	T	T	T	T	T	T
EM9191	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
EM7690	Not supported																															

a. F=FDD LTE supported; T=TDD LTE supported; S = SDL (Supplementary Downlink) band (for 5G SA only)

Table 2-3: Supported 4G LTE Bands^a

Device	B1	B2	B3	B4	B5	B7	B8	B12	B13	B14	B17	B18	B19	B20	B25	B26	B28	B29	B30	B32	B34	B38	B39	B40	B41	B42	B43	B46	B48	B66	B71	
EM9291 EM9293	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F ^b	F ^b	F ^b	T	T	T	T	T	T	T	T	T	T	F	F
EM9190 EM9191 EM7690	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F ^b	F	T	T	T	T	T	T	T	T	T	T	F	F

a. F=FDD LTE supported; T=TDD LTE supported
b. Downlink only

Table 2-4: Supported UMTS^a Bands^b

Device	B1	B2	B4	B5	B6	B8	B9	B19
EM9291 EM9293	Y	Y	Y	Y	—	Y	—	Y
EM9190 EM9191 EM7690	Y	Y	Y	Y	Y	Y	Y	Y

- a. DC-HSPA+, HSPA+, HSPA, UMTS
- b. F=FDD LTE supported; T=TDD LTE supported; Y=Supported

Table 2-5: Supported GNSS Bands

Device	GPS/QZSS	GLONASS	Galileo	BeiDou
EM9291 EM9293	L1/L5	G1	E1/E5a	B1I/B2a
EM9190 EM9191 EM7690				

2.2 3GPP Compliance

Table 2-6 summarizes each module’s compliance with 3GPP standards.

Table 2-6: 3GPP Compliance and Data Rates

	EM9291	EM9293	EM9190	EM9191	EM7690
3GPP Standard	5G NR: Release 16 4G LTE: Release 15 UMTS: Release 9		5G NR: Release 15 4G LTE: Release 15 UMTS: Release 9		4G LTE: Release 15 UMTS: Release 9
5G Capability	5G NR Sub-6G 120 MHz	5G NR Sub-6G 200 MHz	5G NR Sub-6G 200 MHz 5G mmW 800 MHz	5G NR Sub-6G 100 MHz	—
LTE Layers (DL)	16 (LTE only) 10 (with 120 MHz NR)	20 (LTE only) 8 (with 200 MHz NR)	20 (LTE only) 8 (with 200 MHz NR)	20 (LTE only) 12–16 (with 100 MHz NR)	20
Uplink MIMO	2x2		—		
Downlink MIMO	2x2, 4x4				
Antennas used for Tx	4 (ANT0–ANT3) ^a		2 (MAIN, MIMO1) ^b		
UMTS Capability	DC-HSPA+				

- a. For EM92XX antenna receptacle RF Technology support details, refer to [1] *EM92XX Product Technical Specification (Doc# 41114313)*, RF Specifications chapter.
- b. For EM91XX antenna receptacle RF Technology support details, refer to [2] *EM919X/EM7690 Product Technical Specification (Doc# 41113174)*, RF Specifications chapter.

2.2.1 Supported Carrier Aggregation Combinations

Supported carrier aggregation combinations vary from module to module. For details, refer to [1] *EM92XX Product Technical Specification (Doc# 41114313)* and [2] *EM919X/EM7690 Product Technical Specification (Doc# 41113174)*.

2.3 Module Pinouts

EM92XX modules are pin-compatible with EM91XX modules, except as indicated in [Table 2-7](#).

Table 2-7: Pin Support Variations by EM Series

Pin #	EM92XX	EM91XX
40	UIM2_PRES	QTM0_PON
42	UIM2_DATA	QTM1_PON
44	UIM2_CLK	QTM2_PON
46	UIM2_RST#	QTM3_PON
48	UIM2_PWR	QTM_IO_1.9V ^a
56	RFFE_CLK	NC
58	RFFE_DATA	NC
65	1P8_TUNER_PWR	ANT_CTRL3

a. EM91XX Pin 48 may be identified as QTM_IO_PWR in some documents.

2.4 Regulatory Compliance and Industry Certifications

[Table 2-8](#) and [Table 2-9](#) indicate each module's regulatory compliance and industry certifications.

Table 2-8: Regulatory Compliance

Device	<u>USA</u>	<u>Canada</u>	<u>Taiwan</u>	<u>EU</u>	<u>Japan</u>
	FCC	ISED	NCC	RED	MIC
EM9291	Y	Y ^a	Y ^a	Y ^a	Y ^a
EM9293	Y	Y ^a	Y	Y ^a	Y ^a
EM9190 EM9191 EM7690	Y	Y	Y	Y	Y

a. Pending

Table 2-9: Industry Certifications

Device	GCF	PTCRB
EM9291 EM9293	Y	Y
EM9190 EM9191 EM7690	Y	Y

2.5 Interfaces

2.5.1 Power Interface

EM92XX and EM91XX modules use the same PCIe and USB power-on/off sequences, with different timing parameter values. [Table 2-10](#) and [Table 2-11](#) lists all parameters for both module series and indicates terminology and value differences between the module series using bold text and matching colored cells.

Table 2-10: Power On/Off PCIe Timing

EM92XX					EM91XX				
Symbol	Min	Typ	Max	Unit	Symbol	Min	Typ	Max	Unit
T_settle	—	—	—	ms	T_settle	—	—	—	ms
T_pvppl	150	—	—	ms	T_pvppl	50	—	—	ms
T_rst_pla	—	760	950	ms	T_rst_pla	—	157	—	ms
T_rst_poff	0	See ^a	—	s	T_rst_poff	0	See ^a	—	s
T_pwr_on_seq	—	43	53	s	T_pwr_on_seq	—	4.5	10	s
T_pwr_off_seq	—	6	10	s	T_pwr_off_seq	—	4.5	8	s
T_perst_clk	100	—	—	μs	T_perst_clk	100	—	—	μs

a. PCIE_PERST_N can be asserted (signal low) any time up to the moment Full_Card_Power_Off_N is asserted.

Table 2-11: Power On/Off USB Timing

EM92XX					EM91XX				
Symbol	Min	Typ	Max	Unit	Symbol	Min	Typ	Max	Unit
T_pwr_on_seq	—	52	62	s	T_pwr_on_seq	—	14.7	35	s
T_pwr_pla	—	0.91	1.1	s	T_pwr_pla	—	250	300	ms
T_pwr_off_seq	—	6	10	s	T_pwr_off_seq	—	4.5	8	s

2.5.2 Reset Interface

EM92XX and EM91XX modules provide pin 67 for the host to perform a hard reset.

To reset the module, the host must pulse the pin with a logic low signal:

- EM92XX—Pulse pin 67 (RESET_N) low for 450 ms (minimum) and release.
- EM91XX—Pulse pin 67 (RESET#) low for 400–800 ms and release.

For details, refer to the Full_Card_Power_Off_N and RESET_N Usage table in [1] *EM92XX Product Technical Specification (Doc# 41114313)*, and the Full_Card_Power_Off# and RESET# Usage table in [2] *EM919X/EM7690 Product Technical Specification (Doc# 41113174)*.

2.6 SIM Interface

Table 2-12 describes EM92XX and EM91XX modules' support for external SIMs and embedded SIMs (eSIM).

Table 2-12: Supported SIMs

Device	UIM1	UIM2	
	External (1.8V/3V)	External (1.8V)	eSIM (1.8V)
EM9291 EM9293	Y	Y	Y
EM9190 EM9191 EM7690	Y	—	Y ^a

a. SKU-dependent

2.7 mmW

Table 2-13: mmW Support

Device	mmW
EM9291 EM9293	N
EM9190	Y
EM9191 EM7690	N

>> 3: References

3.1 Web Site Support

Check source.sierrawireless.com for the latest available documentation for EM series modules.

3.2 Reference Documents

- [1] EM92XX Product Technical Specification (Doc# 41114313)
- [2] EM919X/EM7690 Product Technical Specification (Doc# 41113174)