Development Kit User Guide

AirPrime HL Series

SIERRA WIRELESS®

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Document History

Version	Date	Updates
1.0	November 21, 2013	Creation
2.0	March 04, 2014	Added HL8548x support
2.1	March 10, 2014	Updated: • Board version number • Table 3 Available Connections • 3.8 UART0/SPI1
		Deleted obsolete connectors
3.0	December 12, 2014	Added Snap-in socket information; updated information for board version 1400897-I
		Removed socket board information
4.0	March 16, 2015	Added HL75xx, HL8518, HL8528, HL8529 and HL8549x support
5.0	October 12, 2015	Added HL6528RDx support
		Updated: • Table 2 Connector and Switch Description • Table 4 AirPrime HL Series Development Kit Test Ports

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1. Overview

This document describes the AirPrime HL Series Development Kit (board version 1400897-I) and how it integrates with the AirPrime HL6528x, HL75xx and HL85xxx series of embedded modules via a specific Snap-in connector. It also briefly describes the different interfaces and peripheral connections supported by the HL Series Development Kit and provide schematics to facilitate the user's understanding and configuration of the development kit board for their own application use.

The AirPrime HL Series Development Kit may be used to develop both software and hardware applications based on embedded modules from the AirPrime HL series.

The following table enumerates the different HL6528x, HL75xx and HL85xxx variants that can be used with the development kit.

Table 1. Supported Module Variants

Series	Variant	Part Number	Description
HL6528x	HL6528	1102403	1.8V; GSM/GPRS capable
	HL6528-G	1102404	1.8V; GSM/GPRS capable with GLONASS support
	HL6528-2.8V	1102405	2.8V; GSM/GPRS capable
	HL6528-G2.8V	1102406	2.8V; GSM/GPRS capable with GLONASS support
	HL6528 AUTO	1102313	1.8V; GSM/GPRS capable (automotive grade)
	HL6528-G AUTO	1102314	1.8V; GSM/GPRS capable with GLONASS support (automotive grade)
	HL6528-2.8V AUTO	1102315	2.8V; GSM/GPRS capable (automotive grade)
	HL6528-G2.8V AUTO	1102316	2.8V; GSM/GPRS capable with GLONASS support (automotive grade)
	HL6528RD	1102609	1.8V; GSM/GPRS capable
	HL6528RD-G	1102610	1.8V; GSM/GPRS capable with GLONASS support
	HL6528RD-2.8V	1102611	2.8V; GSM/GPRS capable
	HL6528RD-G2.8V	1102612	2.8V; GSM/GPRS capable with GLONASS support
HL75xx	HL7518	1600601	1.8V; LTE (B4, B13) capable
	HL7519	1600570	1.8V; LTE (B2, B4, B13) capable
	HL7528	1600583	1.8V; LTE (B1, B3, B5, B7) capable
	HL7548	1600571	1.8V; LTE (B2, B4, B5, B17) capable
	HL7549	1600617	1.8V; LTE (B3, B7, B28A, B28B) capable
	HL7588	1600572	1.8V; HSPA+ (B2, B5)/LTE (B2, B4, B5, B13, B17) capable

Series	Variant	Part Number	Description
HL85xxx	HL8518	1600676	1.8V; GSM/GPRS/UMTS (B1, B8) capable
	HL8528	1600677	1.8V; GSM/GPRS/EDGE GSM 850/PCS 1900/UMTS (B2, B5) capable
	HL8529	1600678	1.8V; UMTS (B2, B5) capable
	HL8548	1102149	1.8V; EDGE/WCDMA/HSxPA capable
	HL8548-G	1102150	1.8V; EDGE/WCDMA/HSxPA capable with GLONASS support
	HL8549	1600556	1.8V; EDGE/WCDMA/HSxPA capable
	HL8549-G	1600557	1.8V; EDGE/WCDMA/HSxPA capable with GLONASS support

For more information about the HL series of embedded modules, refer to the product technical specifications listed in section 6 Reference Documents.

2. General Description

This section gives a brief overview of the AirPrime HL Series Development Kit and briefly describes the interfaces and special jumper pads available, and lists all available test points on the development kit board.

2.1. RoHS Compliance

The AirPrime HL Series Development Kit board is compliant with RoHS (Restriction of Hazardous Substances in Electrical and Electronic Equipment) Directive 2011/65/EU 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)”.

The AirPrime HL6528x, HL75xx and HL85xxx series of embedded modules are also compliant with this directive.

2.2. Development Kit

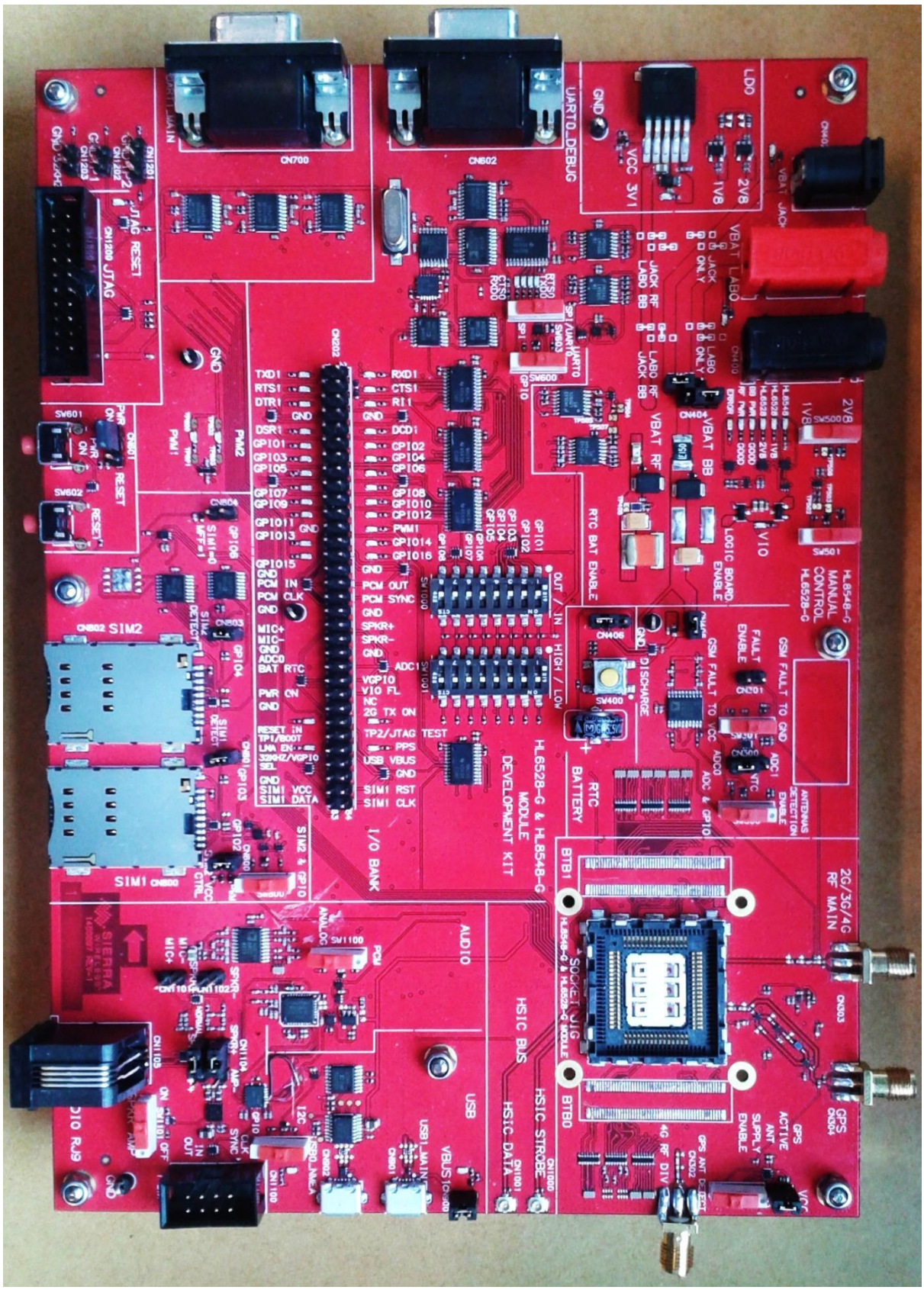


Figure 1. AirPrime HL Series Development Kit (board version 1400897-I)

2.2.1. Features

Interfaces available on the development kit board include:

- Power supply connectors
- ON/OFF switch and pushbutton
- Reset pushbutton
- Tests points (TP) to access all signals of the embedded module
- Main serial link RS232, UART1 with full signals including a Ring Indicator signal
- Auxiliary serial link RS232, UART0 with 4 signals
- Full Speed USB0 Connector (I^2C signals conversion for GNSS on HL6528x-G modules)
- Full Speed USB1 Connector (for HL6528RDx, HL75xx and HL85xxx only)
- 2 SIMs (with SIM presence management)
  - SIM 1: selectable 1.8/3V or SON8 embedded SIM (unsoldered by default)
  - SIM 2: 1.8/3V SIM
- Audio connectors, selectable for PCM conversion output or analog output from the HL module
- GPIOs
- DIP switches for GPIO logic input/output control
- LEDs for several indications
- Automatic detection and adaptation to either 2.8V or 1.8V module variant (for HL6528x only)
- External board-to-board connectors (unsoldered by default)
- Back up battery and discharge circuit
- JTAG connector
- Main RF connector antenna
- Diversity 4G RF connector antenna
- GNSS connector antenna
- Snap-in connector (for plugging in the HL module; note that this connector is not applicable to the HL8549x)

Refer to section 3 Interfaces for detailed information about these interfaces.

2.2.2. Connectors and Component Placement

Refer to the following figure for the location of connectors and other components on the AirPrime HL Series Development Kit.

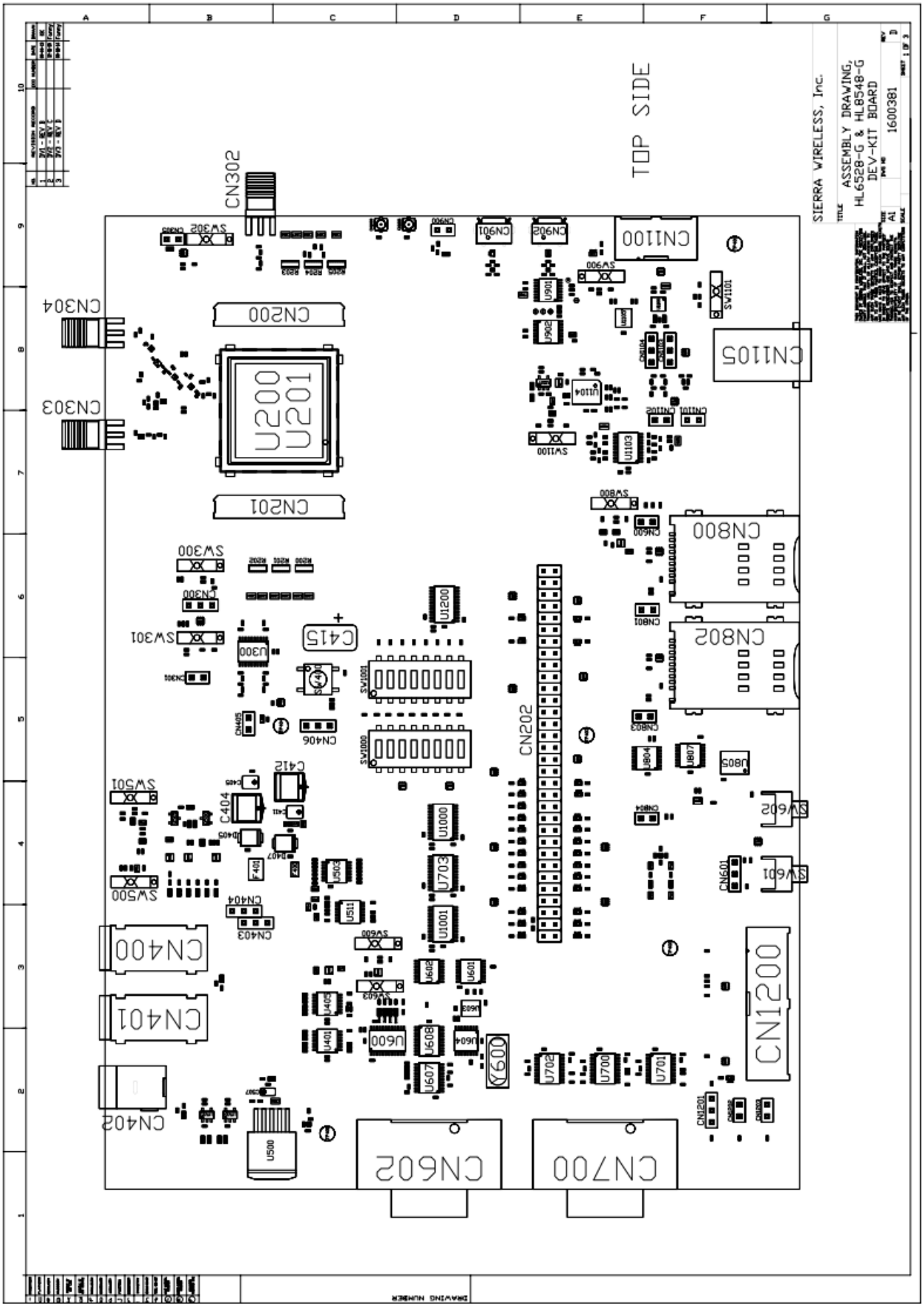


Figure 2. Available Connectors and Components on the AirPrime HL Series Development Kit

The following table describes the connectors and switches available on the development kit and the table after describe the different connections available.

Table 2. Connector and Switch Description

Connector / Switch	Description	HL6528x	HL75xx	HL85xxx
CN402	4V, 3.75A power jack	✓	✓	✓
CN401	3.7V, 4A positive lab power supply (+)	✓	✓[1]	✓
CN400	Negative lab power supply (-)	✓	✓[1]	✓
CN700	UART1 (main UART)	✓	✓	✓
CN602	UART0 (SPI to UART); SW Spytracer	✓[5]		
CN202	GPIOs (1 to 8)	✓[5]	✓	✓
	GPIOs (9 to 16) Multiplexed with other features; not compliant with HL6528x		✓	✓
CN902	USB0 (I^2C to USB, GPIO1 and GPIO5) GNSS NMEA for HL6528x-G, and as I^2C signals on USB for HL85xxx	✓		✓[2]
CN901	USB1		✓	✓
SW602	Reset	✓	✓	✓
SW601	Power on (POK_IN); low level active 2 seconds de-bouncing	✓	✓	✓
CN1105	Headset jack (RJ9). PCM Codec conversion output or analog audio output (for HL6528x only)	✓	✓[3]	✓
CN1100	Digital audio (PCM) for HL6528x, PCM signals probe for HL75xx and HL85xxx	✓	✓	✓
CN406	Real time clock backup battery	✓	✓[1]	✓
CN300 (Pin 1)	ADC0 input, 0-3V	✓	✓[1]	✓
CN300 (Pin 3)	ADC1 input, 0-3V	✓	✓	✓
CN800	SIM1	✓	✓	✓
CN802	SIM2	✓	✓[1]	
CN1200	JTAG	✓[6]	✓[1]	
CN202 (Pin 24)	PWM; multiplexed with GPIO12	✓		✓[2]
CN202 (Pin 46)	VGPIO – reference voltage output	✓	✓	
CN202 (Pin 52)	2G RF transmit signal (Transmit ON for LTE)	✓	✓	
U200	Snap-in connector	✓	✓	✓[4]
CN303	2G/3G/4G RF main connector	✓	✓	✓
CN304	GNSS connector	✓		✓[2]
CN302	2G/3G/4G RF diversity connector		✓	
CN200 and CN201	Board to board connector (development kit to socket board connection) (unsoldered)			

1 This feature is only available on the HL7528 and HL7549.

2 This feature is not available on the HL8518, HL8528 and HL8529.

3 This feature in not available on the HL7518, HL7519 and HL7548.

4 This connector is not applicable for the HL8549x.

5 This feature is not available on the HL6528RDx.

6 This feature is not available on the HL6528RD and HL6528RD-G.

Table 3. Available Connections

Connector/Switch	Connection
CN1103	Positive audio line • Connect Pin 1 and Pin 2 with a jumper to bypass audio amplifier when using a handset audio terminal • Connect Pin 2 and Pin 3 with a jumper to enable audio amplifier when using a handset audio terminal
CN1104	Negative audio line • Connect Pin 1 and Pin 2 with a jumper to bypass audio amplifier when using a handset audio terminal • Connect Pin 2 and Pin 3 with a jumper to enable audio amplifier when using a handset audio terminal
CN300	• Pin 1 is ADC0 input, 0-3V • Pin 2 connected to NTC on board • Pin 3 is ADC1 input,0-3V • Note that SW300 must be switched “ADC & GPIO” to disable antenna detection when ADC is connected to an external input • Both ADC0 and ADC1 are connected by default
CN301	• Jumper connected = Fault Enable • Jumper disconnected = No Fault Simulator
CN305	Short with a jumper to enable power supply for GNSS active antenna with internal VCC reference voltage 3.1V, or connect a separate active antenna bias voltage can to Pin 2. This connector is shorted by default.
CN403	• Connect Pin 2 and Pin 3 with a jumper for applications using a 4V power supply unit (via CN402) • Connect Pin 1 and Pin 2 with a jumper when using a lab power supply (via CN401 and CN400)
CN404	• Connect Pin 1 and Pin 2 with a jumper for applications using a 4V power supply unit (via CN402) • Connect Pin 2 and Pin 3 with a jumper when using a lab power supply (via CN401 and CN400)
CN405	Short with a jumper to power ON the Development Kit. This connector is shorted by default.
CN406	• Connect Pin 1 and Pin 2 with a jumper to enable RTC backup battery for module • Connect Pin 2 and Pin 3 with a jumper to disable and discharge RTC backup battery • Disconnect the RTC backup battery with module by not connecting any jumpers
CN600	Short with a jumper to enable SIM2. This connector is shorted by default.
CN601	• Connect Pin 1 and Pin 2 with a jumper to bypass the POK_IN button (SW601). The Development Kit will automatically be powered on when VBAT is present. Pin 1 and Pin 2 are connected with a jumper by default. • Do not connect a jumper to enable Development Kit power on by pushing SW601 (2 seconds de-bouncing).
CN801	Short with a jumper to enable SIM1 insertion detection. This connector is shorted by default.
CN803	Short with a jumper to enable SIM2 insertion detection. This connector is shorted by default.

Connector/Switch	Connection
CN804	Short with a jumper to enable SIM switch control. This connector is open by default. If shorted with a jumper, the embedded SIM on the development kit (U805) will be connected to the SIM1 interface of the embedded module. Note that this feature is only available on the HL85xxx.
CN901	Short with a jumper to enable USB1 port (this feature is not available for the HL6528x). This connector is shorted by default.
SW1000	• Switch to “OUT” to disable GPIO1 to GPIO8 (default setting) • Switch to “IN” to enable GPIO1 to GPIO8
SW1001	• Switch to “HIGH” to enable GPIO1 to GPIO8 pull up • Switch to “LOW” to enable GPIO1 to GPIO8 pull down
SW1100	• Switch to “ANALOG” for analog audio out • Switch to “PCM” for PCM audio out through the PCM analog audio converter
SW1101	• Switch to “ON” to enable amplifier for audio out • Switch to “OFF” to disable amplifier for audio out
SW300	• Switch to “ANTENNAS DETECTION ENABLE” for antenna detection • Switch to “ADC & GPIO” for ADC application (default setting)
SW301	• Switch to “GSM FAULT TO VCC” for antenna fault simulator to VCC • Switch to “GSM FAULT TO GND” for antenna fault simulator to GND
SW302	• Switch to “GPS ANT DETECT” for GNSS antenna detection (only active for GNSS port on the Development Kit) • Switch to “GPS ACTIVE ANT SUPPLY ENABLE” to enable GNSS active antenna supply (default setting)
SW400	Discharge button for RTC battery. For internal Sierra Wireless use only.
SW500	• Switch to “1.8V” to manually detect the HL6528-1.8V module type (not used) • Switch to “2.8V” to manually detect the HL6528-2.8V module type (not used)
SW501	• Switch to “HL6528-G” to manually detect the HL6528x module type (not used) • Switch to “HL8548-G” to manually detect the HL75xx, HL85xxx module type (not used)
SW600	• Switch to “UART0” for UART applications (default setting) • Switch to “GPIO” for other GPIO applications (not available for the HL6528x)
SW603	*Note: This switch only has a bearing when using an HL85xxx module. The UART0/debug interface will always function as an SPI to UART interface regardless of this switch’s setting when using an HL6528x; it has no effect when using an HL75xx.* • Switch to “SPI/UART0” to use the UART0 interface/debug port of the HL85xxx • Switch to “SPI” to use the SPI interface of the HL8518, HL8528 or HL8529
SW800	• Switch to “SIM2 & GPIO” for SIM2 applications (default setting) • Switch to “PWM” for PWM applications
SW900	• Switch to “I2C” for I^2C applications (default setting) • Switch to “GPIO” for GPIO1 and GPIO5 applications

2.2.3. Snap-In Connector

The Snap-in connector houses the HL series embedded module and allows easy switching between any of the supported HL series embedded module.

Note: The HL8549x module does not use this connector as it is soldered directly on the development kit.

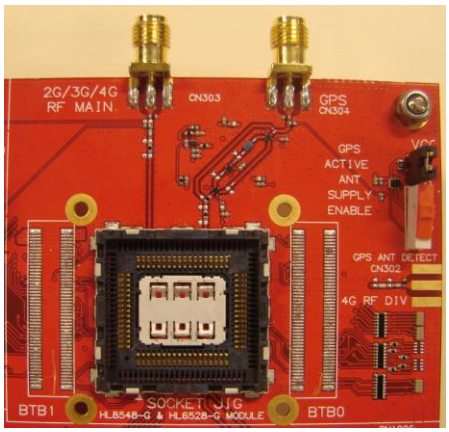


Figure 3. Snap-in Connector

Note: To ensure that the HL embedded module works properly with the development kit, make sure that the HL series embedded module is positioned properly inside the Snap-in connector.

Refer to the following figures for examples of the correct module orientation inside the Snap-in connector.

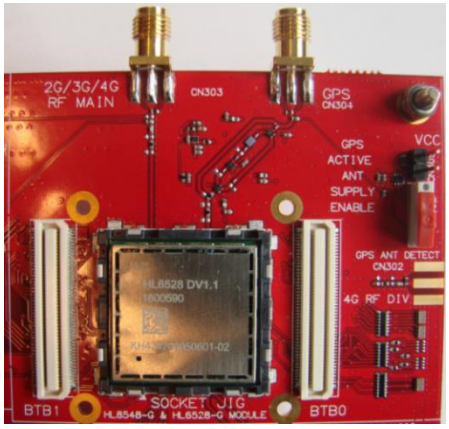


Figure 4. Module Position for HL6528x (without label)

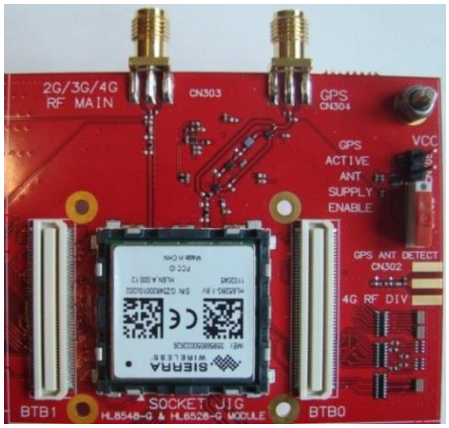


Figure 5. Module Position for HL6528x (with label)

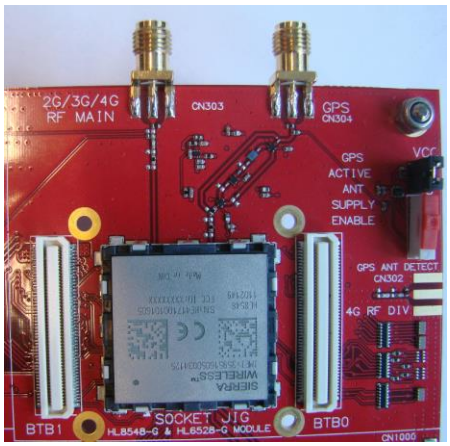


Figure 6. Module Position for HL75xx and HL85xxx

After plugging an HL series embedded module in the Snap-in connector, attach the Snap-in cover as shown in the figure below.

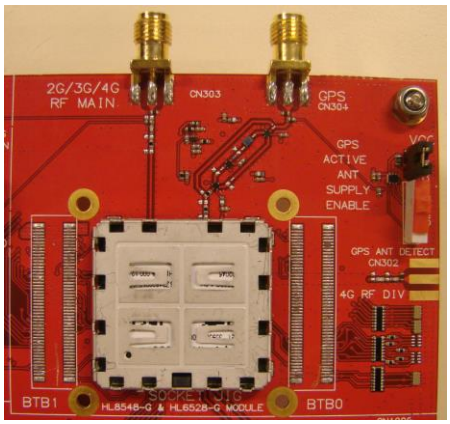


Figure 7. Snap-in Connector with Embedded Module and Cover

2.2.4. Test Ports

There are a total of 64 test ports available in the AirPrime HL Series Development Kit. The following table lists the test port serigraphy and the corresponding signal names of the applicable HL series module.

For more information about these signals, refer to the product technical specifications listed in section 6 Reference Documents.

Table 4. AirPrime HL Series Development Kit Test Ports

Test Port #	Test Port Serigraphy	Board to Board Connector Pin #	HL6528x Signal Name	HL75xx Signal Name	HL85xxx Signal Name
1	TXD1	CN200.81	UART1_TX	UART1_TX	UART1_TX
2	RXD1	CN200.85	UART1_RX	UART1_RX	UART1_RX
3	RTS1	CN200.73	UART1_RTS	UART1_RTS	UART1_RTS
4	CTS1	CN200.79	UART1_CTS	UART1_CTS	UART1_CTS
5	DTR1	CN200.77	UART1_DTR	UART1_DTR[1] / TRACE_DATA3[2]	UART1_DTR
6	RI1	CN200.71	UART1_RI	UART1_RI[1]	UART1_RI
7	GND				
8	GND				
9	DSR1	CN200.83	UART1_DSR	UART1_DSR[1] / TRACE_DATA0[2]	UART1_DSR
10	DCD1	CN200.75	UART1_DCD	UART1_DCD[1] / TRACE_DATA1[2]	UART1_DCD
11	GPIO1	CN201.32	GPIO1 / I2C1_CLK	GPIO1 / I2C_CLK[3,4]	GPIO1/I2C_CLK
12	GPIO2	CN201.30	GPIO2	GPIO2 / TRACE_DATA2[2]	GPIO2
13	GPIO3	CN201.51	UIM1_DET / GPIO3	GPIO3 / UIM_DET	GPIO3 / UIM_DET
14	GPIO4	CN201.69	UIM2_DET / GPIO4	GPIO4	GPIO4
15	GPIO5	CN200.90	GPIO5 / I2C1_DATA	GPIO5 / I2C_SDA[3,4]	GPIO5/I2C_SDA
16	GPIO6	CN201.60	GPIO6	GPIO6	GPIO6
17	GPIO7	CN201.40	GPIO7	GPIO7	GPIO7
18	GPIO8	CN201.42	GPIO8	GPIO8 / TRACE_CLK[2]	GPIO8
19	GPIO9	CN200.8	UIM2_VCC	NC1	NC1
20	GPIO10	CN201.66	SPI1_MISO	GPIO10[2] / SPI1_MISO[3,4]	GPIO10
21	GPIO11	CN201.38	SPI1_CLK	GPIO11[2] / SPI1_CLK[3,4]	GPIO11
22	GPIO12	CN200.10	UIM2_CLK / PMW	GPIO12[2] / UIM2_CLK[4]	PWM2/GPIO12
23	GND				
24	PWM1	CN200.4	UIM2_RESET / BUZZER	UIM2_RESET[4]	PWM1
25	GPIO13	CN201.70	SPI1_SRDY	GPIO13[2] / SPI1_SRDY[3,4]	DEBUG_TX / GPIO13

Test Port #	Test Port Serigraphy	Board to Board Connector Pin #	HL6528x Signal Name	HL75xx Signal Name	HL85xxx Signal Name
26	GPIO14	CN201.68	SPI1_MRDY	GPIO14[2] / SPI1_MRDY[3,4]	DEBUG_RX / GPIO14
27	GPIO15	CN201.64	SPI1_MOSI	GPIO15[2] / SPI1_MOSI[3,4]	GPIO15
28	GPIO16	CN200.6	UIM2_DATA	NC2 / UIM2_DATA[4]	NC2
29	GND				
30	GND				
31	PCM IN	CN201.78	PCM_IN	PCM_IN[5]	PCM_IN
32	PCM OUT	CN201.76	PCM_OUT	PCM_OUT[5]	PCM_OUT
33	PCM CLK	CN201.74	PCM_CLK	PCM_CLK[5]	PCM_CLK
34	PCM SYNC	CN201.80	PCM_SYNC	PCM_SYNC[5]	PCM_SYNC
35	GND				
36	GND				
37	MIC+	CN201.93	MIC_P	NC	NC
38	SPKR+	CN201.97	SPKR_P	NC	NC
39	MIC-	CN201.95	MIC_N	NC	NC
40	SPKR-	CN201.99	SPKR_N	NC	NC
41	GND				
42	GND				
43	ADC0	CN201.53	ADC0	NC	ADC0
44	ADC1	CN201.55	ADC1	ADC1	ADC1
45	BAT RTC	CN201.35	BAT-RTC	BAT_RTC	BAT_RTC
46	VGPIO	CN201.20	VGPIO	VGPIO	VGPIO
47	PWR ON	CN201.33	PWR_ON	PWR_ON	PWR_ON
48	VIO FL				
49	GND				
50	NC				
51	RESET IN	CN201.37	RESET_IN	RESET_IN	RESET_IN
52	2G TX ON	CN201.29	2G_TX_ON	TX_ON[2,7] / GPIO21[3]	2G_TX_ON
53	TP1 / BOOT	CN201.25	TP1	TP1	TP1
54	TP2 / JTAG TEST	CN200.84	RESERVED	26M_CLKOUT	26M_CLKOUT
55	LNA EN	CN200.32	EXT_LNA_GPS_EN	NC	EXT_LNA_GPS_EN[6]
56	PPS	CN200.34	PPS	NC	PPS[6]
57	32KHZ / VGPIO SEL	CN200.76	NC	32K_CLKOUT	32K_CLKOUT
58	USB VBUS	CN201.92	NC	NC	NC
59	GND				
60	GND				
61	SIM1 VCC	CN201.43	UIM1_VCC	UIM1_VCC	UIM1_VCC
62	SIM1 RST	CN201.47	UIM1_RESET	UIM1_RESET	UIM1_RESET
63	SIM1 DATA	CN201.45	UIM1_DATA	UIM1_DATA	UIM1_DATA

Test Port #	Test Port Serigraphy	Board to Board Connector Pin #	HL6528x Signal Name	HL75xx Signal Name	HL85xxx Signal Name
64	SIM1 CLK	CN201.49	UIM1_CLK	UIM1_CLK	UIM1_CLK

1 Not available on the HL7518 and HL7548.

2 Not available on the HL7528 and HL7549.

3 Only available on the HL7528 and HL7549.

4 Not available on the HL7518, HL7519, HL7548 and HL7588.

5 Only available on the HL7528, HL7549 and HL7588.

6 Not available on the HL8518, HL8528 and HL8529.

7 Not available on the HL7518.

2.3. Special Solder for Jumper Solder Pads

Jumper solder pads are used for interfaces and peripherals that can be disconnected electrically.

To connect signals between the embedded module and the dedicated connector on the HL Series Development Kit, solder these jumper pads.

Figure 8. Jumper Solder Pad

Interfaces and peripherals that may be electrically disconnected via jumper solder pads include:

- Module Detection Circuit (from TP502 to TP507)
- PWM1 (from TP800 to TP801)
- PWM2 (from TP802 to TP803)
- VBATT_RF bypass U400 chipset (TP405)

*Note: All jumper solders are **not soldered** in the initial development kit configuration.*

3. Interfaces

3.1. Power Supply

Two power supply sources are available on the HL Series Development Kit:

- DC jack (via CN402)
- LABO connector (via CN401/CN400)

Figure 9. Power Supply Connector (CN402, CN401 and CN400)

Either power supplies can be used to supply the development kit, or they can be used to supply power to VBAT_BB and VBAT_RF separately depending on CN403 and CN404's jumper configuration. Refer to the following diagram for possible configuration settings.

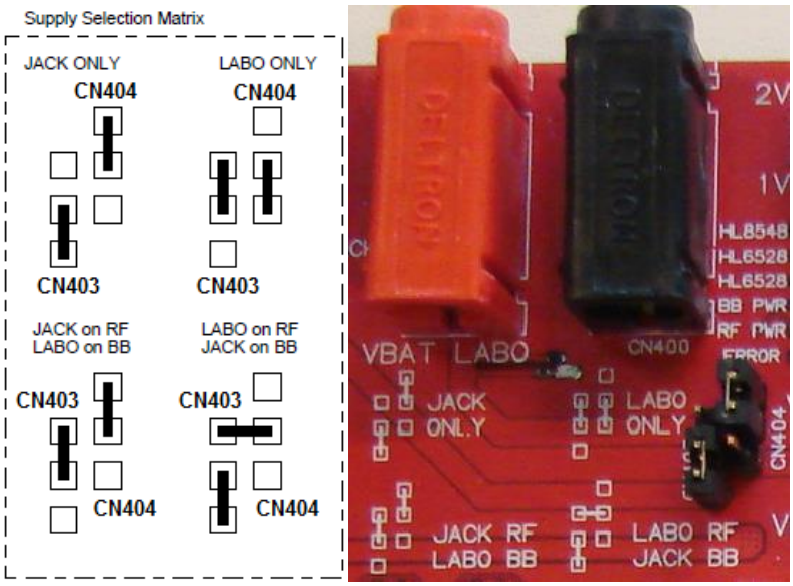


Figure 10. Power Source Selection (Schematic Diagram and Actual Development Kit Picture)

Other interfaces on the development kit are powered by VBAT, which is connected to VBAT_BB through CN405 (refer to Figure 21 Jumper for Supplying the Development Kit Interfaces Separately for the location of CN405).

3.2. Control Functions

3.2.1. Power ON/OFF

Once the HL Series Development Kit is connected to an external source, the HL module will start monitoring the ON/OFF pin for a power on event. A power on event can be triggered by either:

- Pressing pushbutton SW601 once for approximately 2 seconds, or by
- Shorting CN601.1 and CN601.2.

Note that shorting pins 1 and 2 of CN601 bypasses the POK_IN signal which means that the development kit will be powered on as soon as it is connected to an external source (without needing to press pushbutton SW601).

The module can be powered off by disconnecting the development kit from the power source or by issuing the appropriate AT command. For more information about AT commands, refer to document [1] AirPrime HL6 and HL8 Series AT Commands Interface Guide.

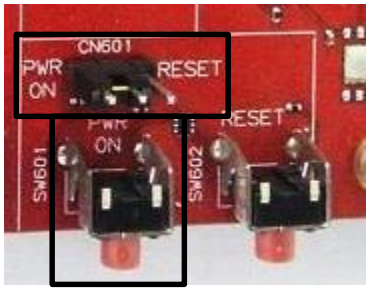


Figure 11. PWR ON Pushbutton and CN601 Jumper

Note: Do not put a jumper between pins 2 and 3 of CN601. Doing this will cause the module to always reset. Refer to the following section for information about properly resetting the module.

3.2.2. ~RESET

The ~RESET pushbutton starts a general reset when it is pushed. Reset can only be executed after the module has been switched ON.

Note: An operating system reset is preferred to a hardware reset.

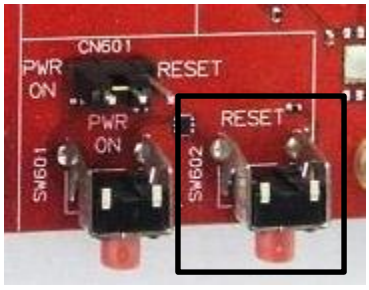


Figure 12. ~RESET Pushbutton

3.3. USB0

The USB0 connection on the development kit is available from CN902.

Note: This interface is not supported on the HL6528RD and HL6528RD-2.8V.

The HL Series modules provide an I²C interface for NMEA package delivery, and an I²C to USB transceiver is embedded on the HL Series Development Kit. The transceiver can be detected by the PC while the HL Series module is connected to the development kit.

For detailed information about the transceiver embedded on the development kit, refer to http://www.ftdichip.com/Products/ICs/FT201X.html.

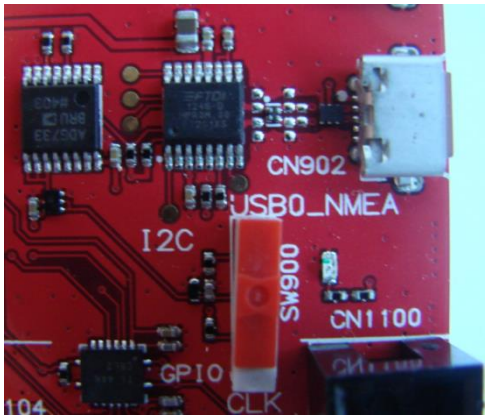


Figure 13. USB0 Interface

3.4. USB1

The USB1 connection on the development kit is available from CN901.

Note: This interface is only used for the HL6528RDx, HL75xx and HL85xxx modules.

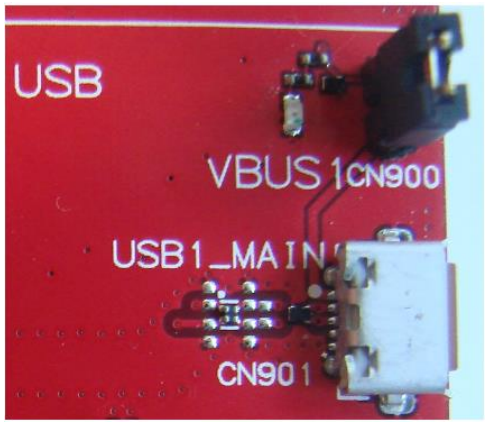


Figure 14. USB1 Interface

3.5. Audio

Note: HL75xx and HL85xxx modules do not support analog audio.

A headset jack (CN1105) is available on the development kit which allows the HL series module to connect to an audio interface. Switch SW1100 allows audio selection from direct analog audio connection or PCM codec conversion output, and switch SW1101 is used for activating an audio amplifier. Jumpers CN1103 and CN1104 are used to bypass or to enable an audio amplifier.

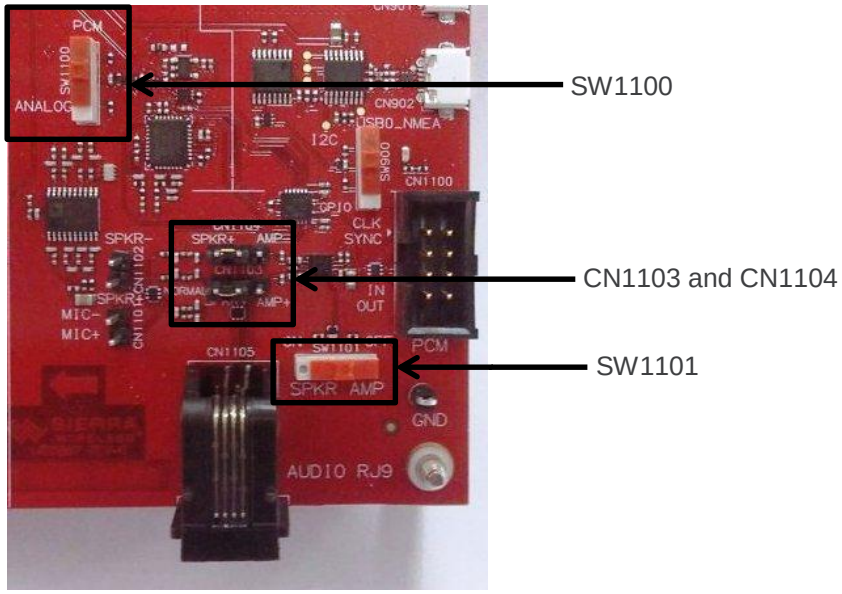


Figure 15. Audio Interface

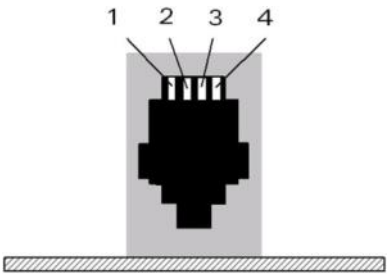


Figure 16. 4-pin RJ9 Connector for Audio Signals

Refer to the following table for Audio connector signal pin description.

Table 5. Audio Connector Pin Description

Pin Number	Signal Name	I/O	I/O Type	Description
1	MIC_N	I	Analog	Microphone negative input
2	SPK_N	O	Analog	Main speaker negative output
3	SPK_P	O	Analog	Main speaker positive output
4	MIC_P	I	Analog	Main microphone positive input

Both microphone and speaker signals are configured in differential mode.

3.6. SIM1 and SIM2

The HL Series Development Kit has two SIM connectors:

- SIM1 (CN800)
- SIM2 (CN802)

The development kit also supports a SON8 embedded SIM (U805) which can be connected to the SIM1 interface of the embedded module by shorting CN804 with a jumper.

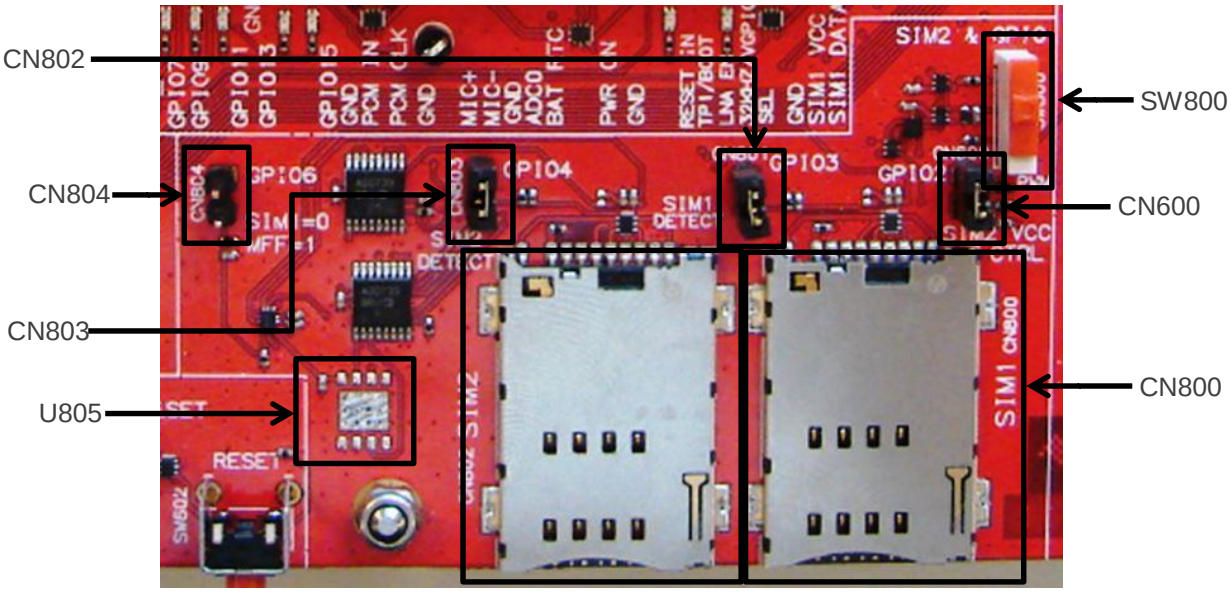


Figure 17. SIM1 and SIM2 Interface

Note: Sierra Wireless recommends that SIM1 be used for single SIM applications.

Table 6. SIM1 Connector Pin Description

Pin Number	Signal Name	I/O	I/O Type	Description
1	UIM1_VCC	O	1V7 << 1V9 or 2V7 << 2V95	SIM Power Supply
2	UIM1_RESET	O	1V7 << 1V9 or 2V7 << 2V95	SIM Reset
3	UIM1_CLK	O	1V7 << 1V9 or 2V7 << 2V95	SIM Clock
4	CC4	Not used		
5	GND			Ground
6	VPP	Not used		
7	UIM1_DATA	I/O	1V7 << 1V9 or 2V7 << 2V95	SIM Data
8	CC8	Not used		
9	VIO	I	VIO*	VIO supply from module
10	UIM1_DETECT	I	VIO*	SIM Card Detect
11,12,13,14	GND			Ground casing

* VIO = 1V8 or 2V8 depending on the HL embedded module.

Table 7. SIM2 Connector Pin Description

Pin Number	Signal Name	I/O	I/O Type	Description
1	UIM2_VCC	O	2V7 << 3V	SIM Power Supply
2	UIM2_RESET	O	2V7 << 3V	SIM Reset
3	UIM2_CLK	O	2V7 << 3V	SIM Clock
4	CC4	Not used		
5	GND			Ground
6	VPP	Not used		
7	UIM2_DATA	I/O	2V7 << 3V	SIM Data
8	CC8	Not used		
9	VIO	I	VIO*	VIO supply from module
10	UIM2_DETECT	I	VIO*	SIM Card Detect
11,12,13,14	GND			Ground casing

* VIO = 1V8 or 2V8 depending on the HL embedded module.

The following table shows SIM configuration support per HL Series Embedded Module. The development kit must be configured according to the SIM configuration being used.

Table 8. SIM Configuration

HL Variant	Configuration	SIM1	SIM2	Embedded SIM
HL6528x	Single SIM	✓		
			✓	
	DSDS*	✓	✓	
	DSSS**	✓		✓
HL7518	Single SIM	✓		
HL7519, HL7528, HL7548, HL7549 and HL7588	Single SIM	✓		
	DSSS**	✓		✓
HL85xxx	Single SIM	✓		
	DSSS**	✓		✓

* Dual SIM Dual Standby

** Dual SIM Single Standby

For HL6528x with single SIM configuration,

- When using SIM1, short CN801 with a jumper to enable SIM1 insertion detection
- When using SIM2,
  - SW800 should be switched to position “SIM2 & GPIO”
  - Short CN600 with a jumper to enable the SIM2 connector
  - Short CN803 with a jumper to enable SIM2 insertion detection

For HL6528x with DSDS (SIM1 and SIM2) configuration,

- SW800 should be switched to position “SIM2 & GPIO”
- Short CN801 with a jumper to enable SIM1 insertion detection
- Short CN600 with a jumper to enable the SIM2 connector
- Short CN803 with a jumper to enable SIM2 insertion detection

For HL6528x with DSDS (SIM1 and Embedded SIM) configuration,

- Short CN801 with a jumper to enable SIM1 insertion detection
- Short CN804 with a jumper to enable U805 (Embedded SIM)

For HL75xx and HL85xxx with single SIM configuration,

- Short CN801 with a jumper to enable SIM1 insertion detection
- Open CN804 to disable U805 (Embedded SIM)

For HL75xx and HL85xxx with DSSS (SIM1 and Embedded SIM) configuration,

- Short CN801 with a jumper to enable SIM1 insertion detection
- Short CN804 with a jumper to enable U805 (Embedded SIM)

3.7. UART1

UART1 connection on the development kit is available from CN700, which is a SUB-D 9-pin female connector. This interface is used to communicate between an AirPrime HL series module and a PC or host processor.

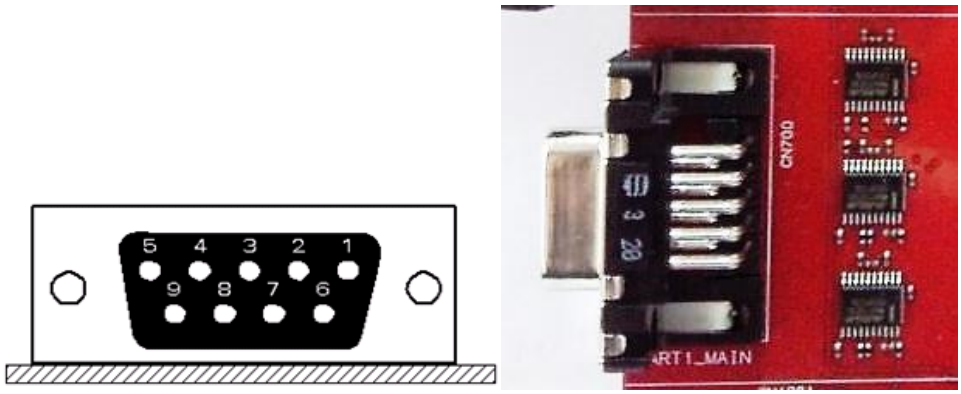


Figure 18. UART1 Connector

Refer to the following table for the UART1 connector pin description.

Table 9. Pin Description of the UART1 Connector

Pin #	Signal Name	I/O	I/O Type	Description
1	CT109 DCD	O	RS232 (V24/V28)	Data carrier detect
2	CT104 RXD	O	RS232 (V24/V28)	Receive serial data
3	CT103 TXD	I	RS232 (V24/V28)	Transmit serial data
4	CT108-2 DTR	I	RS232 (V24/V28)	Data terminal ready

Pin #	Signal Name	I/O	I/O Type	Description
5	GND			Ground
6	CT107 DSR	O	RS232 (V24/V28)	Data set ready
7	CT105 RTS	I	RS232 (V24/V28)	Request to send
8	CT106 CTS	O	RS232 (V24/V28)	Clear to send
9	CT125 RI	O	RS232 (V24/V28)	Ring indicator

3.8. UART0/SPI1

Note: This interface is not supported on the HL6528RDx and HL75xx.

The UART0/SPI1 connector, CN602, is a SUB-D 9-pin female connector and is used for connecting the HL Series embedded module's debug port interface.

This interface is used for legacy HL6528x "SpyTracer" debugging. For more information about SpyTracer debugging, refer to section 5.1 Getting SpyTracer Debugging Data.

When using the HL85xxx, the operating mode of this connector can be set using SW603. When using a legacy HL6528x module, the UART0 connector functions as an SPI to UART interface regardless of SW603's setting.

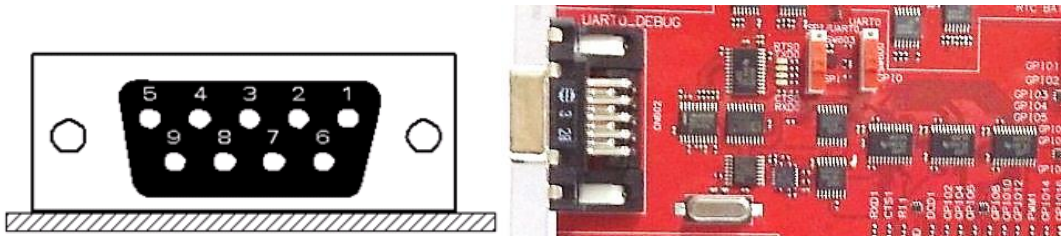


Figure 19. UART0 Connector

Refer to the following table for the UART1 connector pin description.

Table 10. UART0 Connector Pin Description

Pin #	Signal Name	I/O	I/O Type	Description
1	Not used*	-	-	-
2	CT104 RXD	O	RS232 (V24/V28)	Receive serial data
3	CT103 TXD	I	RS232 (V24/V28)	Transmit serial data
4	Not used*	-	-	-
5	GND			Ground
6	Not used*	-	-	-
7	CT105 RTS	I	RS232 (V24/V28)	Request to send
8	CT106 CTS	O	RS232 (V24/V28)	Clear to send
9	Not used*	-	-	-

* Only 4 signals are used.

3.9. GPIO Control

Note: This interface is not supported on the HL6528RDx.

Two switch sets, SW1000 and SW1001, are available on the Development Kit for GPIO test purposes.

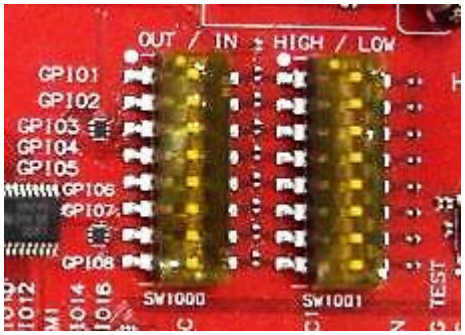


Figure 20. GPIOs Control Switches

SW1000 enables GPIO1 to GPIO8; while SW1001 enables these GPIOs to be connected to VIO either as 1kΩ pull ups or 100Ω pull lows.

GPIO settings can be set or reset using AT commands. For more information about AT commands, refer to document [1] AirPrime HL6 and HL8 Series AT Commands Interface Guide.

3.10. Current Measurement

Note: This interface is not supported on the HL6528RDx.

To measure the current consumed by the HL series embedded module, disconnect CN405 and supply the Development Kit interfaces separately. Refer to the following figure for the jumper location.

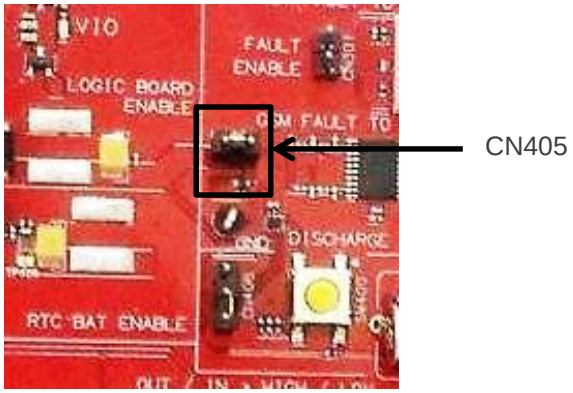


Figure 21. Jumper for Supplying the Development Kit Interfaces Separately

VBAT_BB and VBAT_RF can be measured separately or as a total current drain depending on the configurations of CN403 and CN404.

3.11. JTAG

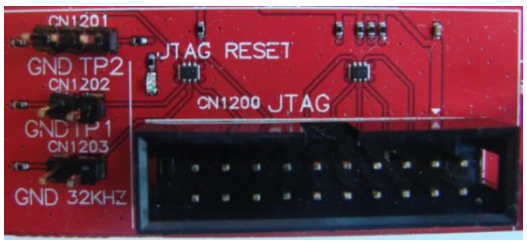


Figure 22. JTAG Connector

Warning: *This interface is not available for customer use. Default configurations should not be tampered with.*

3.12. Antenna Connections

Note: This interface is not supported on the HL6528RDx.

Three SMA connectors are available on the HL Series Development Kit for main RF, 4G diversity and GNSS antenna connections.

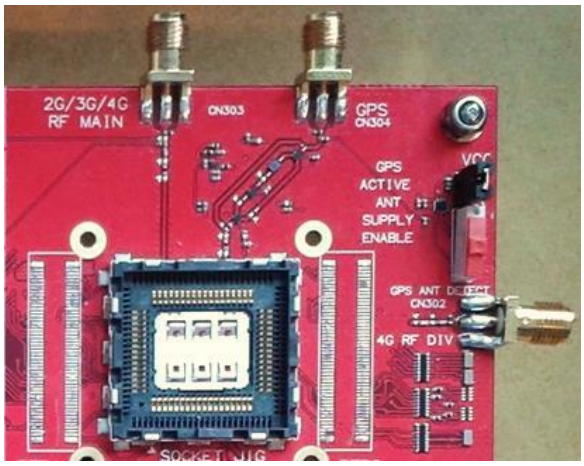


Figure 23. RF, 4G Diversity and GNSS Antenna Connectors

3.13. RTC Backup Battery

Note: This interface is not supported on the HL6528RDx.

The HL Series Development Kit provides an input signal, BAT_RTC, for connecting a coin battery. This pin is used as a backup power supply to preserve the date and time when VBATT is switched OFF (no VBATT).

Connect pins 1 and 2 of CN406 with a jumper to use this feature.

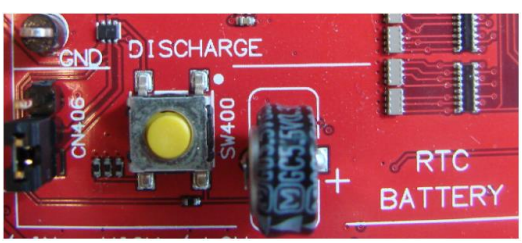


Figure 24. RTC Coin Battery Location

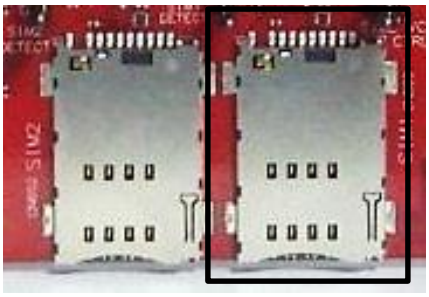
4. Getting Started with the HL Series Development Kit

This section describes how the AirPrime HL Series Development Kit is set up as well as describes communications testing, making calls and debugging with an embedded module.

4.1. Setting Up the Development Kit

Perform the following steps before powering the Development Kit on.

1. Ensure that switches and connectors are configured accordingly. By default, the development kit board is configured from the factory before shipment. Refer to Table 3 Available Connections for some of the board's default settings.
2. Plug in an HL Series embedded module to the Snap-in connector and attach the Snap-in cover. Or, when using an HL8549x module, solder it directly on the development kit.
3. Insert a SIM or USIM card in the SIM1 slot, CN800, if communications are required.



Note:	*SIM2 is optional in the HL6528x,and not applicable for the HL75xx and HL85xxx.*

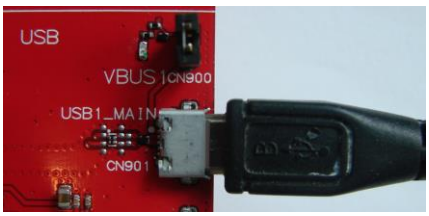
4. Connect the HL module to the PC.

   For HL6528x, connect the RS232 cable between the PC port and CN700 of the Development Kit for UART1 connection.

   By default, baud rate = 115.2Kbps, data bits = 8, parity = N, and stop bits = 1.

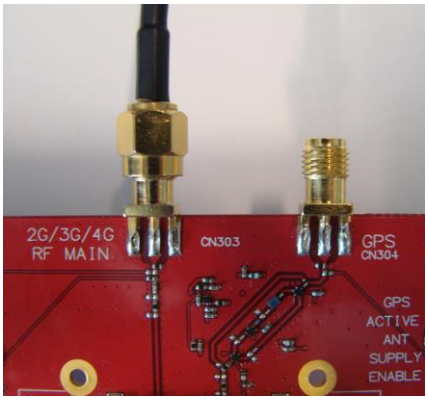
Note:	*Although the HL75xx and HL85xxx support UART connections, it is highly recommended that a USB connection be used instead as UART may not be enabled by default in the firmware.*

   For HL75xx and HL85xxx, connect the USB cable between the PC port and CN901 of the Development Kit for USB1 connection.

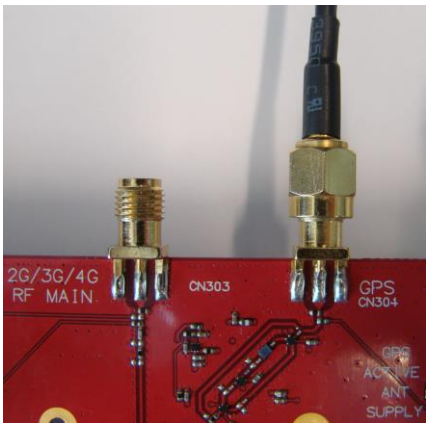


Note:	*The provided USB driver should be also installed in the host computer.*

5. Connect a GSM or LTE antenna to CN303 of the Development Kit depending on the HL embedded module used.



6. Connect a GNSS antenna to CN304 of the Development Kit (when using an HL embedded module that supports GNSS).

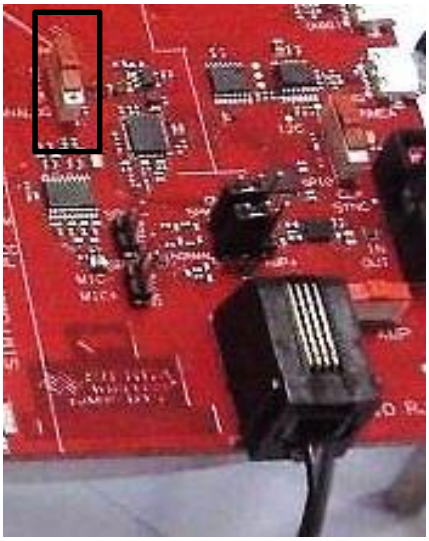


7. Connect a 4G diversity antenna to CN302 when using an HL75xx module.

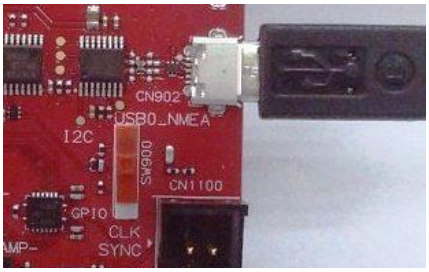
8. Connect a handset to CN1105 for audio communications.

   For HL6528x, select either digital (PCM) or analog audio via SW1100.

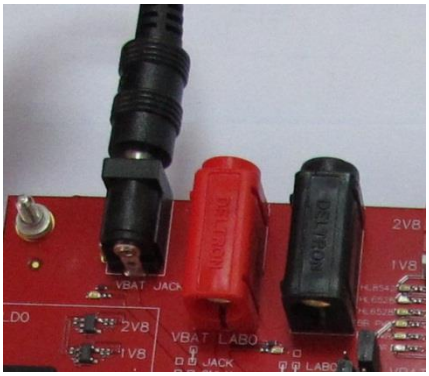
   For HL7588 and HL85xxx, select digital (PCM) audio via SW1100.



9. To get NMEA output, connect a USB cable to USB0.



10. Connect a 4V power supply unit to CN402.



Note:	*Make sure that Pin 2 and Pin 3 of CN403, as well as Pin 1 and Pin 2 of CN402 are connected with a jumper when using a 4V power supply unit.*

Alternatively, a lab power supply can be connected to CN401 and CN400. (If using a lab power supply, it is recommended to set it to 3.7V with 4A output to prevent failure at power on.)

Note:	*Make sure that Pin 1 and Pin 2 of CN403, as well as Pin 2 and Pin 3 of CN402 are connected with a jumper when using a lab power supply.*

The AirPrime HL Series Development Kit should look like the following figure after it has been properly set up.

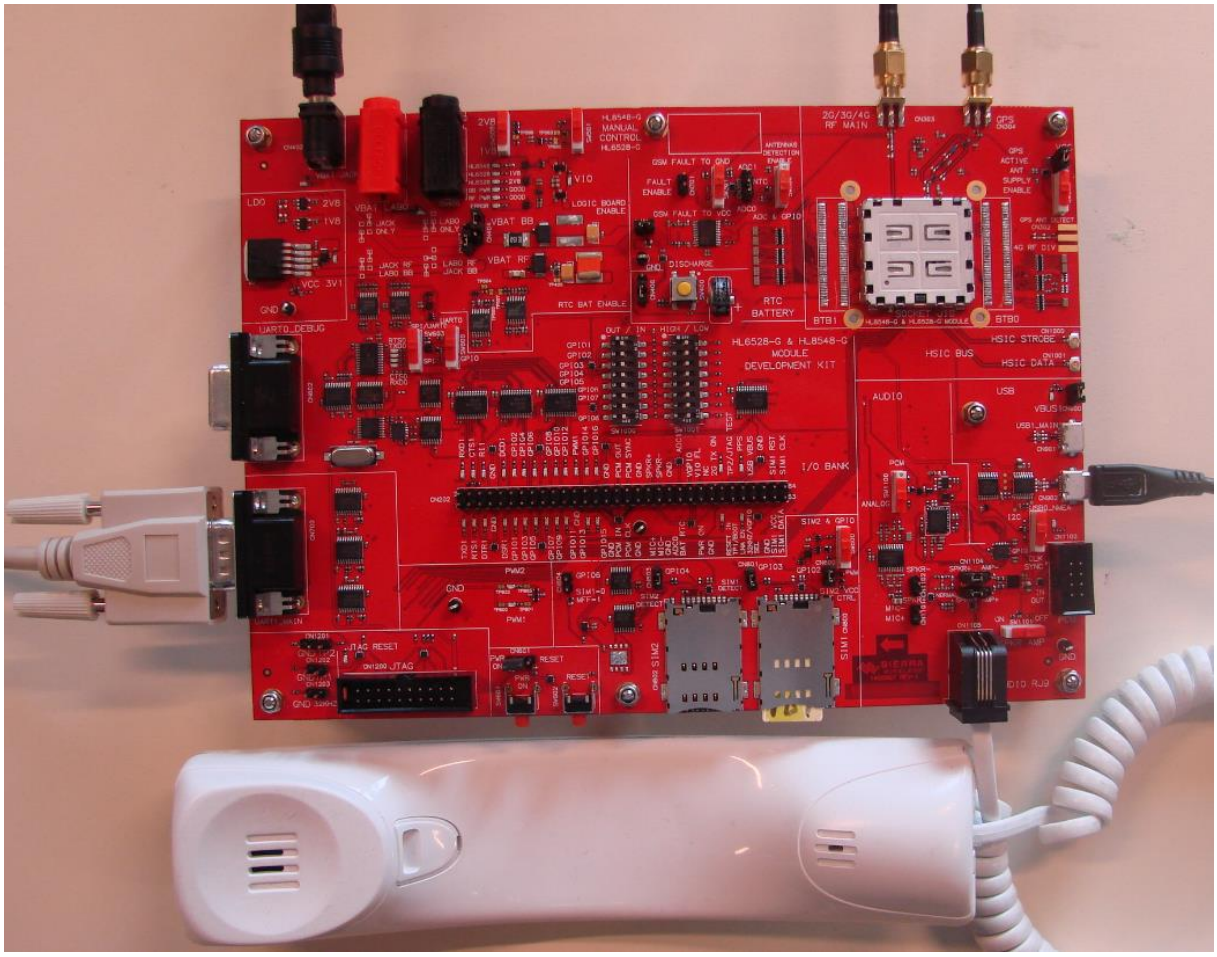


Figure 25. AirPrime HL Series Development Kit with an HL6528 Embedded Module Inside the Snap-in Connector

4.2. Switching the Development Kit On

The Development Kit will automatically be powered on if Pin 1 and Pin 2 of CN601 are connected with a jumper. Otherwise, push SW601 for approximately 2 seconds to power the Development Kit on.

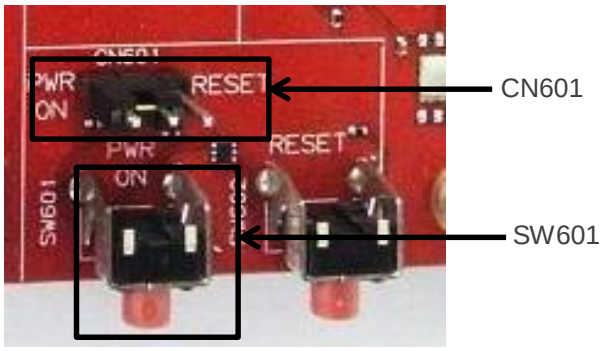


Figure 26. CN601 and SW601

Two green LEDs, D403 and D501, are lit when the Development Kit has been properly powered on and is ready for use.

Figure 27. D403 and D501

4.3. RF Communications with the HL6528x

4.3.1. Configure the COM Port

Configure the COM port settings by selecting the port which is connected to the Development Kit and specifying the following port settings.

- Bits per second 115200
- Data bits 8
- Parity None
- Stop bits 1
- Flow control Hardware

Test communications using a PC terminal emulator (for example, HyperTerminal) by entering **AT**↵.
The module should answer with **OK**.

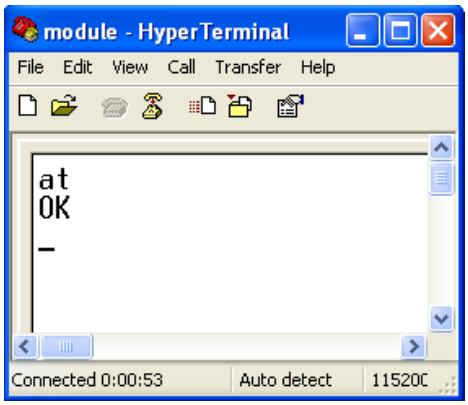
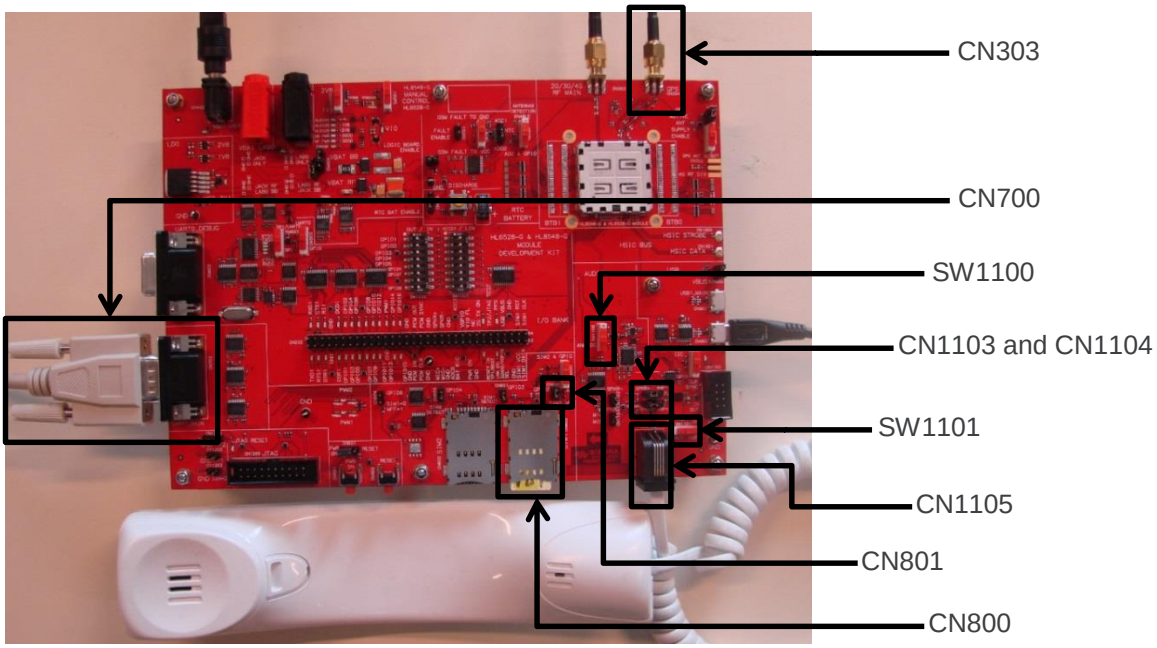


Figure 28. AT Communication with the AirPrime HL6528x

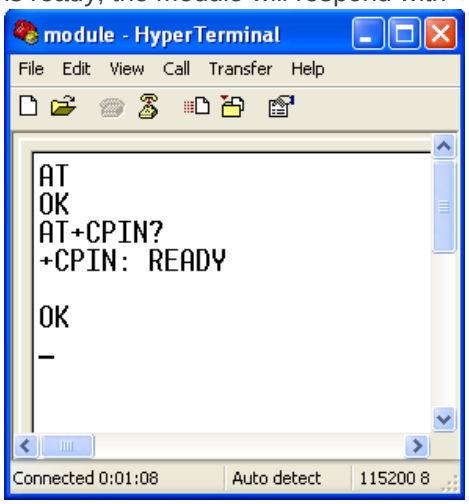
4.3.2. Make a Voice Call

To make a voice call with the Development Kit, follow these steps.

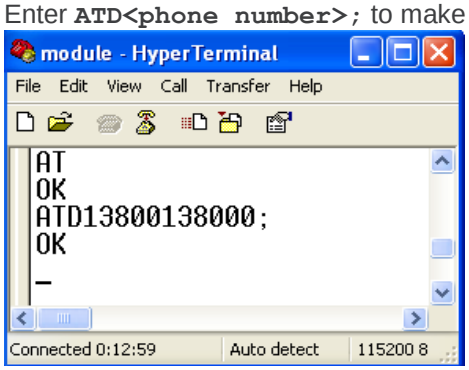
1. Ensure that:
   - a power cable is connected to CN402
   - a UART RS232 cable is connected to CN700
   - a SIM card is inserted in SIM1 (CN800)
   - CN801 is connected with a jumper
   - a GSM antenna is connected to CN303
   - a handset is connected to CN1105
   - SW1100 is switched to either “ANALOG” or “PCM” depending on whether analog or digital audio is to be used
   - SW1101 is switched to either “ON” or “OFF” depending on whether an audio amplifier is used
   - Pins 1 and 2 of jumpers CN1103 and CN1104 are connected to bypass the audio amplifier
   - Pins 2 and 3 of jumpers CN1103 and CN1104 are connected to enable the audio amplifier



2. From a PC terminal emulator (for example, HyperTerminal), input **AT+CPIN?**. If the SIM card is ready, the module will respond with **+CPIN: READY**, otherwise it will return **ERROR**.



3. Enter **ATD<phone number>;** to make a call. For example, enter **ATD13800138000;**.



4.4. RF Communications with the HL75xx and HL85xxx

The provided USB driver should be installed in the host computer. The HL75xx and HL85xxx modules are automatically detected when the USB cable is connected to the PC via the Development Kit board.

Test communications using a PC terminal emulator (for example, HyperTerminal) by entering **AT**↵. The module should answer with **OK**.

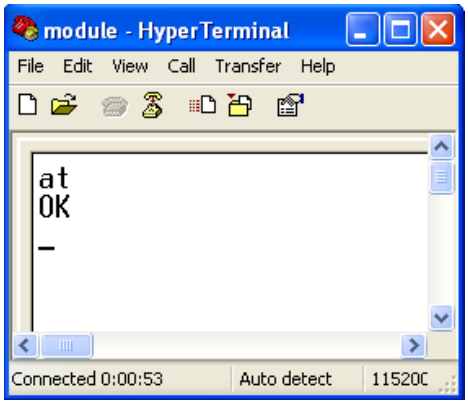
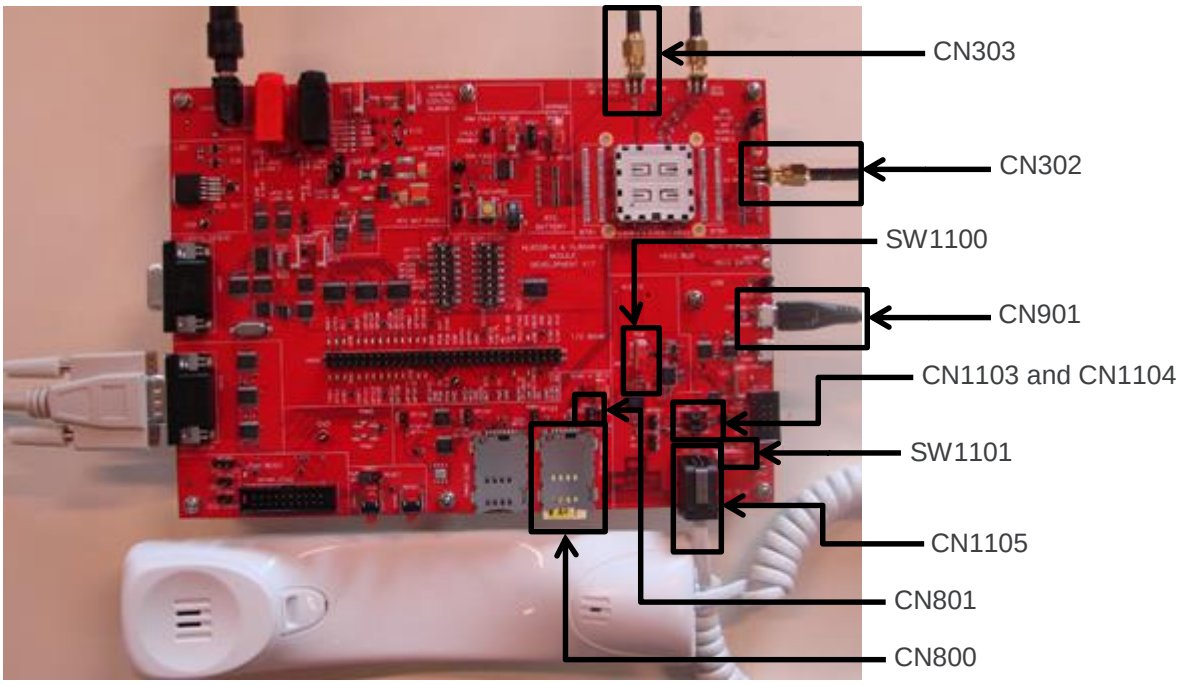


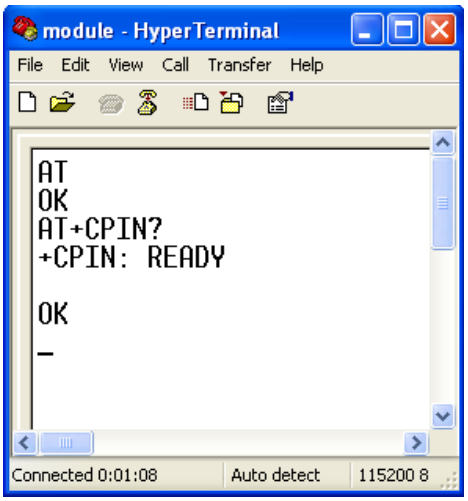
Figure 29. AT Communication with the AirPrime HL75xx and HL85xxx

To make a voice call with the Development Kit, follow these steps.

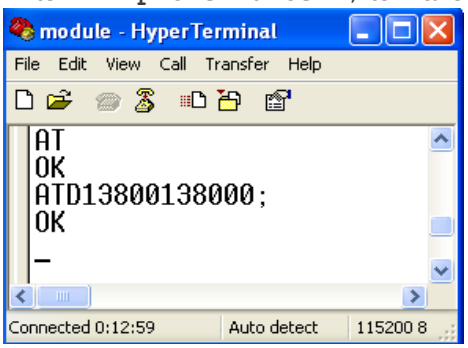
1. Ensure that:
   - a power cable is connected to CN402
   - a USB cable is connected to CN901
   - a SIM card is inserted in SIM1 (CN800)
   - CN801 is connected with a jumper
   - an antenna is connected to CN303 (GSM antenna for the HL85xxx; LTE antenna for the HL75xx)
   - an RF diversity antenna is connected to CN302 for the HL75xx
   - a handset is connected to CN1105
   - SW1100 is switched to “PCM” (note that the HL7518, HL7519 and HL7548 do not support PCM)
   - SW1101 is switched to either “ON” or “OFF” depending on whether an audio amplifier is used
   - Pins 1 and 2 of jumpers CN1103 and CN1104 are connected to bypass the audio amplifier
   - Pins 2 and 3 of jumpers CN1103 and CN1104 are connected to enable the audio amplifier



2. From a PC terminal emulator (for example, HyperTerminal), input **AT+CPIN?**. If the SIM card is ready, the module will respond with **+CPIN: READY**, otherwise it will return **ERROR**.



3. Enter **ATD<phone number>;** to make a call. For example, enter **ATD13800138000;**.

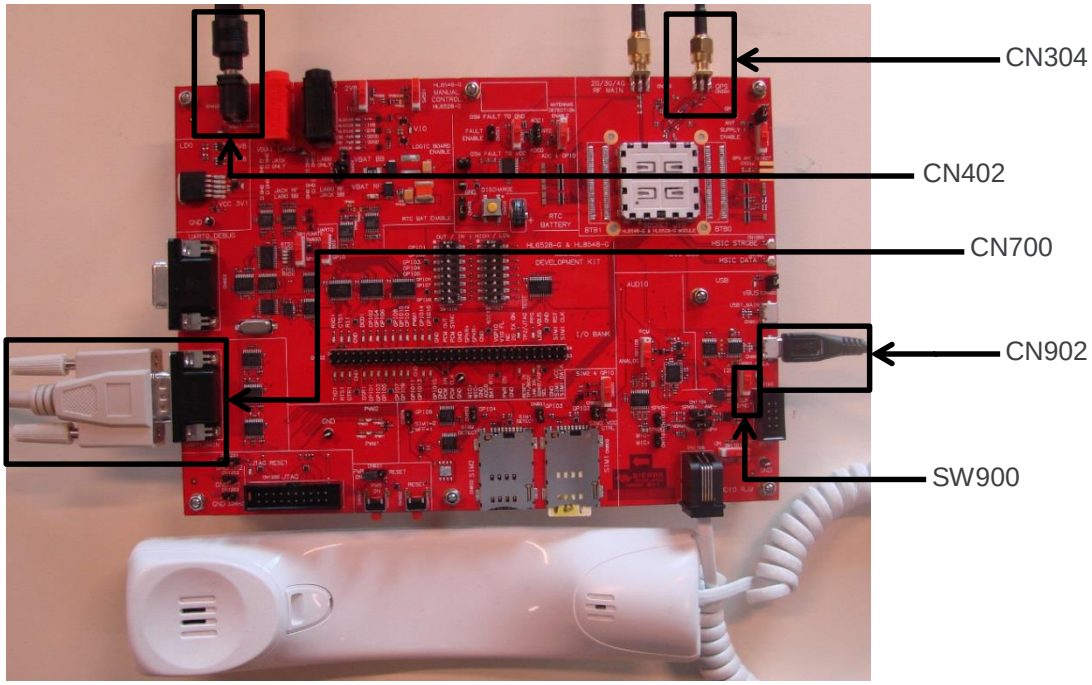


Note: The HL75xx will automatically attach to the network.

4.5. GPS Communications with the HL6528-G

To get GNSS NMEA output, ensure that:

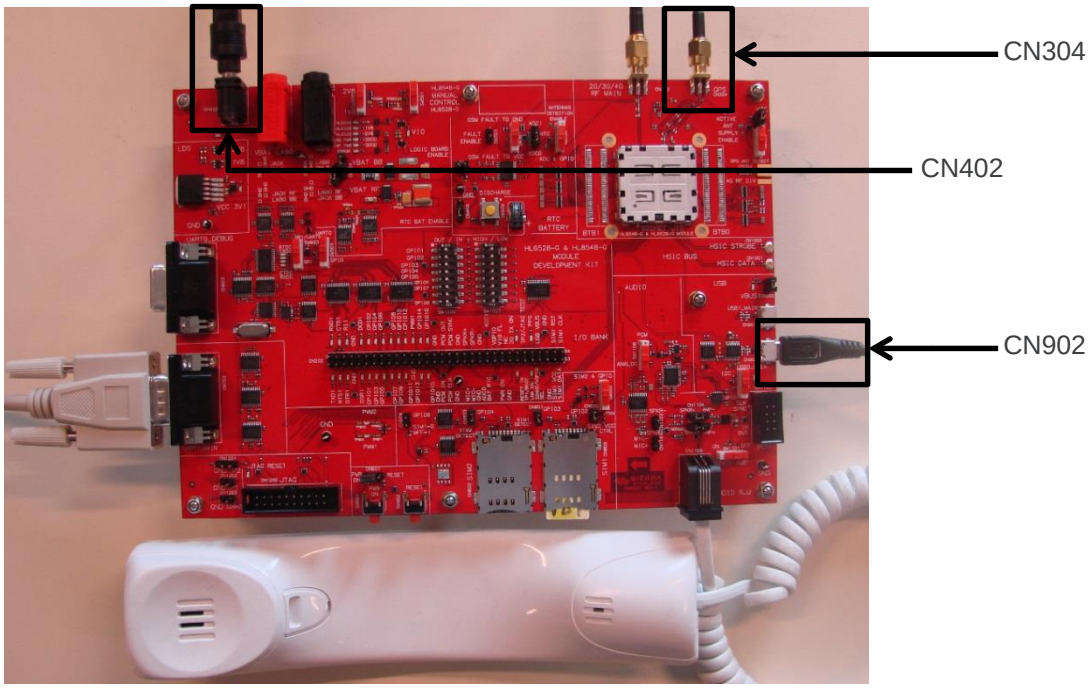
- a power cable is connected to CN402
- a GNSS antenna is connected to CN304
- a UART RS232 cable is connected to CN700
- a micro USB cable is connected to USB0 (CN902), and
- SW900 is switched to position “I2C”



4.6. GPS Communications with the HL854x-G

To get GNSS NMEA output, ensure that:

- a power cable is connected to CN402
- a GNSS antenna is connected to CN304, and
- a micro USB cable is connected to USB1 (CN901)



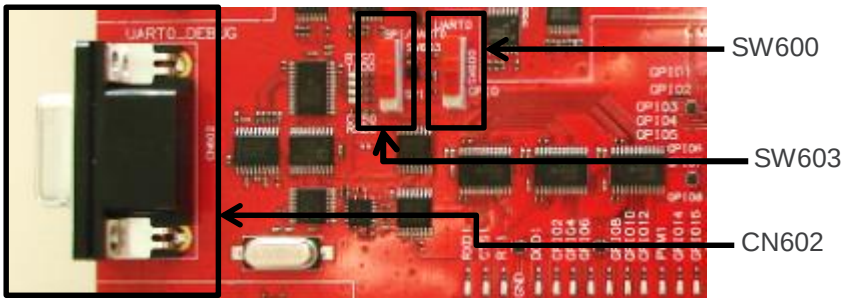
5. Other Hardware Settings

5.1. Getting SpyTracer Debugging Data (for HL6528x only)

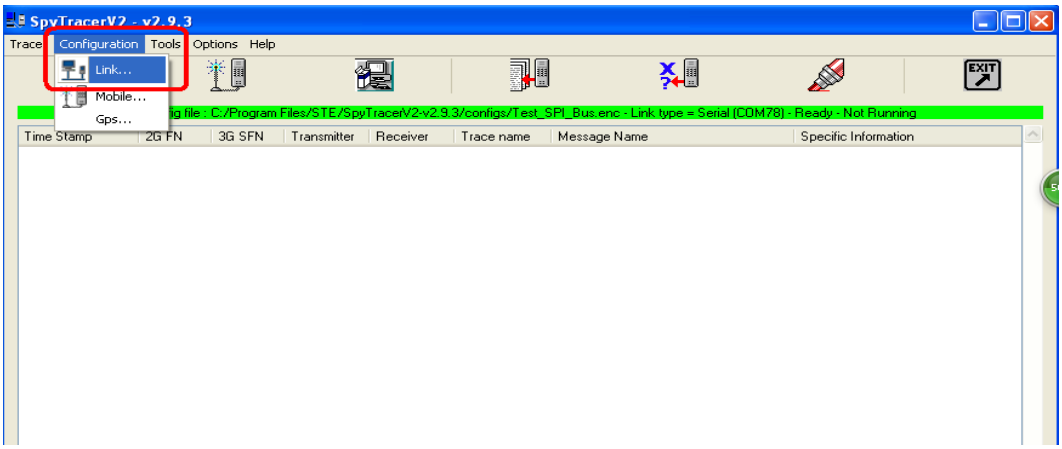
Note: Contact your Sierra Wireless representative for more details about the SpyTracer tool.

To get SpyTracer debug data, follow these steps:

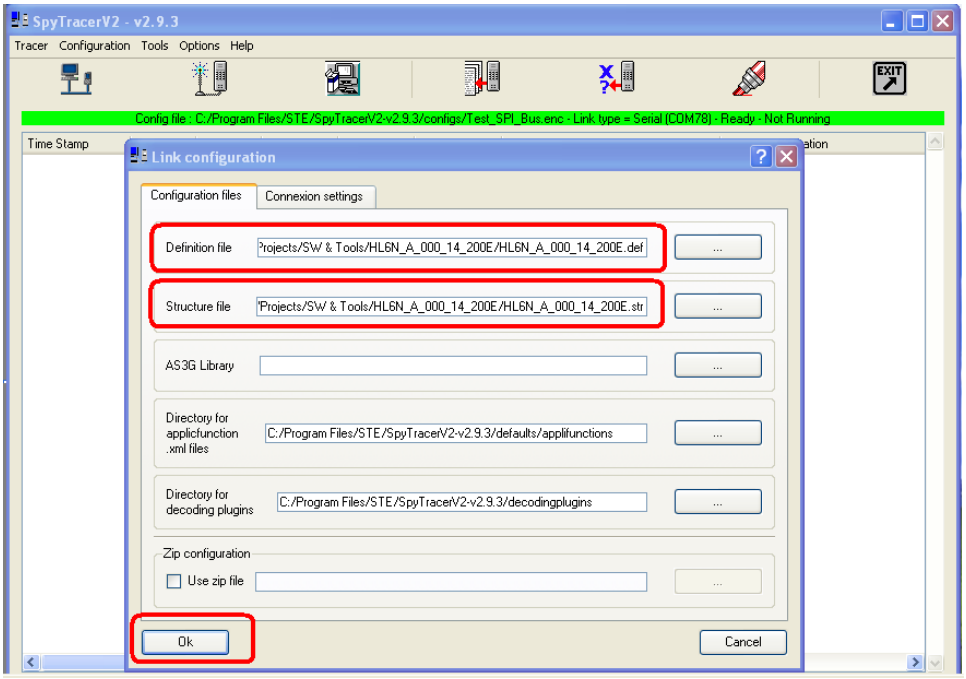
1. Ensure that:
   - a UART RS232 cable is connected to UART0 (CN602)
   - SW603 is switched to position “SPI/UART0”
   - SW600 is switched to position “UART0”



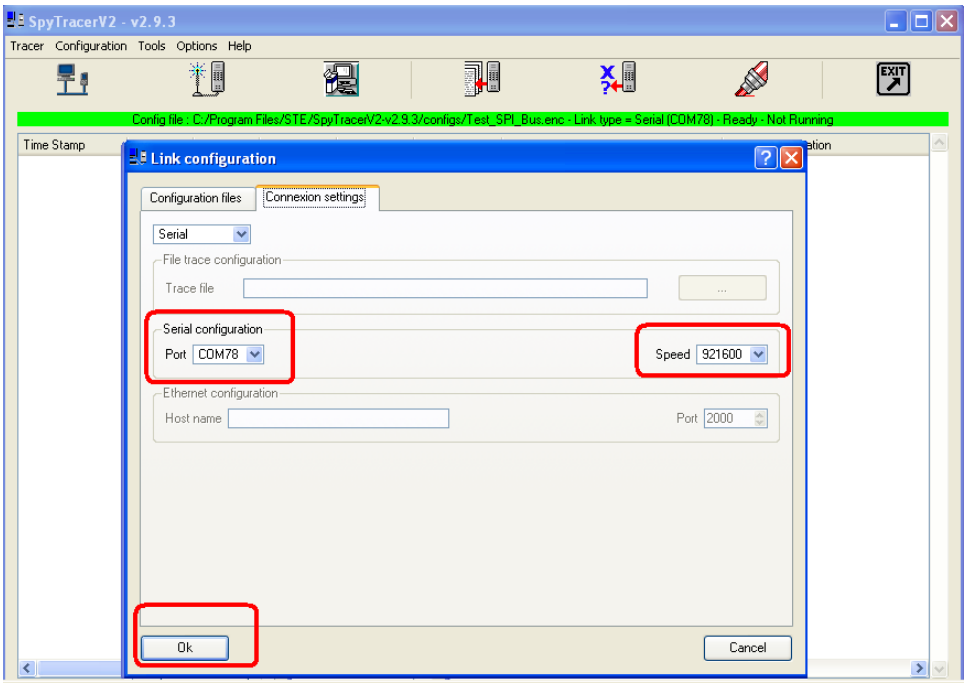
2. Open the SpyTracer tool in the PC.
3. Ensure that the configuration is correct for DEF, STR files and UART_0 port settings. Click **Configuration > Link…**.



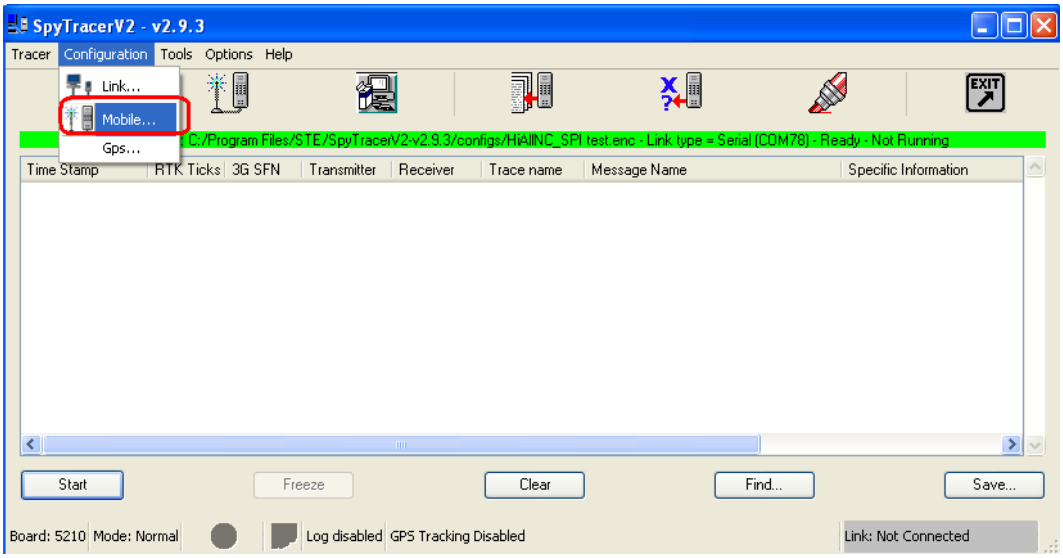
a. Set up DEF and STR file settings as follows.



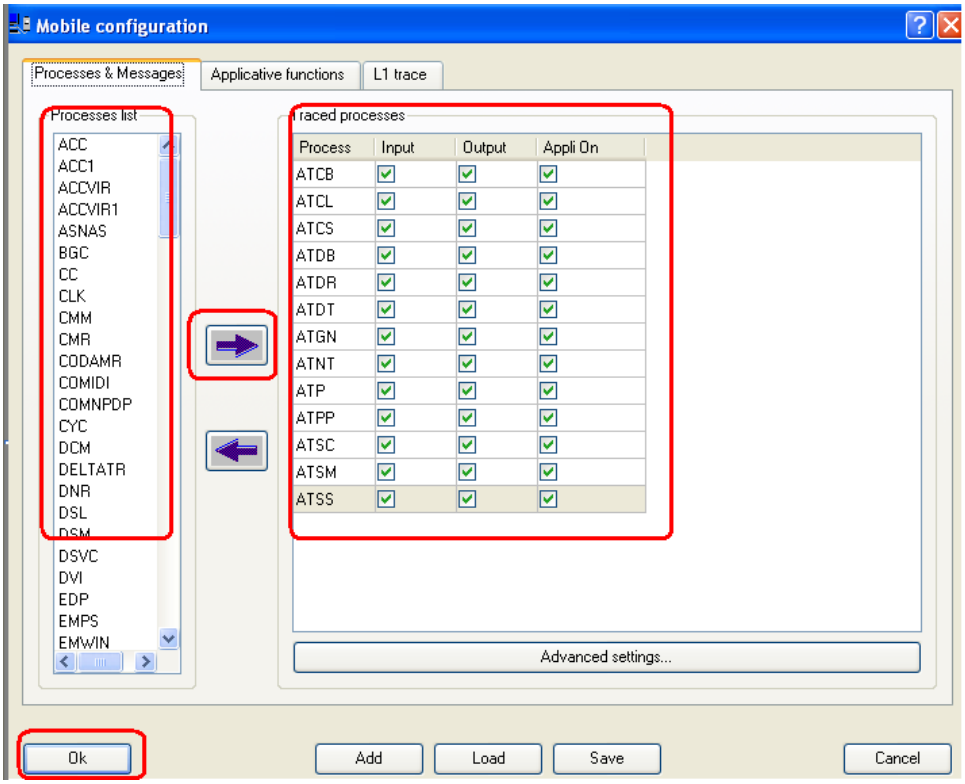
b. Set up UART port settings as follows.



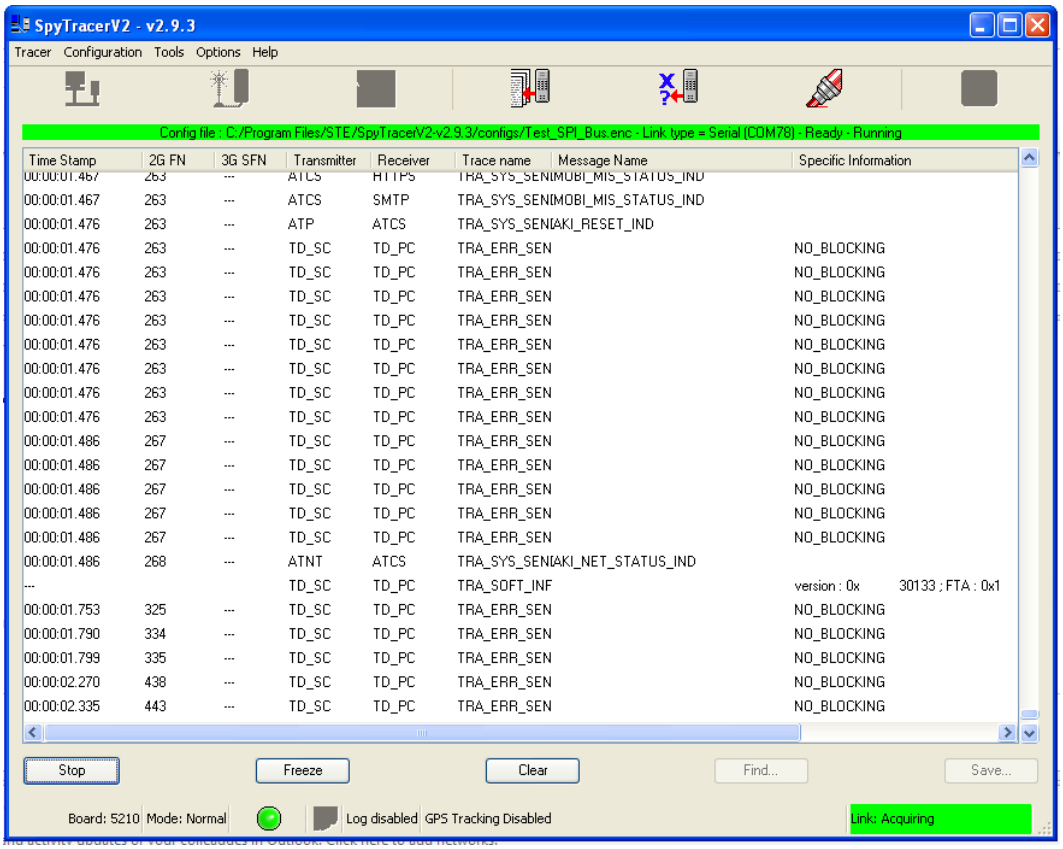
4. Configure mobile settings by clicking **Configuration > Link…**.



a. Set up mobile settings as follows.



5. Click “Start”, then power on the development kit board. The screen should start printing information as shown in the figure below.



6. Reference Documents

[1] AirPrime HL6 and HL8 Series AT Commands Interface Guide
Reference Number: 4114680

[2] AirPrime HL6528x Product Technical Specification
Reference Number: 4114016

[3] AirPrime HL6528x (Automotive) Product Technical Specification
Reference Number: 4116503

[4] AirPrime HL6528RDx Product Technical Specification
Reference Number: 4117701

[5] AirPrime HL7518 Product Technical Specification
Reference Number: 4115834

[6] AirPrime HL7519, HL7548 and HL7588 Product Technical Specification
Reference Number: 4116369

[7] AirPrime HL7528 Product Technical Specification
Reference Number: 4116873

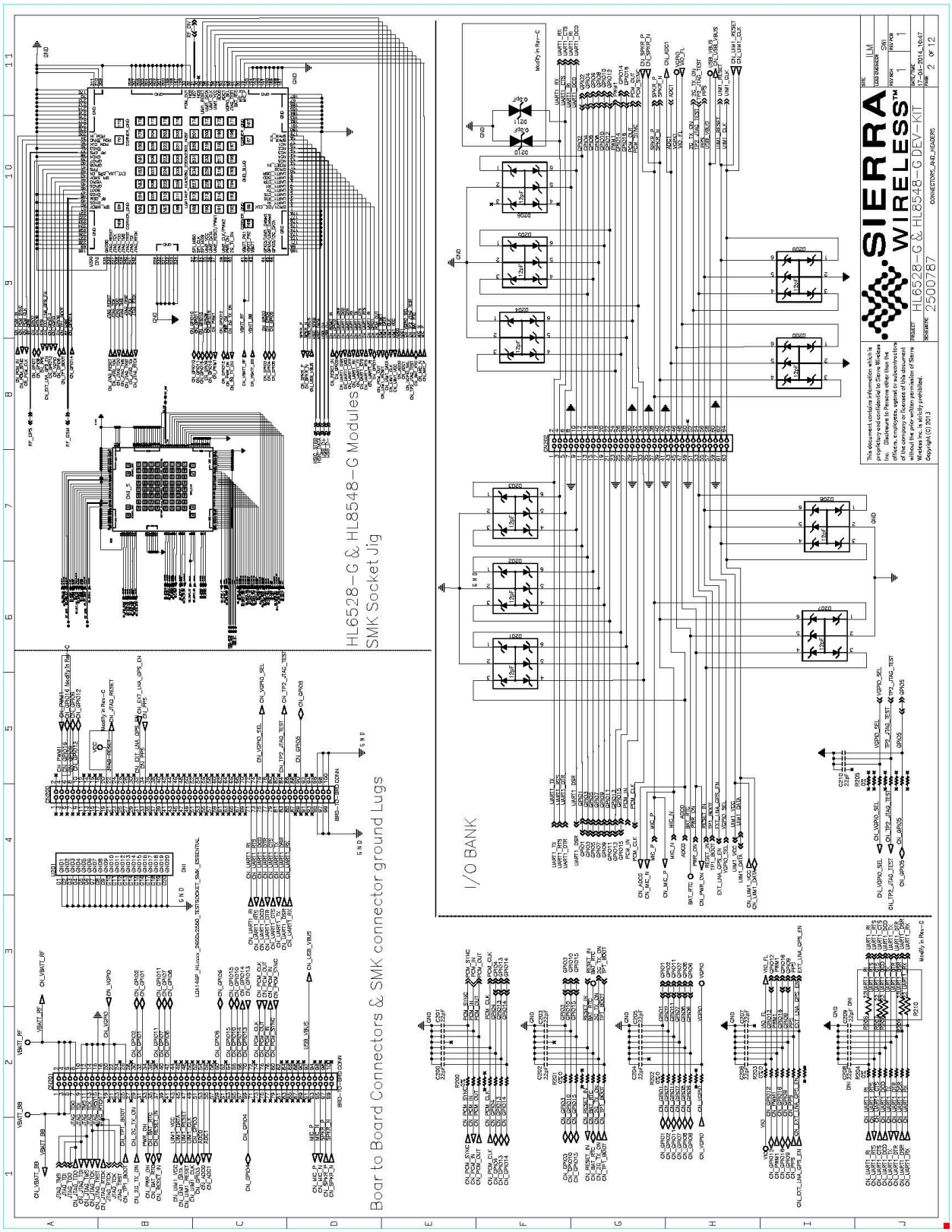
[8] AirPrime HL7549 Product Technical Specification
Reference Number: 4117459

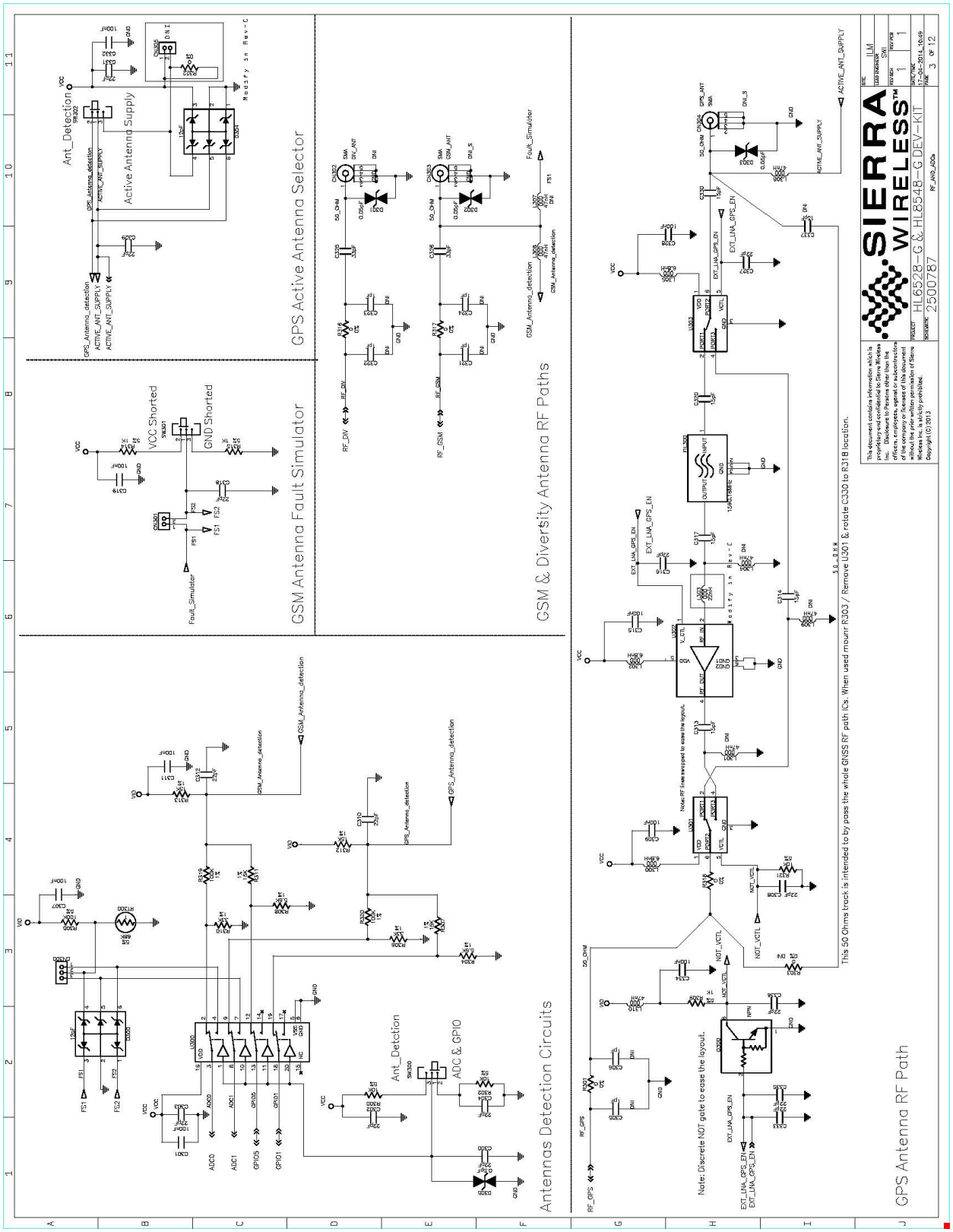
[9] AirPrime HL8518, HL8528, HL8528 Product Technical Specification
Reference Number: 4117047

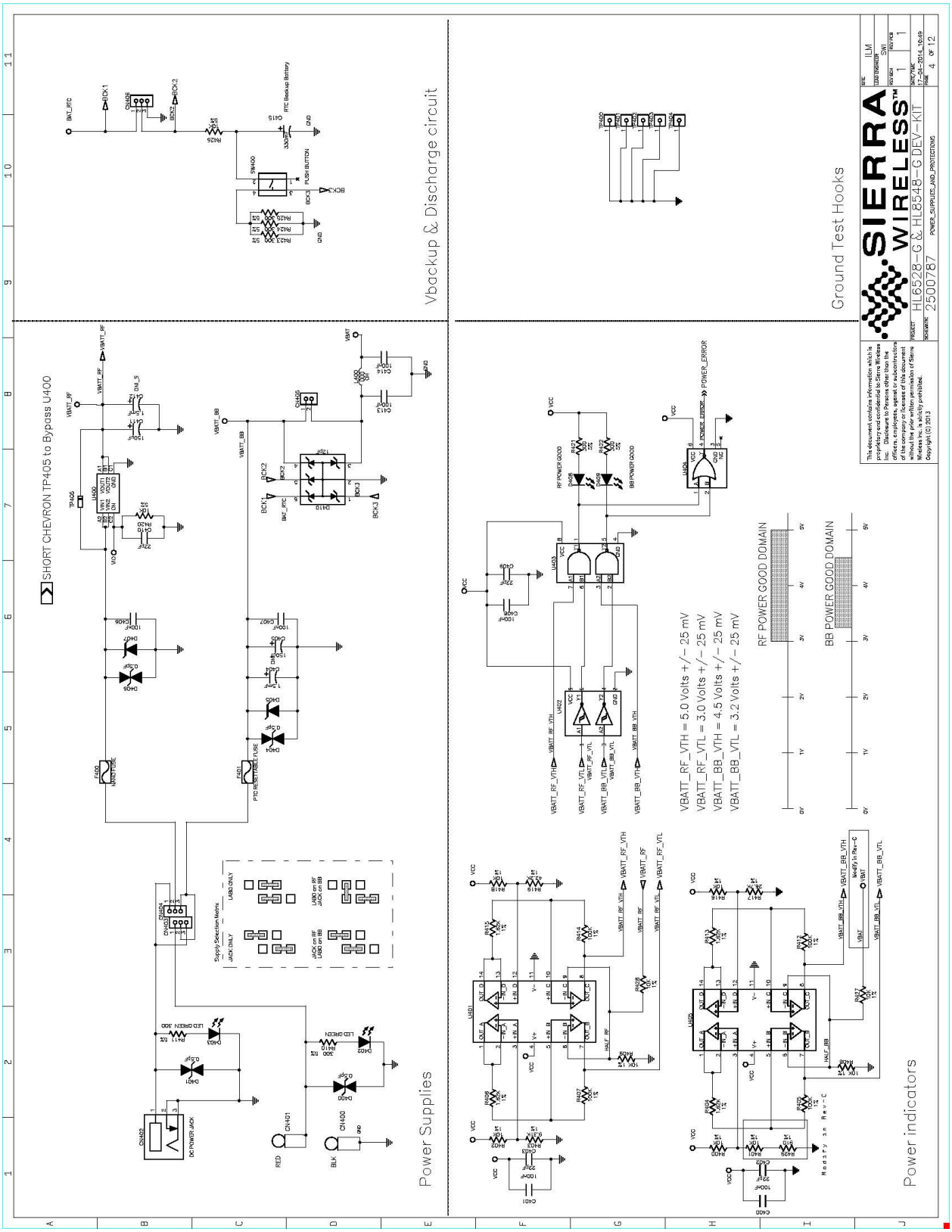
[10] AirPrime HL8548 and HL8548-G Product Technical Specification
Reference Number: 4114663

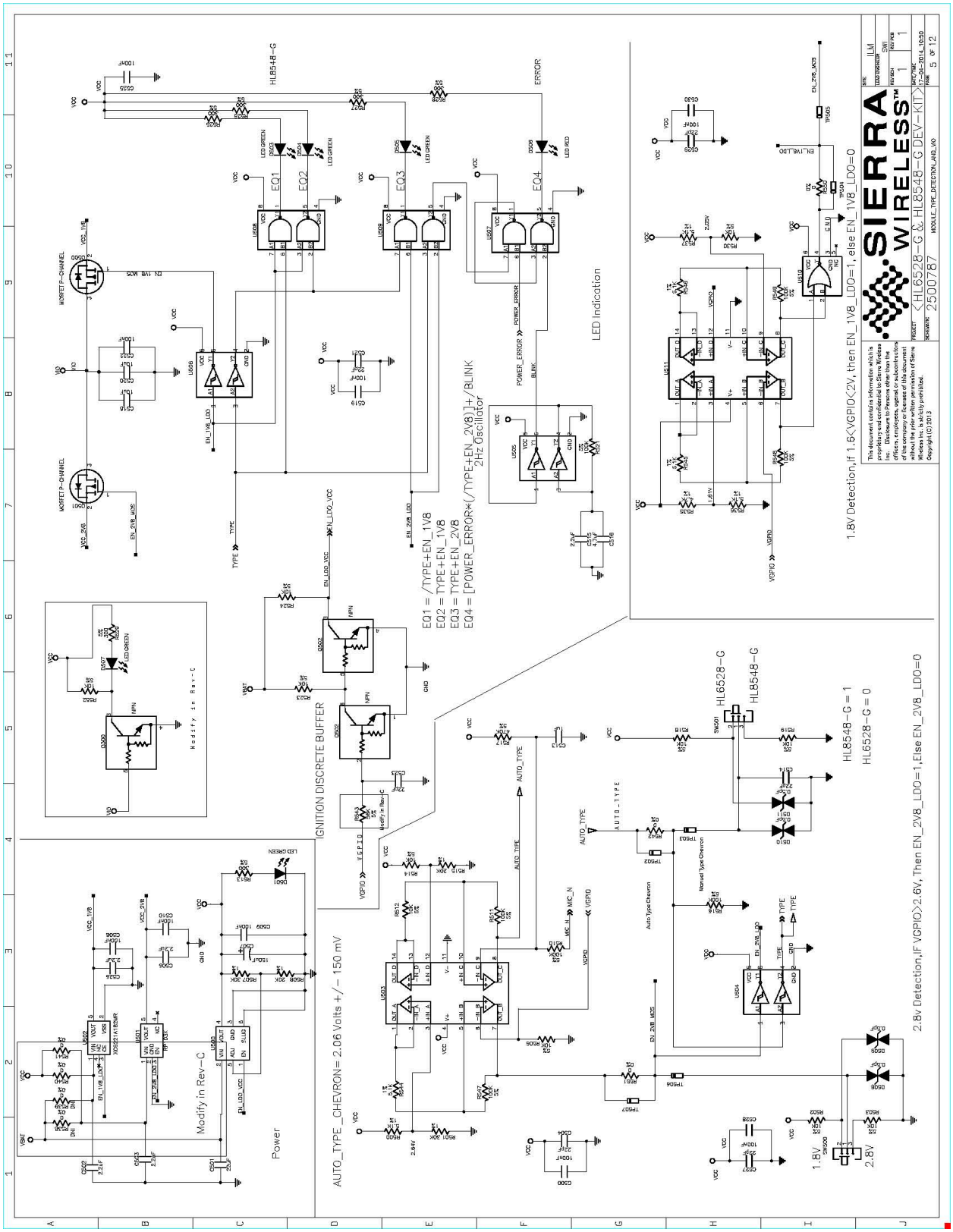
[11] AirPrime HL8549 and HL8549-G Product Technical Specification
Reference Number: 4115653

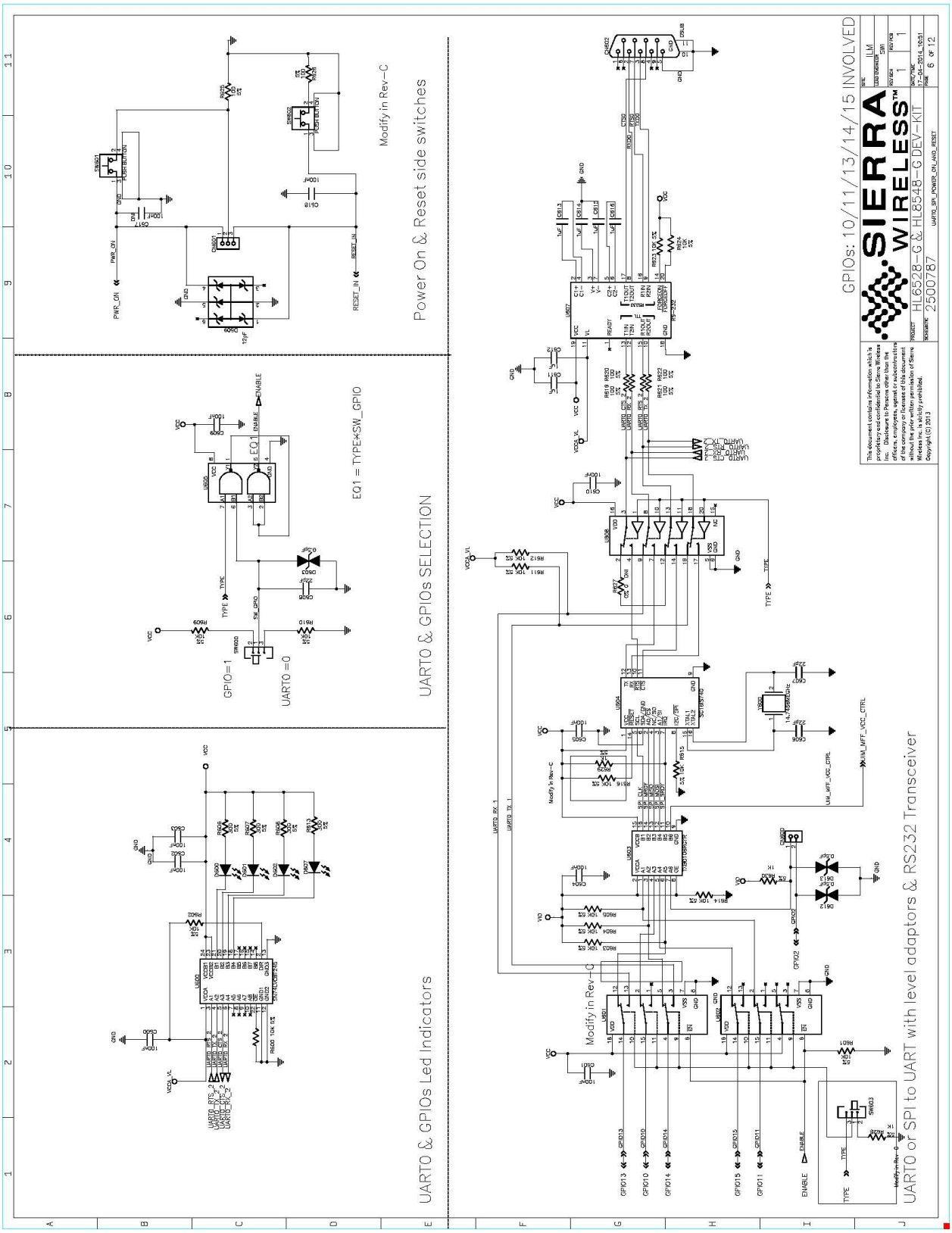
7. Dev-Kit Schematic Diagrams

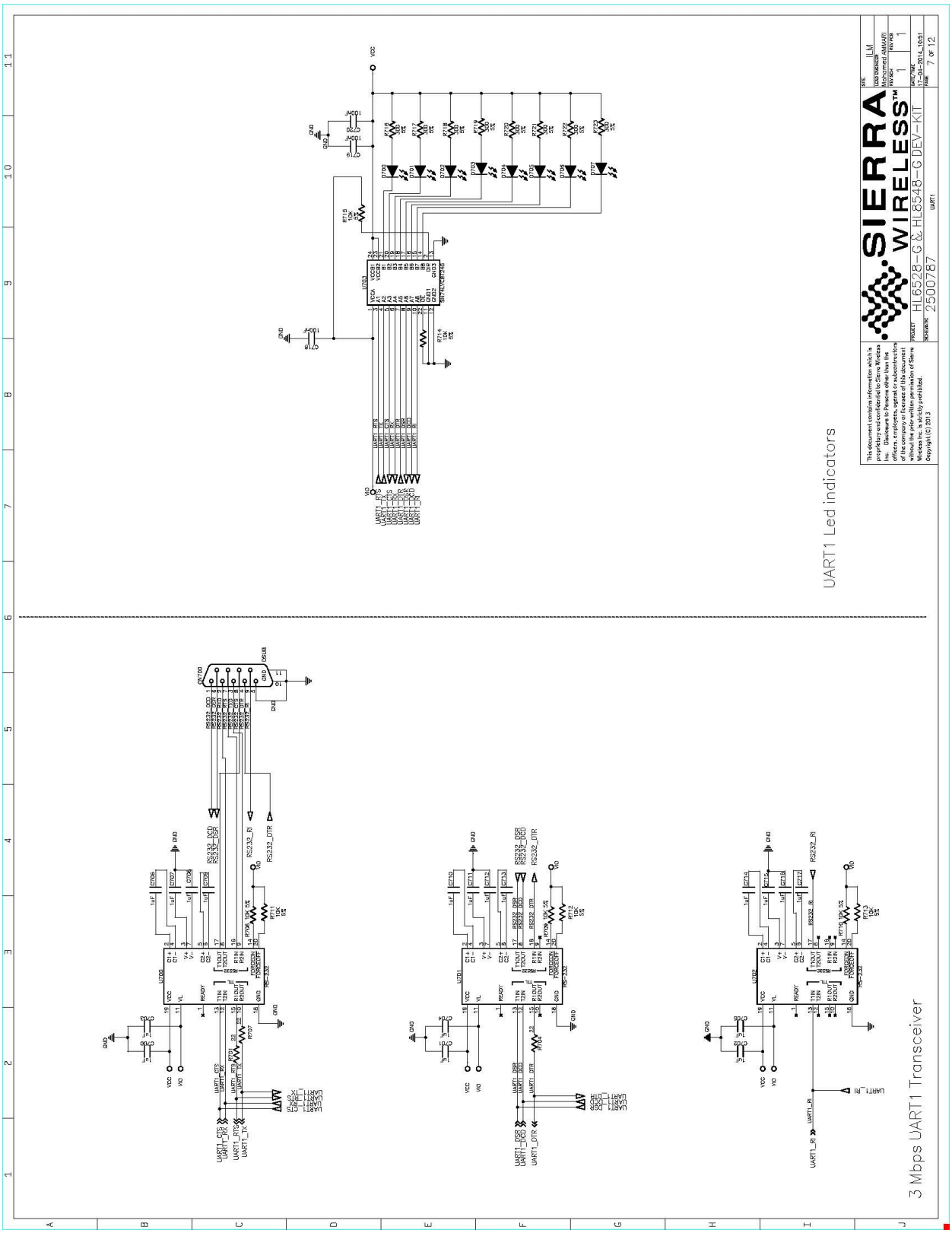


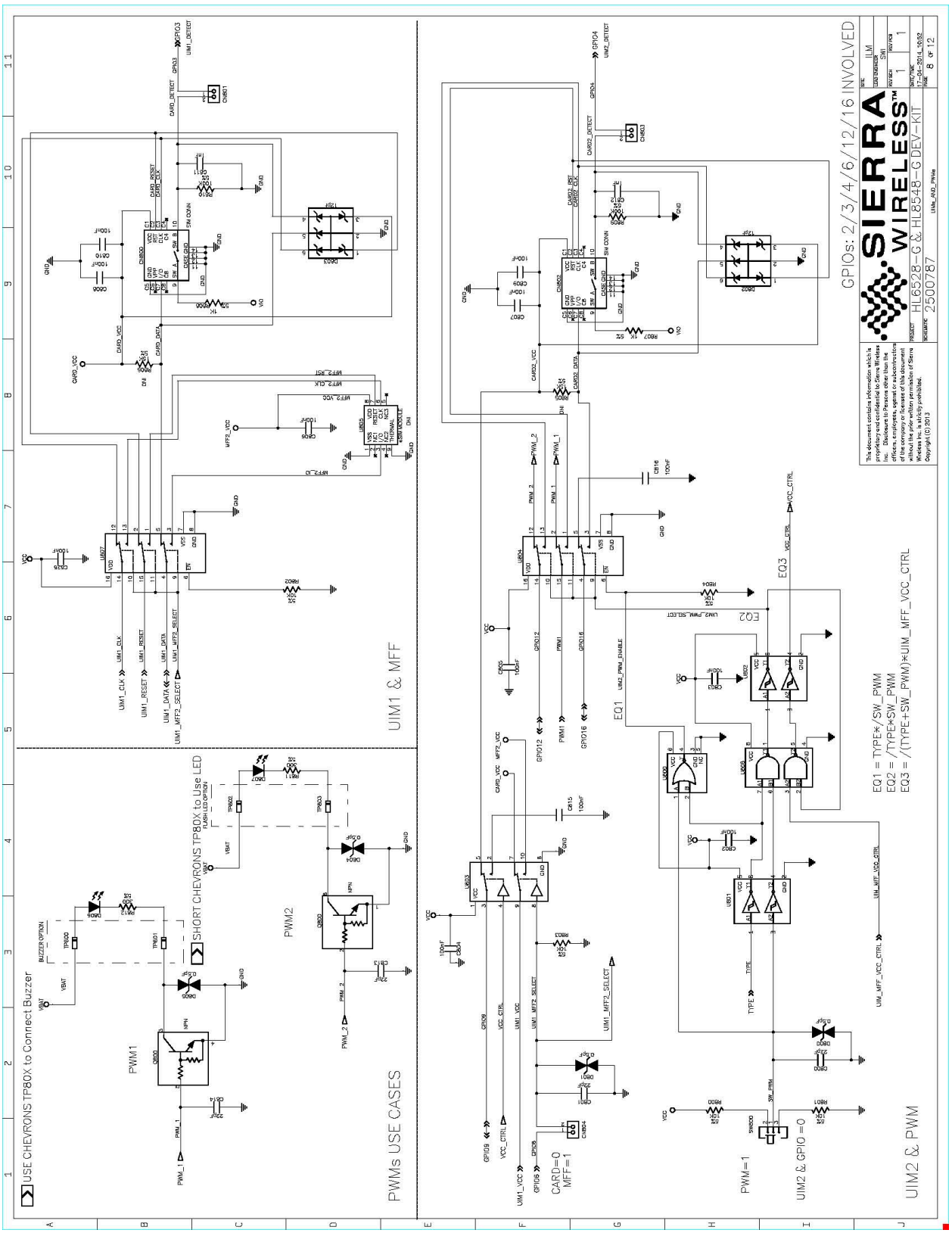

GPS Active Antenna Selector
GSM Antenna Fault Simulator
GSM & Diversity Antenna RF Paths
Antennas Detection Circuits
GPS Antenna RF Path
Active Antenna Supply
Ant_Detection
VCC Shorted
GND Shorted
ADC & GPIO
SIERRA WIRELESS
HL6528-G & HL8548-G DEV-KIT
2500787
This 50 Ohms track is intended to by pass the whole GNSS RF path (Cs, When used mount R303 / Remove L301 & rotate C330 to R318 location.
Note: Discrete NOT gate to ease the layout.

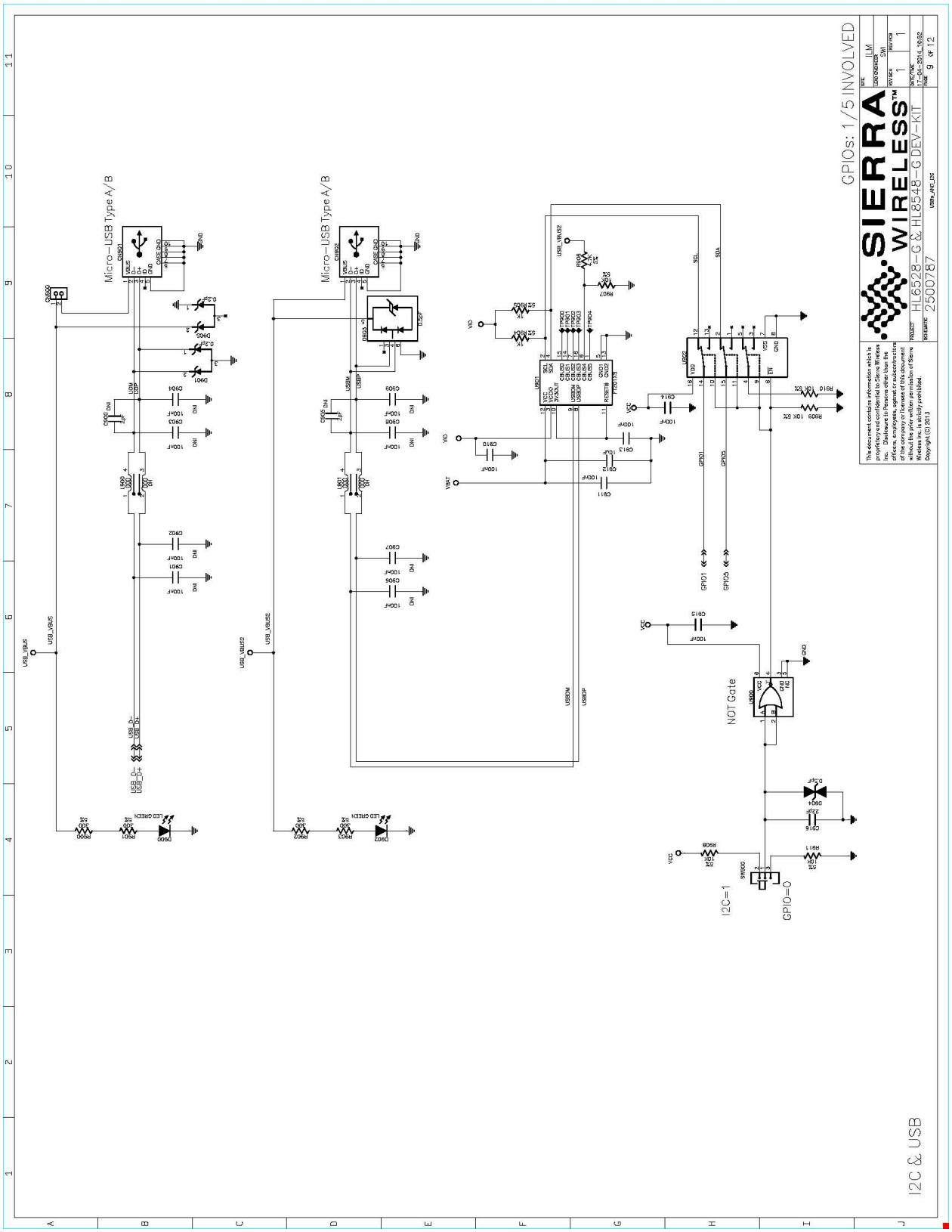

Vbackup & Discharge circuit
Ground Test Hooks
Power Supplies
Power indicators
SHORT CHEVRON TP405 to Bypass U400
VBATT_RF_VTH = 5.0 Volts +/- 25 mV
VBATT_RF_VTL = 3.0 Volts +/- 25 mV
VBATT_BB_VTH = 4.5 Volts +/- 25 mV
VBATT_BB_VTL = 3.2 Volts +/- 25 mV
RF POWER GOOD DOMAIN
BB POWER GOOD DOMAIN
SIERRA WIRELESS
HL6528-G & HL8548-G DEV-KIT
2500787
POWER_SUPPLIES_AND_PROTECTIONS


HL8548-G
ERROR
LED Indication
EQ1 = /TYPE+EN_1V8
EQ2 = TYPE+EN_1V8
EQ3 = TYPE+EN_2V8
EQ4 = [POWER_ERROR*(/TYPE+EN_2V8)]+/BLINK
2Hz Oscillator
1.8V Detection,If 1.6<VGPIO<2V, then EN_1V8_LDO=1, else EN_1V8_LDO=0
IGNITION DISCRETE BUFFER
AUTO_TYPE_CHEVRON= 2.06 Volts +/- 150 mV
Modify in Rev-C
Power
HL6528-G
HL8548-G
HL8548-G = 1
HL6528-G = 0
2.8v Detection,IF VGPIO>2.6V, Then EN_2V8_LDO=1,Else EN_2V8_LDO=0
SIERRA WIRELESS
<HL6528-G & HL8548-G DEV-KIT>
2500787


Power On & Reset side switches
UART0 & GPIOs SELECTION
UART0 & GPIOs Led Indicators
UART0 or SPI to UART with level adaptors & RS232 Transceiver
GPIOs: 10/11/13/14/15 INVOLVED
SIERRA WIRELESS
HL6528-G & HL8548-G DEV-KIT
2500787
EQ1 = TYPE*SW_GPIO
GPIO=1
UART0=0
Modify in Rev-C


UART1 Led indicators
3 Mbps UART1 Transceiver
SIERRA WIRELESS
HL6528-G & HL8548-G DEV-KIT
2500787
UART1


GPIOs: 2/3/4/6/12/16 INVOLVED
SIERRA WIRELESS
HL6528-G & HL8548-G DEV-KIT
2500787
UIM1 & MFF
UIM2 & PWM
PWMs USE CASES
USE CHEVRONS TP80X to Connect Buzzer
SHORT CHEVRONS TP80X to Use LED
EQ1 = TYPE#/SW_PWM
EQ2 = /TYPE*SW_PWM
EQ3 = /(TYPE+SW_PWM)+UIM_MFF_VCC_CTRL
CARD=0
MFF=1
PWM=1
UIM2 & GPIO =0


GPIOs: 1/5 INVOLVED
SIERRA WIRELESS™
HL6528-G & HL8548-G DEV-KIT
2500787
I2C & USB
Micro-USB Type A/B
Micro-USB Type A/B
NOT Gate
I2C=1
GPIO=0
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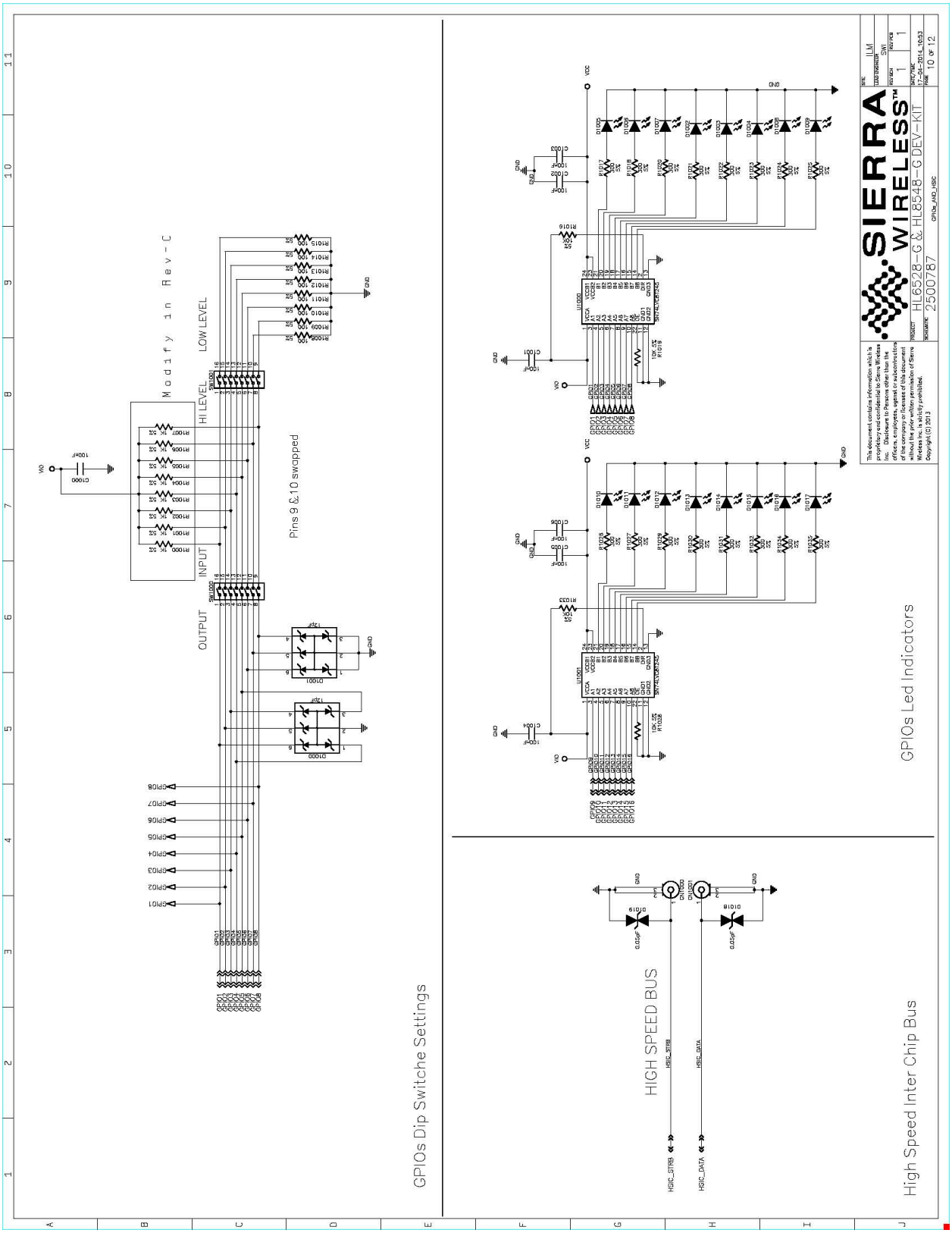
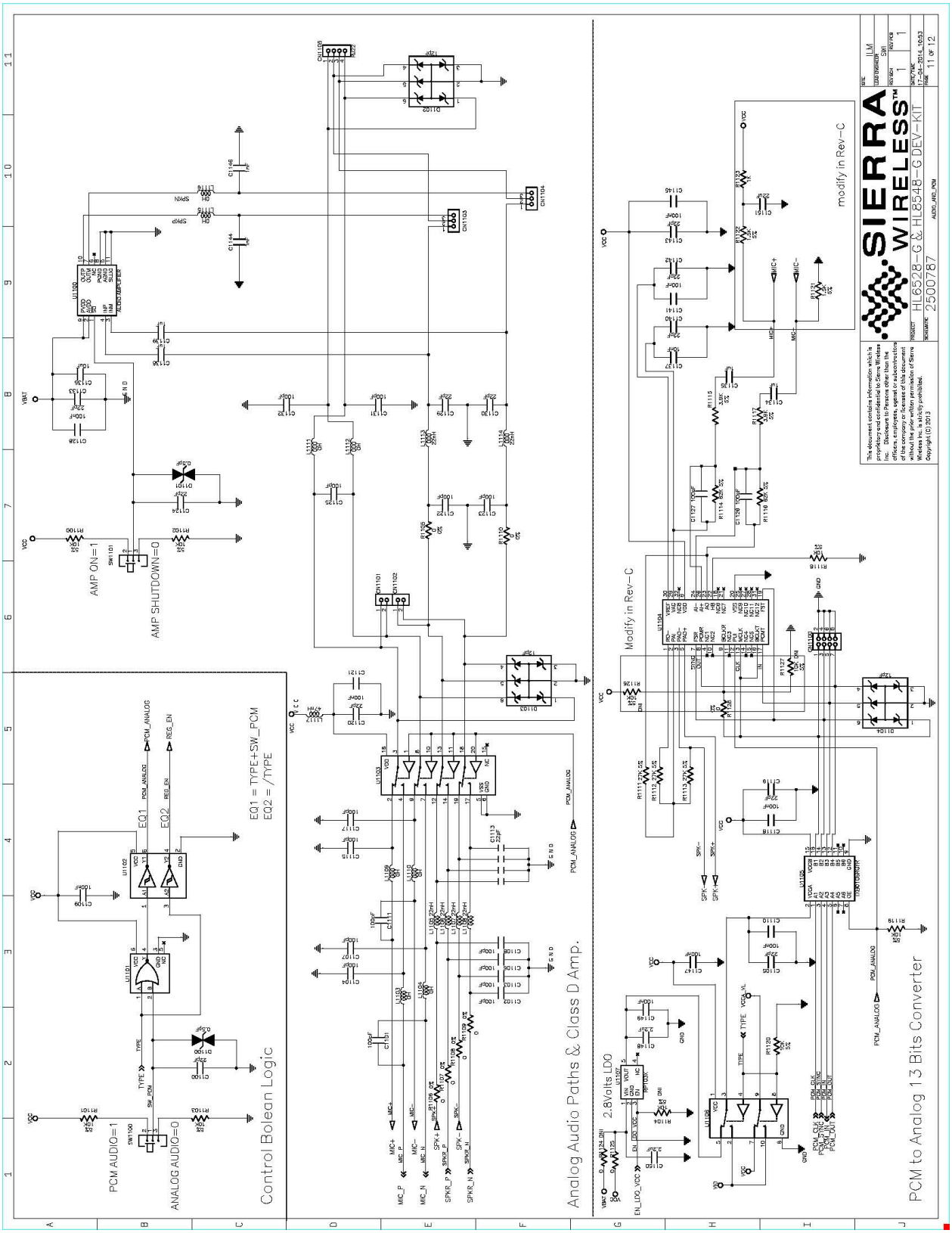
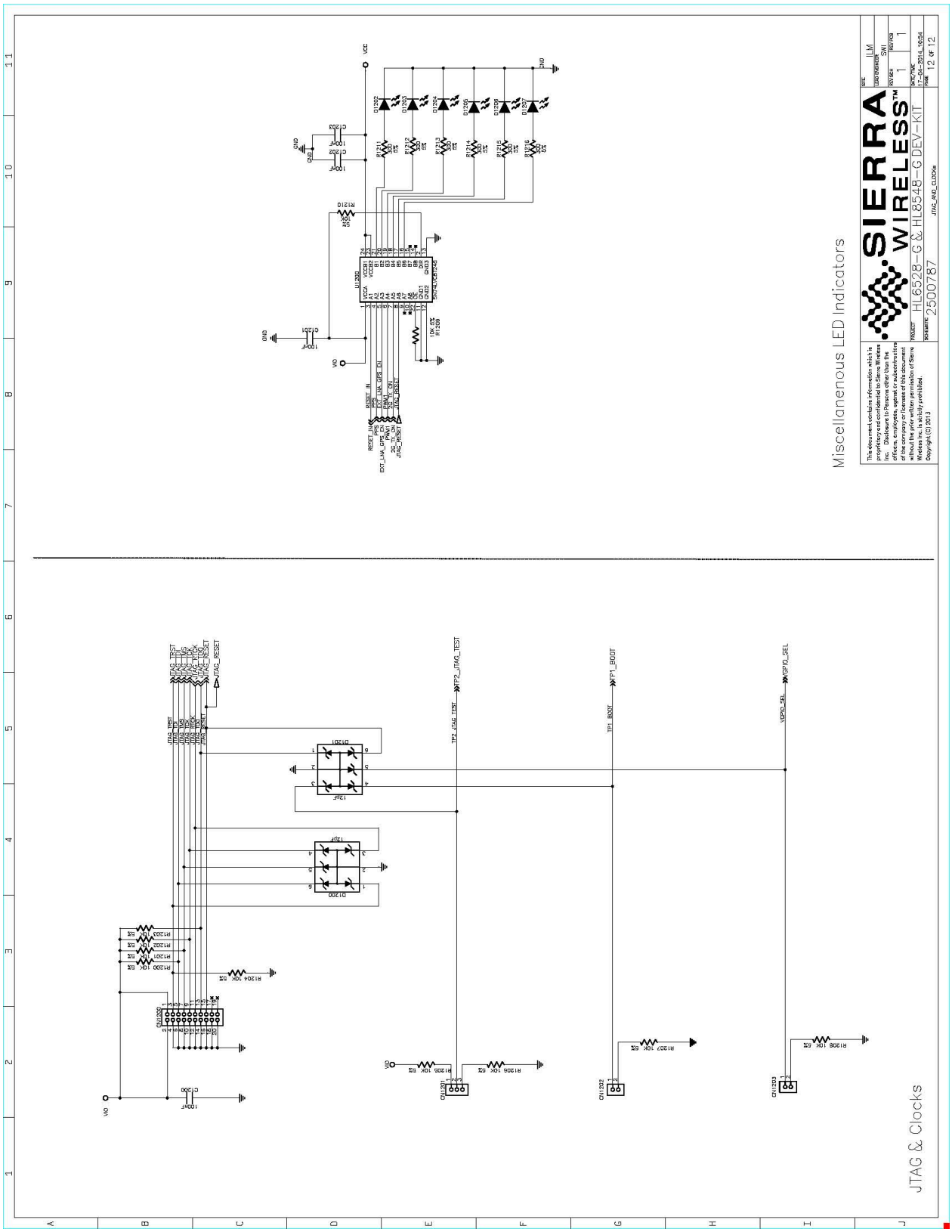

GPIOs Dip Switche Settings
Modify in Rev-C
LOW LEVEL
HI LEVEL
INPUT
OUTPUT
Pins 9 &10 swapped
GPIOs Led Indicators
HIGH SPEED BUS
High Speed Inter Chip Bus
HL6528-G & HL8548-G DEV-KIT
2500787


SIERRA WIRELESS
HL6528-G & HL8548-G DEV-KIT
2500787
AUDIO_AND_PCM
modify in Rev-C
Modify in Rev-C
AMP ON=1
AMP SHUTDOWN=0
PCM AUDIO=1
ANALOG AUDIO=0
EQ1 = TYPE+SW_PCM
EQ2 = /TYPE
Control Bolean Logic
Analog Audio Paths & Class D Amp.
2.8Volts LDO
PCM to Analog 13 Bits Converter


Miscellaneous LED Indicators
JTAG & Clocks
SIERRA WIRELESS
HL6528-G & HL8548-G DEV-KIT
2500787

SIERRA
WIRELESS®