User Guide (DRAFT)

AirPrime WMP Series

SIERRA WIRELESS

WA_DEV_WMPR_PTS_001
001
September 20, 2010

Important Notice

Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

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Document History

Version	Date	Updates
001	September 20, 2010	Creation

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1. Introduction

The AirPrime WMP50/100/150 and WMP100ESIM/150ESIM Intelligent Embedded Modules are self-contained E-GSM/GPRS 900/1800 and 850/1900 quad-band embedded modules. In addition, they are EDGE-Rx capable except for the WMP50.

1.1. Physical Dimensions

- Length: 25 mm
- Width: 25 mm
- Thickness: 3.65 mm for WMP50, WMP100, and WMP100ESIM
  3.78 mm for WMP150 and WMP150ESIM
- Weight: 4.25 g

1.2. GSM/GPRS/EDGE-RX Features

- 2 Watts EGSM 900/GSM 850 radio section running under 3.6 Volts
- 1 Watt GSM1800/1900 radio section running under 3.6 Volts
- Hardware GPRS class 10 capable
- Hardware EDGE-Rx class 10 capable

1.3. Interfaces

- Digital section running under 2.8 Volts and 1.8Volts.
- 3V/1V8 SIM interface
- 1.8V Parallel interface for devices (memories, LCD, etc.)
- Power supplies
- Watchdog
- Serial links (UART)
- Analogue audio
- ADC / DAC
- PCM digital audio
- Keyboard
- USB 2.0 slave
- Serial buses (I^2C, SPI)
- PWM (BUZZER)
- GPIOs
- SIM (external SIM and optional embedded SIM)

1.4. Operating System

- Real Time Clock with calendar
- Echo Cancellation + noise reduction (quadri codec)
- Full GSM or GSM/GPRS/EDGE-Rx Operating System stack

1.5. Connection Interfaces

The WMP series embedded module has a ball grid array pin out that includes:

- An RF connection
- Baseband signals connection

1.6. Environment and Mechanics

1.6.1. RoHS Directive Compliant

The WMP Series modules are compliant with RoHS Directive 2002/95/EC which sets limits for the use of certain restricted hazardous substances. This directive states that "from 1st July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)".

1.6.2. Disposing of the Product

This electronic product is subject to the EU Directive 2002/96/EC for Waste Electrical and Electronic Equipment (WEEE). As such, this product must not be disposed off at a municipal waste collection point. Please refer to local regulations for directions on how to dispose of this product in an environmental friendly manner.

2. Functional Specifications

2.1. RF Functionalities

The Radio Frequency (RF) range complies with the Phase II EGSM 900/DCS 1800 and GSM 850/PCS 1900 recommendation. The frequencies are listed in the table below.

Table 1. List of RF Frequency Ranges

RF Bandwidth	Transmit band (Tx)	Receive band (Rx)
GSM 850	824 to 849 MHz	869 to 894 MHz
E-GSM 900	880 to 915 MHz	925 to 960 MHz
DCS 1800	1710 to 1785 MHz	1805 to 1880 MHz
PCS 1900	1850 to 1910 MHz	1930 to 1990 MHz

The RF part is based on a specific quad band chip including:

- a Digital low-IF receiver
- a Quad-band LNAs (Low Noise Amplifier)
- an Offset PLL (Phase Locked Loop) transmitter
- a Frequency synthesizer
- a Digitally controlled crystal oscillator (DCXO)
- a Tx/Rx FEM (Front-End Module) for quad-band GSM/GPRS/EDGE-Rx

2.2. Operating System

The AirPrime WMP Series embedded module is Sierra Wireless Software Suite compliant. With the Sierra Wireless Software Suite and the AirPrime WMP Series embedded module, customers can embed their own applications with the AirPrime WMP and turn the WMP Series embedded module into a solution for their specific market need.

The operating system allows for the AirPrime WMP Series embedded module to be controlled by AT commands. However, some interfaces in the AirPrime WMP Series embedded module may still not be available even with AT command control as these interfaces are dependent on the peripheral devices connected to the AirPrime WMP Series embedded module.

3. Technical Specifications

3.1. Power Supply

The following table describes the electrical characteristics of the input power supply voltage that will guarantee nominal functioning of the AirPrime WMP Series Embedded Modules.

Table 2. Input Power Supply Voltage

	V_{MIN}[4]	V_{NOM}	V_{MAX}	$I_{TYP.}$	I_{MAX}	Ripple max (U_{ripp})
VBATT-BB[1]	3.2	3.6	4.8	0.1 A	0.3 A	100mV[3]
VBATT-RF[1,2]	3.2	3.6	4.8	1.4 A	1.5 A	See Table 3 Maximal Voltage Ripple (Uripp) Versus Frequency

(1): This value has to be guaranteed during the burst (with 1.5A Peak in GSM or GPRS mode)

(2): Maximum operating Voltage Stationary Wave Ratio (VSWR) 2:1

(3): Take the VBATT-RF ripple max in consideration only if you use the same power supply for VBATT-RF and VBATT-BB.

(4): The minimum start-up voltage must be 3.3V for WMP100ESIM and WMP150ESIM.

Note: The ESIM version WMP modules require at least 3.3V start-up voltage.

Table 3. Maximal Voltage Ripple (Uripp) Versus Frequency

Freq. (kHz)	U_{ripp} Max (mVpp)	Freq. (kHz)	U_{ripp} Max (mVpp)	Freq. (kHz)	U_{ripp} Max (mVpp)
<100	96	800	27	1500	>60
200	51	900	67	1600	>60
300	37	1000	67	1700	>60
400	15	1100	>60	1800	>60
500	54	1200	>60	>1900	>60
600	21	1300	>60		
700	55	1400	>60		

3.2. Mechanical Specifications

3.3. Physical Characteristics

The WMP modules have a complete self-contained shield. They differ from mechanical dimensions as described below.

Table 4. Mechanical Difference of WMP modules

Mechanical Difference	WMP50, WMP100, WMP100ESIM	WMP150, WMP150ESIM
Shield Type	Soldered can	Soldered belt and Clip-on cover
Dimension, Thickness	25x25x3.65 mm	25x25x3.78 mm
Weight	4.25 g	4.25 g

3.3.1. Mechanical Drawings for the WMP100 and WMP150

Refer to the following pages for the mechanical specifications of WMP100 and WMP150 modules.

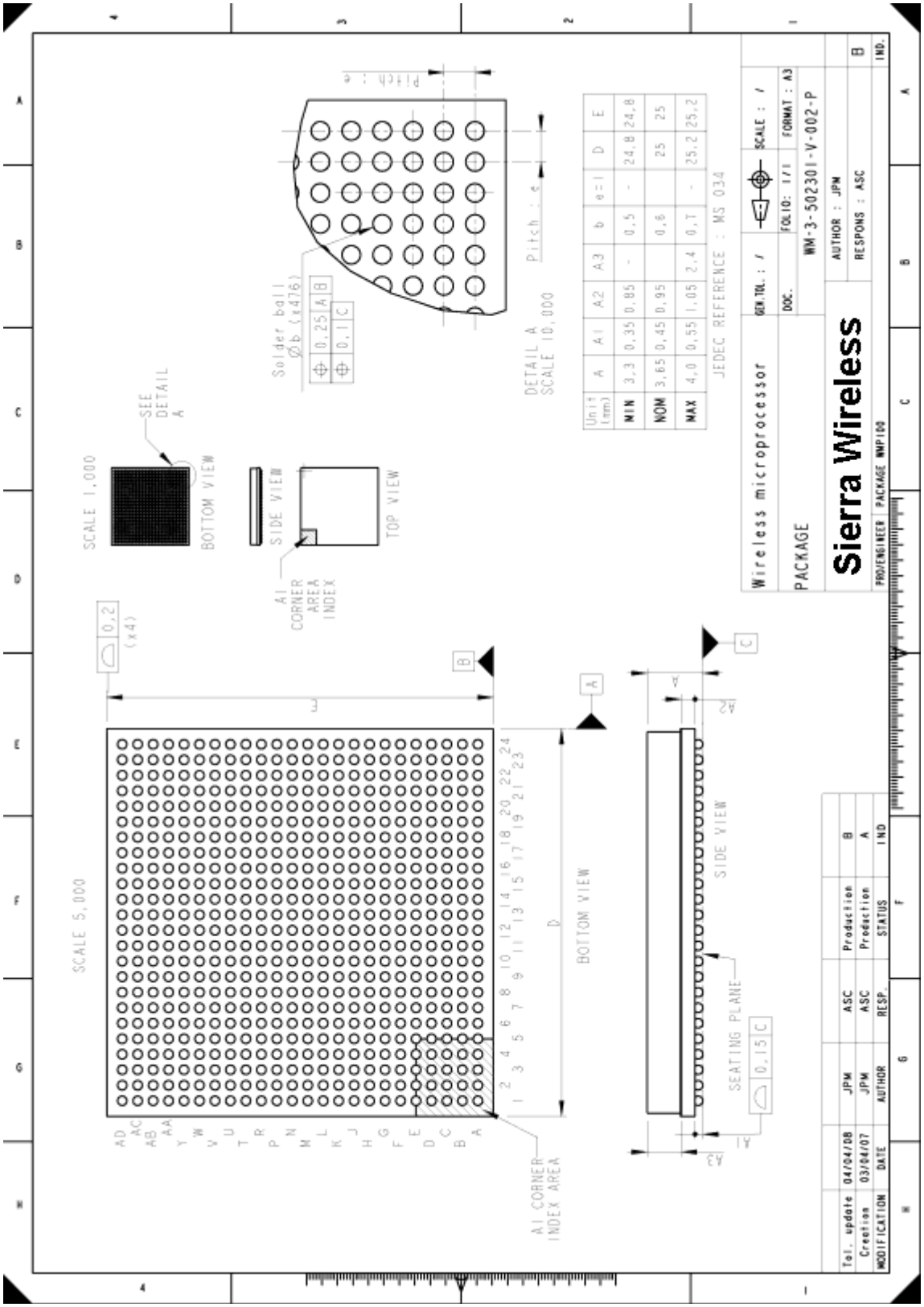

Figure 1. Mechanical Drawing of WMP100 (Bottom View)

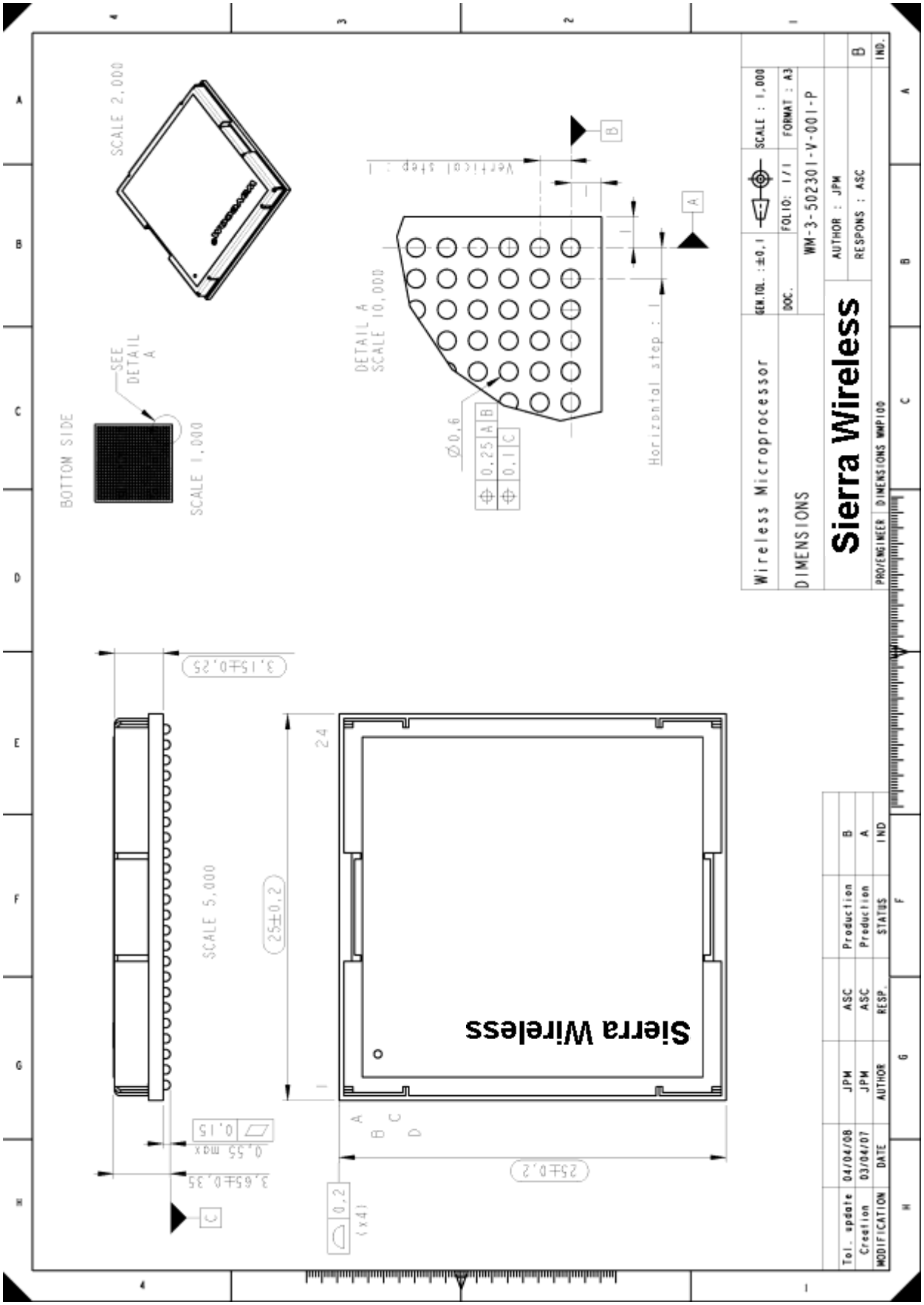

Figure 2. Mechanical Drawing of WMP100 (Top View)

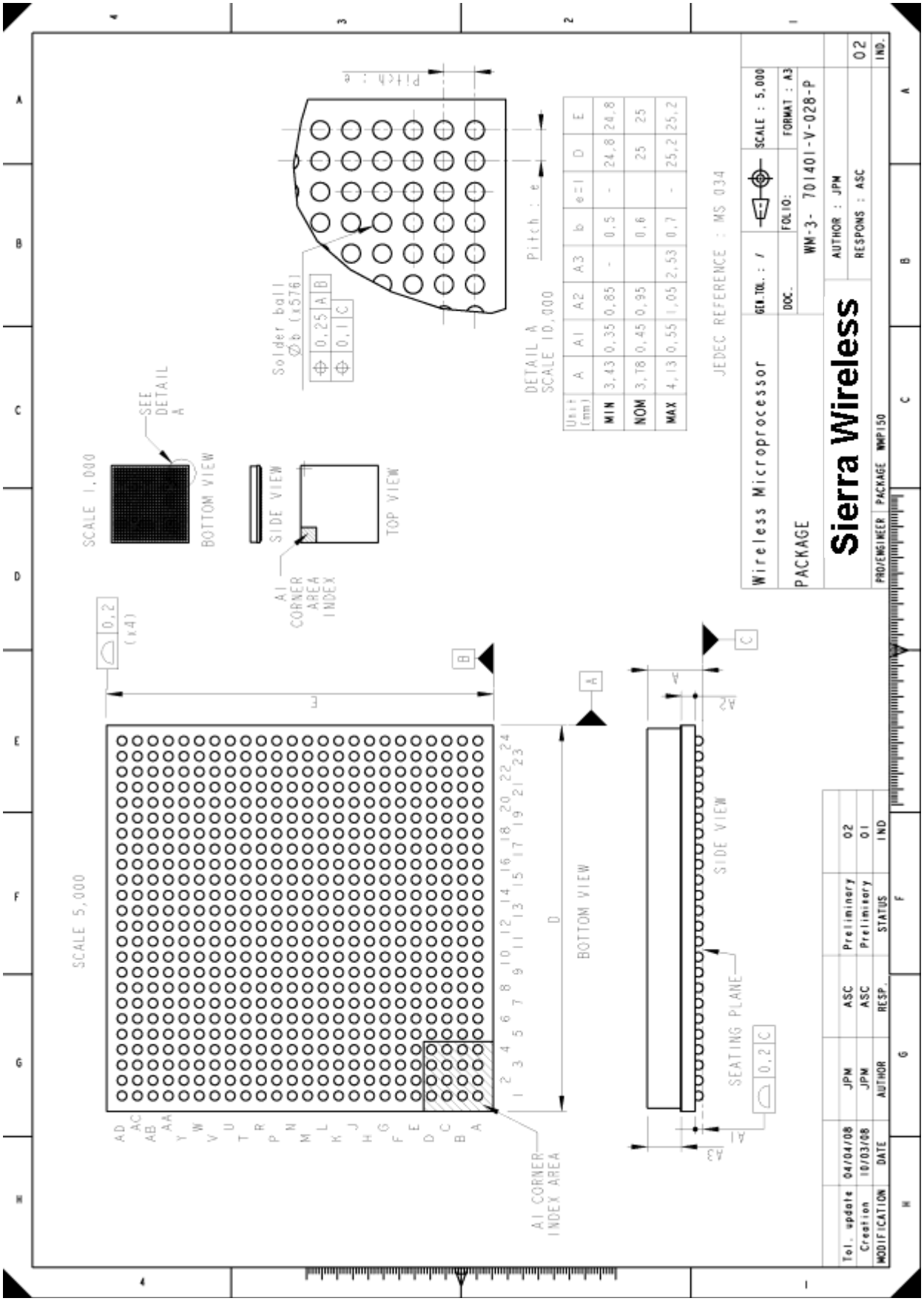

Figure 3. Mechanical Drawing of WMP150 (Bottom View)

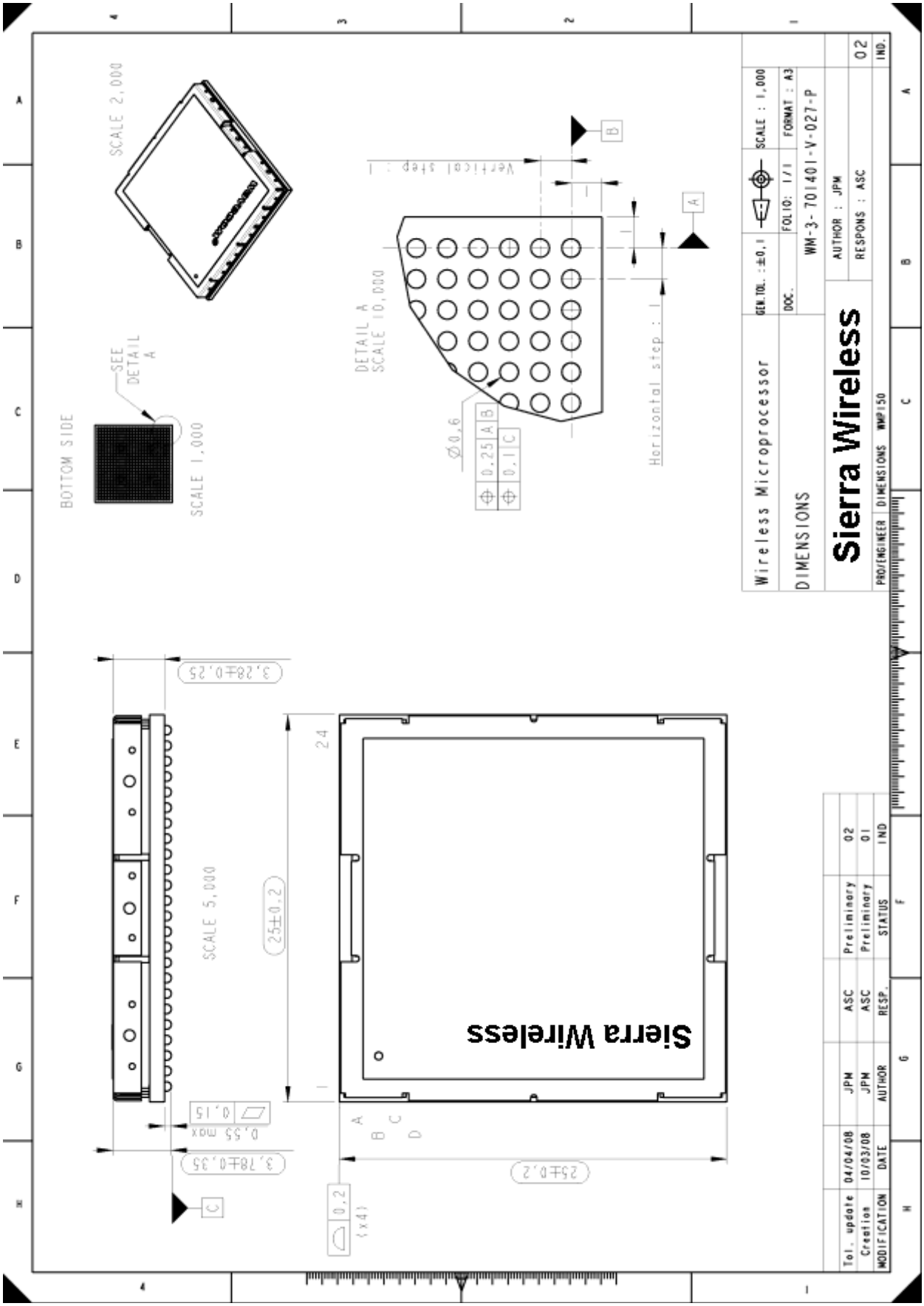

Figure 4. Mechanical Drawing of WMP150 (Top View)

4. Interfaces

4.1. Ball Grid Array Pin Description

Pin labeling on the WMP module with Sierra Wireless Software Suite v2.0 is shown below.

Table 5. WMP Series Pin Description

Signal Name	Description	I/O	Voltage Domain	MUX	MUX	MUX	Ball Number
VBATT-RF	Power Supply	I	VBATT	VBATT-RF	_	_	A12, A13, A14, B12, B13, B14
VBATT-BB	Power Supply	I	VBATT	VBATT-BB	_	_	AC1, AC2, AD1, AD2
RF-OUT	Radio antenna connection	I/O	Analog RF	RF-OUT	_	_	B23
VCC_2V8	Power Supply	O	VCC_2V8	VCC_2V8	_	_	R1
VCC_1V8	Power Supply	O	VCC_1V8	VCC_1V8	_	_	AD5
BAT-RTC	Power Supply	I/O	BAT-RTC	BAT-RTC	_	_	U6
SIM-CLK	SIM clock	O	1V8 / 2V9	SIM-CLK	_	_	Y2
~SIM-RST	SIM reset	O	1V8 / 2V9	~SIM-RST	_	_	Y1
SIM-IO	SIM data	I/O	1V8 / 2V9	SIM-IO	_	_	W1
SIM-VCC	SIM power supply	O	1V8 / 2V9	SIM-VCC	_	_	W2
SIMPRES	SIM presence detection	I/O	VCC_1V8	SIMPRES	INT8	GPIO18	Y3
MIC1P	Microphone input 1 positive	I	Analog	MIC1P	_	_	AC10
MIC1N	Microphone input 1 negative	I	Analog	MIC1N	_	_	AB10
MIC2P	Microphone input 2 positive	I	Analog	MIC2P	_	_	AC9
MIC2N	Microphone input 2 negative	I	Analog	MIC2N	_	_	AB9
SPK1P	Speaker output 1 positive	O	Analog	SPK1P	_	_	AC8
SPK1N	Speaker output 1 negative	O	Analog	SPK1N	_	_	AB8
SPK2P	Speaker output 2 positive	O	Analog	SPK2P	_	_	AC7

Signal Name	Description	I/O	Voltage Domain	MUX	MUX	MUX	Ball Number
SPK2N	Speaker output 2 negative	O	Analog	SPK2N	_	_	AB7
CHG-IN	Charger input voltage	I	Analog	CHG-IN	_	_	V2, V3
CHG-GATE	Charger transistor control output	O	Analog current	CHG-GATE	_	_	V4
ADC1 / BAT-TEMP	Analog to Digital converter 1	I	Analog	ADC1 / BAT-TEMP	_	_	N18
ADC3	Analog to Digital converter 3	I	Analog	ADC3	_	_	M17
ADC2	Analog to Digital converter 2	I	Analog	ADC2	_	_	N17
DAC0	Digital to Analog converter	O	Analog	DAC0	_	_	V14
XIN_32K	Oscillator crystal input	I	Analog	XIN_32K	_	_	AC24
XOUT_32K	Oscillator crystal output	O	Analog	XOUT_32K	_	_	AB24
~RESET	Input Reset signal	I/O	VCC_1V8	~RESET	_	_	V6
~EXT-RESET	Output External reset	O	VCC_1V8	~EXT-RESET	_	_	AB14
ON/~OFF	Power ON	I	VBATT-BB	ON/~OFF	-	-	U5
BOOT	BOOT control	I	VCC_1V8	BOOT	_	_	W18
LED0	WMP100 & WMP150 Status LED	O	Open Drain VBATT	LED0	_	_	U3
BUZZER0	Buzzer output control	O	Open Drain VBATT	BUZZER0	_	_	U4
ROW0	Row Scan of keypad	I/O	VCC_1V8	ROW0	GPIO9	_	AC23
ROW1	Row Scan of keypad	I/O	VCC_1V8	ROW1	GPIO10	_	AD22
ROW2	Row Scan of keypad	I/O	VCC_1V8	ROW2	GPIO11	_	AD21
ROW3	Row Scan of keypad	I/O	VCC_1V8	ROW3	GPIO12	_	AC22
ROW4	Row Scan of keypad	I/O	VCC_1V8	ROW4	GPIO13	_	AD23
COL0	Column Scan of keypad	I/O	VCC_1V8	COL0	GPIO4	_	AD19
COL1	Column Scan of keypad	I/O	VCC_1V8	COL1	GPIO5	_	AD20
COL2	Column Scan of keypad	I/O	VCC_1V8	COL2	GPIO6	_	AC20
COL3	Column Scan of keypad	I/O	VCC_1V8	COL3	GPIO7	_	AC19
COL4	Column Scan of keypad	I/O	VCC_1V8	COL4	GPIO8	_	AC21

Signal Name	Description	I/O	Voltage Domain	MUX	MUX	MUX	Ball Number
PCM-SYNC	PCM frame synchronization	O	VCC_1V8	PCM-SYNC	_	_	Y21
PCM-CLK	PCM clock	O	VCC_1V8	PCM-CLK	_	_	W21
PCM-OUT	PCM data output	O	VCC_1V8	PCM-OUT	_	_	W22
PCM-IN	PCM data input	I	VCC_1V8	PCM-IN	_	_	AA22
CT103 / TXD1	Transmit serial data	I/O	VCC_2V8	CT103 / TXD1	GPIO36	_	R17
CT104 / RXD1	Receive serial data	I/O	VCC_2V8	CT104 / RXD1	GPIO37	_	T13
~CT105 / RTS1	Ready To Send	I/O	VCC_2V8	~CT105 / RTS1	GPIO38	_	Y18
~CT106 / CTS1	Clear To Send	I/O	VCC_2V8	~CT106 / CTS1	GPIO39	_	N15
~CT107 / DSR1	Data Set Ready	I/O	VCC_2V8	~CT107 / DSR1	GPIO40	_	T12
~CT108-2 / DTR1	Data Serial Ready	I/O	VCC_2V8	~CT108-2 / DTR1	GPIO41	_	M16
~CT109 / DCD1	Data Carrier Detect	I/O	VCC_2V8	~CT109 / DCD1	GPIO43	_	AB16
~CT125 / RI1	Ring Indicator	I/O	VCC_2V8	~CT125 / RI1	GPIO42	_	AA18
CT103 / TXD2	Transmit serial data	I/O	VCC_1V8	CT103 / TXD2	INT6	GPIO14	T16
CT104 / RXD2	Receive serial data	I/O	VCC_1V8	CT104 / RXD2	GPIO15	_	U17
~CT105 / RTS2	Ready To Send	I/O	VCC_1V8	~CT105 / RTS2	INT7	GPIO17	V13
~CT106 / CTS2	Clear To Send	I/O	VCC_1V8	~CT106 / CTS2	GPIO16	_	W17
SCL1	I²C serial clock	I/O	Open drain	SCL1	GPIO26	_	AA15
SDA1	I²C serial data	I/O	Open Drain	SDA1	GPIO27	_	AA16
SPI1_CLK	SPI serial clock	I/O	VCC_2V8	SPI1-CLK	GPIO28	_	U15
SPI1_IO	SPI serial data input and output	I/O	VCC_2V8	SPI1-IO	GPIO29	_	V12
SPI1-I	SPI serial data input only input	I/O	VCC_2V8	SPI1-I	GPIO30	_	R13
SPI1-LOAD	SPI load	I/O	VCC_2V8	SPI1-LOAD	INT5	GPIO31	M14
SPI2-CLK	SPI serial clock	I/O	VCC_2V8	SPI2-CLK	GPIO32	_	R15
SPI2-IO	SPI serial data input and output	I/O	VCC_2V8	SPI2-IO	GPIO33	_	M13
SPI2-I	SPI serial data input only input	I/O	VCC_2V8	SPI2-I	GPIO34	_	U16
SPI2- LOAD	SPI load	I/O	VCC_2V8	SPI2-LOAD	INT4	GPIO35	T18
INT3	Interruption input	I/O	VCC_2V8	INT3	GPIO46	_	V18

Signal Name	Description	I/O	Voltage Domain	MUX	MUX	MUX	Ball Number
VPAD-USB	USB power supply	I	VPAD-USB	VPAD-USB	-	-	AB19
USB-DP	Universal Serial Bus Data positive	I/O	VPAD-USB	USB-DP	_	_	W19
USB-DM	Universal Serial Bus Data negative	I/O	VPAD-USB	USB-DM	_	_	AA20
USB-CN	Universal Serial Bus Connect	O	VPAD-USB	USB-CN	_	_	Y20
USB-DET	Universal Serial Bus interruption	I	VCC_1V8	USB-DET	_	_	R14
GPIO44	General Purpose Input Output	I/O	VCC_2V8	GPIO44	_	_	AB13
GPIO19	General Purpose Input Output	I/O	VCC_2V8	GPIO19	_	_	AA17
GPIO21	General Purpose Input Output	I/O	VCC_2V8	GPIO21	_	_	AA13
GPIO20	General Purpose Input Output	I/O	VCC_2V8	GPIO20	_	_	Y13
GPIO47	General Purpose Input Output	I/O	VCC_1V8	GPIO47	_	_	Y15
GPIO48	General Purpose Input Output	I/O	VCC_1V8	GPIO48	_	_	Y16
GPIO0	General Purpose Input Output	I/O	VCC_1V8	GPIO0	_	_	W15
GPIO24	General Purpose Input Output	I/O	VCC_2V8	GPIO24	_	_	N16
GPIO22	General Purpose Input Output	I/O	VCC_2V8	GPIO22	_	_	M15
GPIO23	General Purpose Input Output	I/O	VCC_2V8	GPIO23	_	_	V17
INT0	Interruption input	I/O	VCC_1V8	INT0	A26	GPIO3	V16
INT1	Interruption input	I/O	VCC_2V8	INT1	GPIO25	_	Y19
INT2	Interruption input	I/O	VCC_1V8	INT2	GPIO45	_	Y17
A0	Address bus	O	VCC_1V8	A0	_	_	T19
A1	Address bus	O	VCC_1V8	A1	_	_	U18
A2	Address bus	O	VCC_1V8	A2	_	_	U24
A3	Address bus	O	VCC_1V8	A3	_	_	P24
A4	Address bus	O	VCC_1V8	A4	_	_	N24
A5	Address bus	O	VCC_1V8	A5	_	_	M21
A6	Address bus	O	VCC_1V8	A6	_	_	M24
A7	Address bus	O	VCC_1V8	A7	_	_	N23
A8	Address bus	O	VCC_1V8	A8	_	_	R24

Signal Name	Description	I/O	Voltage Domain	MUX	MUX	MUX	Ball Number
A9	Address bus	O	VCC_1V8	A9	_	_	R22
A10	Address bus	O	VCC_1V8	A10	_	_	P22
A11	Address bus	O	VCC_1V8	A11	_	_	T22
A12	Address bus	O	VCC_1V8	A12	_	_	R23
A13	Address bus	O	VCC_1V8	A13	_	_	M22
A14	Address bus	O	VCC_1V8	A14	_	_	P21
A15	Address bus	O	VCC_1V8	A15	_	_	R21
A16	Address bus	O	VCC_1V8	A16	_	_	P23
A17	Address bus	O	VCC_1V8	A17	_	_	T21
A18	Address bus	O	VCC_1V8	A18	_	_	T24
A19	Address bus	O	VCC_1V8	A19	_	_	M23
A20	Address bus	O	VCC_1V8	A20	_	_	N21
A21	Address bus	O	VCC_1V8	A21	_	_	N22
A22	Address bus	O	VCC_1V8	A22	_	_	M20
A23	Address bus	O	VCC_1V8	A23	_	_	N19
A24	Address bus	I/O	VCC_1V8	A24	GPIO2	_	U22
D0	Data bus	I/O	VCC_1V8	D0	_	_	W24
D1	Data bus	I/O	VCC_1V8	D1	_	_	W23
D2	Data bus	I/O	VCC_1V8	D2	_	_	AA24
D3	Data bus	I/O	VCC_1V8	D3	_	_	Y23
D4	Data bus	I/O	VCC_1V8	D4	_	_	U21
D5	Data bus	I/O	VCC_1V8	D5	_	_	Y22
D6	Data bus	I/O	VCC_1V8	D6	_	_	Y24
D7	Data bus	I/O	VCC_1V8	D7	_	_	V21
D8	Data bus	I/O	VCC_1V8	D8	_	_	V20
D9	Data bus	I/O	VCC_1V8	D9	_	_	U20
D10	Data bus	I/O	VCC_1V8	D10	_	_	V24

Signal Name	Description	I/O	Voltage Domain	MUX	MUX	MUX	Ball Number
D11	Data bus	I/O	VCC_1V8	D11	_	_	V22
D12	Data bus	I/O	VCC_1V8	D12	_	_	V23
D13	Data bus	I/O	VCC_1V8	D13	_	_	AA23
D14	Data bus	I/O	VCC_1V8	D14	_	_	U23
D15	Data bus	I/O	VCC_1V8	D15	_	_	T23
~WAIT	Burst Wait signal	I	VCC_1V8	~WAIT	_	_	R19
~CS0	Chip select Flash	O	VCC_1V8	~CS0	_	_	P19
~CS1	Chip select RAM	O	VCC_1V8	~CS1	_	_	R20
~CS2	Chip select	I/O	VCC_1V8	~CS2	A25	GPIO1	R18
~CS3	Chip select	O	VCC_1V8	~CS3	_	_	T17
CLKBURST	Burst clock	O	VCC_1V8	CLKBURST	_	_	M19
~ADV	Burst address valid signal	O	VCC_1V8	~ADV	_	_	U19
~WE-E	Write enable	O	VCC_1V8	~WE-E	_	_	P20
~OE-R/W	Read enable	O	VCC_1V8	~OE-R/W	_	_	N20
~BE1	2nd byte enable	O	VCC_1V8	~BE1	_	_	P18
InSIM-Test [1]	ESIM personalization	I	1V8 / 2V9	InSIM-Test	_	_	U2

Signal Name	Description	I/O	Voltage Domain	MUX	MUX	MUX	Ball Number
GND	Ground	A1, A10, A11, A15, A16, A17, A18, A19, A2, A20, A21, A22, A23, A24, A3, A4, A5, A6, A7, A8, A9, B1, B10, B11, B15, B16, B17, B18, B19, B20, B21, B22, B24, B3, B4, B5, B6, B7, B8, B9, C1, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C3, C4, C5, C6, C7, C8, C9, D1, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D2, D20, D21, D22, D23, D24, D3, D4, D5, D6, D7, D8, D9, E1, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E2, E20, E21, E22, E23, E24, E3, E4, E5, E6, E7, E8, E9, F1, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F2, F20, F21, F22, F23, F24, F3, F4, F5, F6, F7, F8, F9, G1, G10, G11, G12, G13, G14, G15, G16, G17, G18, G19, G2, G20, G21, G22, G23, G24, G3, G4, G5, G6, G7, G8, G9, H1, H10, H11, H12, H13, H14, H15, H16, H17, H18, H19, H2, H20, H21, H22, H23, H24, H3, H4, H5, H6, H7, H8, H9, J1, J10, J11, J12, J13, J14, J15, J16, J17, J18, J19, J2, J20, J21, J22, J23, J24, J3, J4, J5, J6, J7, J8, J9, K1, K10, K11, K12, K13, K14, K15, K16, K17, K18, K19, K2, K20, K21, K22, K23, K24, K3, K4, K5, K6, K7, K8, K9, L1, L10, L11, L12, L13, L14, L15, L16, L17, L18, L19, L2, L20, L21, L22, L23, L24, L3, L4, L5, L6, L7, L8, L9, M1, M10, M11, M12, M18, M2, M3, M4, M5, M6, M7, M8, M9, N1, N10, N2, N3, N7, N8, N9, P1, P10, P13, P14, P15, P2, P3, P4, P5, P6, P7, P8, P9, R10, R11, R12, R2, R3, R4, R5, R6, R7, R8, R9, T1, T10, T11, T14, T15, T2, T8, T9, U1, U10, U11, U12, U13, U14, U7, U8, U9, V1, V10, V11, V15, V7, V8, V9, W10, W11, W12, W13, W14, W16, W3, W6, W7, W8, W9, Y10, Y12, Y14, Y7, AA1, AA10, AA11, AA12, AA14, AA19, AA2, AA21, AA3, AA4, AA5, AA6, AA7, AA8, AA9, AB1, AB12, AB15, AB17, AB18, AB2, AB21, AB22, AB23, AB3, AB4, AB5, AB6, AC12, AC13, AC14, AC15, AC16, AC17, AC18, AC3, AC4, AC5, AC6, AD10, AD11, AD12, AD13, AD14, AD15, AD16, AD17, AD18, AD24, AD3, AD4, AD6, AD7, AD8, AD9				
RESERVED	Do not connect. (Left opened)	B2, C2, N11, N12, N13, N14, N4, N5, N6, P11, P12, P16, P17, R16, T20, T3, T4, T5, T6, T7, V19, V5, W20, W4, W5, Y11, Y4, Y5, Y6, Y8, Y9, AB11, AB20, AC11					

(1): Pin “InSIM-Test” is connected to ground in normal operation mode. There is no impact on current application.

Note: The I/O direction information is concerning only the nominal signal. When the signal is configured in GPIO, it can always be an Input or an Output.

4.2. RF Interface

The RF (radio frequency) interface of the AirPrime WMP Series embedded modules allow the transmission of RF signals. This interface has a 50Ω nominal impedance and a 0Ω DC resistance.

4.2.1. RF Connections

The RF antenna connection uses a unique BGA Ball associated with grounded BGA balls all around.

4.2.2. Antenna Specifications

The antenna must fulfill the requirements that are specified in the table below. The optimum operating frequency depends on the application. A dual band or a quad band antenna shall work in these frequency bands and have the following characteristics:

Table 6. Antenna Specifications

Characteristics		E-GSM 900	DCS 1800	GSM 850	PCS 1900
TX Frequency		880 to 915 MHz	1710 to 1785 MHz	824 to 849 MHz	1850 to 1910 MHz
RX Frequency		925 to 960 MHz	1805 to 1880 MHz	869 to 894 MHz	1930 to 1990 MHz
Impedance		50 Ohms			
VSWR	Rx max	1.5 :1			
	Tx max	1.5 :1			
Typical radiated gain		0dBi in one direction at least			

5. Certification Compliance and Recommended Standards

5.1. Certification Compliance

The AirPrime WMP Series embedded module connected on a development kit board application is compliant with the following requirements.

Table 7. Standards Conformity for the WMP Series Embedded Module

Domain	Applicable Standard
Safety standard	EN 60950-1 (ed.2006)
Health standard (EMF Exposure Evaluation)	EN 62311 (ed. 2008)
Efficient use of the radio frequency spectrum	EN 301 511 (V 9.0.2)
EMC	EN 301 489-1 (v1.8.1) EN 301 489-7 (v1.3.1)
FCC	FCC Part 22, 24
IC	RSS-132 Issue 2 RSS-133 Issue 5

5.2. Applicable Standards Listing

The table hereafter gives the basic list of standards applicable for the AirPrime WMP Series embedded module (2G (R99/Rel. 4)).

Note: References to any features can be found from these standards.

Table 8. Applicable Standards and Requirements for the WMP Series Embedded Module

Document	Current Version	Title
GCF~~GCF~~	3.38.0~~3.7.1~~	Global Certification Forum – Certification criteria
NAPRD.03~~NAPRD.03~~	5.4~~2.6.0~~	Overview of PCS Type certification review board (PTCRB) Mobile Equipment Type Certification and IMEI control
TS 51.010-1~~TS 51.010-1~~	9.2.0~~5.0.0~~	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification
TS 51.011~~TS 51.011~~	9.2.0~~5.0.0~~	Technical Specification Group Terminals; Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface (Release 5)

The AirPrime WMP Series embedded module has been granted modular approval for mobile applications. Integrators may use this device in their final products without additional FCC/IC (Industry Canada) certification if the following conditions are met. Otherwise, additional FCC/IC approvals must be obtained.

1. At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.
2. To comply with FCC / IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 6 dBi in cellular band and 3.5 dBi in PCS band.
3. The AirPrime WMP Series embedded module and its antenna must not be co-located or operating in conjunction with any other transmitter within a host device.
4. A label must be affixed to the outside of the end product into which the AirPrime WMP Series embedded module is incorporated, with a statement similar to the following:

   This device contains FCC ID: N7NWMP100

   This equipment contains device certified under IC: 2417C-WMP100
5. A user manual with the end product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC/IC RF exposure guidelines.

The end product with an AirPrime WMP Series embedded module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

Note: If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093 and IC RSS-102.

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

6. References

6.1. Web Site Support

Content		Web Site
General information about AirPrime WMP Series embedded module		http://www.sierrawireless.com/en/productsandservices/AirPrime/Embedded_Modules/WMP_Series.aspx
Specific support about the AirPrime WMP Series embedded module	WMP 50	http://www.sierrawireless.com/en/productsandservices/AirPrime/Embedded_Modules/WMP_Series/WMP50.aspx
	WMP100	http://www.sierrawireless.com/en/productsandservices/AirPrime/Embedded_Modules/WMP_Series/WMP100.aspx
	WMP150	http://www.sierrawireless.com/en/productsandservices/AirPrime/Embedded_Modules/WMP_Series/WMP150.aspx
Carrier/Operator approvals	WMP 50	http://www.sierrawireless.com/Support/Downloads/AirPrime/WMP_Series/AirPrime_WMP50.aspx
	WMP100	http://www.sierrawireless.com/Support/Downloads/AirPrime/WMP_Series/AirPrime_WMP100.aspx
	WMP150	http://www.sierrawireless.com/Support/Downloads/AirPrime/WMP_Series/AirPrime_WMP150.aspx
Sierra Wireless Software Suite Introduction		http://www.sierrawireless.com/productsandservices/AirPrime/Sierra_Wireless_Software_Suite/Open_AT_Operating_System.aspx
Developer support for software and hardware		http://forum.sierrawireless.com/

6.2. Reference Documents

For more details, several reference documents can be consulted. The Sierra Wireless documents referenced herein are provided in the Sierra Wireless documentation package; however, the general reference documents which are not Sierra Wireless owned are not provided in the documentation package.

Check the Sierra Wireless website at http://sierrawireless.com for the latest documentation available.

6.2.1. Sierra Wireless Reference Documentation

[1] AirPrime WMP100 & WMP150 Embedded Module Technical Specification
Reference: WM_DEV_WMP150_PTS_002

[2] AirPrime WMP100 & WMP150 Embedded Module Development Kit User Guide
Reference: WM_DEV_WMP150_UGD_001

[3] AT Command Interface Guide for Firmware v7.0 or later
Reference: WM_DEV_OAT_UGD_079

[4] Manufacturing Guidelines
Reference: WM_PGM_WUP_UGD_001

[5] DWLWin Download Application User Guide
Reference: WM_DEV_TOO_UGD_010

[6] ADL User Guide for OS v6.00 or later
Reference: WM_DEV_OAT_UGD_080

6.2.2. General Reference Documentation

[7] "I^2C Bus Specification", Version 2.0, Philips Semiconductor 1998

[8] ISO 7816-3 Standard

6.3. List of Abbreviations

Abbreviation	Definition
AC	Alternative Current
ADC	Analog to Digital Converter
A/D	Analog to Digital conversion
AF	Audio-Frequency
AT	ATtention (prefix for modem commands)
AUX	AUXiliary
CAN	Controller Area Network
CB	Cell Broadcast
CEP	Circular Error Probable
CLK	CLocK
CMOS	Complementary Metal Oxide Semiconductor
CS	Coding Scheme
CTS	Clear To Send
DAC	Digital to Analogue Converter
dB	Decibel
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DR	Dynamic Range
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
E-GSM	Extended GSM
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EMS	Enhanced Message Service
EN	ENable
ESD	ElectroStatic Discharges
FIFO	First In First Out
FR	Full Rate
FTA	Full Type Approval
GND	GrouND
GPI	General Purpose Input
GPC	General Purpose Connector
GPIO	General Purpose Input Output
GPO	General Purpose Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications

Abbreviation	Definition
HR	Half Rate
I/O	Input / Output
JTAG	Joint Test Action Group
LED	Light Emitting Diode
LNA	Low Noise Amplifier
MAX	MAXimum
MIC	MICrophone
MIN	MINimum
MMS	Multimedia Message Service
MO	Mobile Originated
MT	Mobile Terminated
na	Not Applicable
NF	Noise Factor
NMEA	National Marine Electronics Association
NOM	NOMinal
NTC	Négative Temperature Coefficient
PA	Power Amplifier
Pa	Pascal (for speaker sound pressure measurements)
PBCCH	Packet Broadcast Control CHannel
PC	Personal Computer
PCB	Printed Circuit Board
PDA	Personal Digital Assistant
PFM	Power Frequency Modulation
PSM	Phase Shift Modulation
PWM	Pulse Width Modulation
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
RHCP	Right Hand Circular Polarization
RI	Ring Indicator
RST	ReSeT
RTC	Real Time Clock
RTCM	Radio Technical Commission for Maritime services
RTS	Request To Send
RX	Receive
SCL	Serial CLock
SDA	Serial DAta
SIM	Subscriber Identification Module
SMS	Short Message Service
SPI	Serial Peripheral Interface
SPL	Sound Pressure Level
SPK	SPeaKer
SW	SoftWare

Abbreviation	Definition
PSRAM	Pseudo Static RAM
TBC	To Be Confirmed
TDMA	Time Division Multiple Access
TP	Test Point
TVS	Transient Voltage Suppressor
TX	Transmit
TYP	TYPical
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus
USSD	Unstructured Supplementary Services Data
VSWR	Voltage Standing Wave Ratio
WMP	Wireless MicroProcessor

7. Safety Recommendations (For Information Only)

For the safe and efficient operation of your GSM application based on the WMP module, please read the following information carefully.

7.1. RF Safety

7.1.1. General Information

Your GSM terminal is based on the GSM standard for cellular technology. The GSM standard is spread all over the world. It covers Europe, Asia and some parts of America and Africa. This is the most used telecommunication standard.

Your GSM terminal is actually a low power radio transmitter and receiver. It sends out and receives radio frequency energy. When you use your GSM application, the cellular system which handles your calls controls both the radio frequency and the power level of your cellular modem.

7.1.2. Exposure to RF Energy

There has been some public concern about possible health effects of using GSM terminals. Although research on health effects from RF energy has focused on the current RF technology for many years, scientists have begun research regarding newer radio technologies, such as GSM. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product was fitted for use.

If you are concerned about exposure to RF energy there are things you can do to minimize exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular terminal efficiently by following the below guidelines.

7.1.3. Efficient Terminal Operation

For your GSM terminal to operate at the lowest power level, consistent with satisfactory call quality:

If your terminal has an extendible antenna, extend it fully. Some models allow you to place a call with the antenna retracted. However your GSM terminal operates more efficiently with the antenna fully extended.

Do not hold the antenna when the terminal is « IN USE ». Holding the antenna affects call quality and may cause the modem to operate at a higher power level than needed.

7.1.4. Antenna Care and Replacement

Do not use the GSM terminal with a damaged antenna. If a damaged antenna comes into contact with the skin, a minor burn may result. Replace a damaged antenna immediately. Consult your manual to see if you may change the antenna yourself. If so, use only a manufacturer-approved antenna. Otherwise, have your antenna repaired by a qualified technician.

Use only the supplied or approved antenna. Unauthorized antennas, modifications or attachments could damage the terminal and may contravene local RF emission regulations or invalidate type approval.

7.2. General Safety

7.2.1. Driving

Check the laws and the regulations regarding the use of cellular devices in the area where you have to drive as you always have to comply with them. When using your GSM terminal while driving, please:

- give full attention to driving,
- pull off the road and park before making or answering a call if driving conditions so require.

7.2.2. Electronic Devices

Most electronic equipment, for example in hospitals and motor vehicles is shielded from RF energy. However RF energy may affect some improperly shielded electronic equipment.

7.2.3. Vehicle Electronic Equipment

Check your vehicle manufacturer representative to determine if any on-board electronic equipment is adequately shielded from RF energy.

7.2.4. Medical Electronic Equipment

Consult the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc.) to determine if they are adequately shielded from external RF energy.

Turn your terminal **OFF** in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

7.2.5. Aircraft

Turn your terminal OFF before boarding any aircraft.

- Use it on the ground only with crew permission.
- Do not use it in the air.

To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you to have permission from a crew member to use your terminal while the aircraft is on the ground. To prevent interference with cellular systems, local RF regulations prohibit using your modem while airborne.

7.2.6. Children

Do not allow children to play with your GSM terminal. It is not a toy. Children could hurt themselves or others (by poking themselves or others in the eye with the antenna, for example). Children could damage the modem, or make calls that increase your modem bills.

7.2.7. Blasting Areas

To avoid interfering with blasting operations, turn your unit OFF when in a « blasting area » or in areas posted: « turn off two-way radio ». Construction crews often use remote control RF devices to set off explosives.

7.2.8. Potentially Explosive Atmospheres

Turn your terminal **OFF** when in any area with a potentially explosive atmosphere. It is rare, but your application or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injuries or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas such as petrol stations; below decks on boats; fuel or chemical transfer or storage facilities; and areas where the air contains chemicals or particles, such as grain, dust, or metal powders.

Do not transport or store flammable gas, liquid, or explosives, in the compartment of your vehicle which contains your terminal or accessories.

Before using your terminal in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is to be used.