

Features at a Glance

WIDE RANGE OF INTERFACES

Integrated Cortex M4F Microcontroller exposes SPI, QSPI, USART, ADC, I2C, GPIO, and JTAG.

LTE-M / BLUETOOTH 5 - ALL WITH CO-LOCATED RADIO CERTIFICATION

Simplified certification process with reduced costs - multi-wireless integration at its very best for your risk reduction

DEPLOY WITH CONFIDENCE

Wireless security, smart power management, and popular cloud service integration helps your device continue gathering data autonomously.

ZEPHYR RTOS

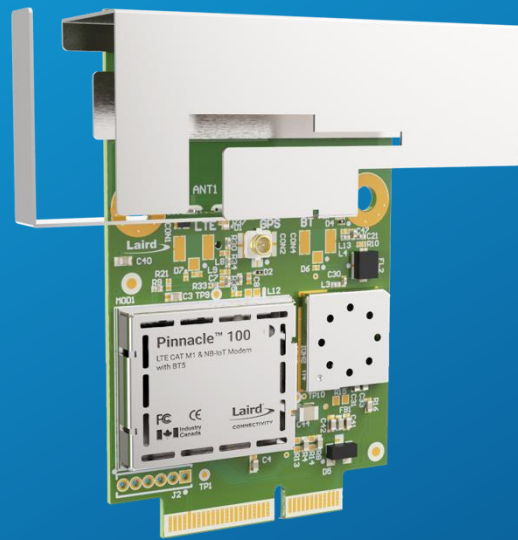
The Zephyr tools suite simplifies complicated configurations, and our DVK environmental sensor and sample test apps get you up and running quickly.

CERTIFIED FOR DEPLOYMENT AROUND THE WORLD

Regulatory approvals for FCC (USA), IC (Canada), ETSI (Europe). Carrier certified for Vodafone, T-Mobile US, AT&T, and Verizon. [all pending].

PERSONAL SUPPORT FOR YOUR IMPLEMENTATION

Free antenna scans, design reviews, on-site EMC support and a global team of FAEs and Tier 2 support help accelerate your product to market.



Pinnacle™ 100 Modem

LTE-M Modem with integrated Bluetooth v5 Cellular End Device certified

- Integrated or external antennas
- Hostless operation – Full flexibility of Zephyr RTOS
- Low power operation – eDRX and PSM
- Powerful MCU on board with integrated Bluetooth v5 including LE long range and Mesh
- Complete radio and cellular certifications
- Wide input voltage range

The Pinnacle™ modem seamlessly incorporates a powerful Cortex M4F controller, full Bluetooth v5 and LTE-M capabilities – all with full regulatory certifications and LTE carrier approvals.

Develop your application directly on the M4F controller using Zephyr RTOS to cut BOM costs and power consumption. Take advantage of the Zephyr community, Laird Connectivity's sample code (cellular, Bluetooth) and hardware interfaces, OR use our hosted mode AT commands set.

This innovative modem family also offers complete antenna flexibility – on-device, off-board, as well as external antennas – to give you design flexibility, reduce complexity, and simplify your overall product solution.

Extremely power conscious, the Pinnacle 100 is ideal for battery-powered devices operating at the edge of your IoT networks, seamlessly bridging the cellular WAN to the Bluetooth PAN. It's never been easier to bridge wireless Bluetooth 5 sensor data to cloud services like AWS IoT over a low-power LTE connection.

- **LTE-M radio via Sierra HL7800**
 - (Altair ALT1250) – LTE bands 1, 2, 3, 4, 5, 8, 12, 13, 20, 28
 - Nordic nRF52840 – BT v5, Coded PHY (Long range), 2MPHY
- **Onboard Cortex-M4F Microcontroller** – 32-bit @64 MHz, 256 KB of RAM, 1 MB internal flash, 8MB QSPI
- **Industrial Temp Range** – Operating range -40° to +85° C
- **Globally & Carrier Certified** – FCC, IC CE, BT SIG plus PTCRB, GCF and **End Device** certified – AT&T, Verizon, Vodafone (all pending)
- **Flexible Programming** – Design your way: Hostless mode via Zephyr RTOS or Hosted mode AT Command Set
- **Secure Firmware Upgrade** – Comes pre-programmed with Laird Connectivity's secure bootloader
- **Antenna Options** – Unique integrated antenna variant plus external variant with U.FL connectors



Security and Building Automation



Wireless Sensor Connectivity



Internet of Things Connectivity



Connected Home



CATEGORY	FEATURE	SPECIFICATION
Chipsets	LTE-M	Sierra HL7800 (Altair Semiconductor ALT1250)
Microcontroller	Bluetooth 5 / MCU	Nordic Semiconductor nRF52840 (Cortex-M4F, 32 bit @ 64 MHz)
	Memory	256 KB RAM 1 MB Internal Flash
	Interfaces	UART
	Additional Features	QSPI, SPI, ADC, I2C, GPIO, Timers
Cellular	Debugging	JTAG, UART
	LTE Category	LTE-M, Release 13 GPP
	Typical transmit power	Up to 23 dBm
	Typical receive sensitivity (LTE-M)	TBC
Bluetooth	Frequency Bands	1, 2, 3, 4, 5, 8, 12, 13, 20, 28
	Standards	Bluetooth v5
	Additional Features	Coded PHY (Long Range), 2MPHY, BLE Mesh
SIM	Class	Class 1 up to +6 dBm max
	Type	4FF Nano SIM card slot Integrated ESIM (future capability)
FW Upgrade	Interface	UART/JTAG
Power Consumption	OTA	Bluetooth and cellular
	Power Save Mode (PSM)	TBC mA
	eDRX	TBC mA
	BLE – TX	TBC mA
Form Factor	System Deep Sleep	TBC mA
	M2 Connector	Double-sided board with M2 style connector interface
Electrical	Operating Voltage	2.2V to 5.5V
Physical	Dimensions	External antenna module: 30.5 x 32 x 4.6 mm Integrated antenna module: 49.2 x 49 x 12.9 mm
	Operating Temperature	-40° to +85° C
Software	Storage Temperature	-40° to +125° C
	Hostless	Zephyr RTOS
Approvals	Hosted	AT Command Set
	Regulatory (pending)	FCC, IC, ETSI, PTCRB / GCF
	Carrier (pending)	Bluetooth SIG
	Environmental	Verizon, AT&T (LTE-M) REACH and RoHS compliant

For full specifications on the Pinnacle 100 modules, please see the appropriate datasheet.

Ordering Information

PART	DESCRIPTION
453-00010	Pinnacle 100 modem, integrated antenna
453-00011	Pinnacle 100 modem, external antenna
453-00010-K1	DVK, Pinnacle 100 modem, integrated antenna
453-00011-K1	DVK, Pinnacle 100 modem, external antenna

Laird Connectivity Certified Antennas

PART NUMBER	TYPE	FREQUENCY	CONNECTOR
EFF6925A3S-15MHF1	Flex PCB	698–875, 1710–1250 MHz	U.FL
DBA6927C1-FSMAM or FSMAF	Dipole	698–2690 MHz	SMA
001-0014	Flex PIFA	2.4–2.5 GHz	U.FL
NanoBlue-MAF94045	PCB Dipole	2.4–2.5 GHz	U.FL
001-0001	Dipole	2.4–2.5 GHz	RPSMA



Pinnacle 100 – Development Kit

With Pinnacle LTE modem, dev board, external BLE environmental sensor board, cables, batteries, antennas, plus SIM card and data, and a complete cloud demo environment build on AWS – start now!

Regulatory Information

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Integration instructions for host product manufacturers

Applicable FCC rules to module

FCC Part 24 / 27; FCC part 15.247

Summarize the specific operational use conditions

The module is must be installed in mobile device.

This device is intended only for OEM integrators under the following conditions:

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- (2) The transmitter module may not be co-located with any other transmitter or antenna

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual

Limited module procedures

Not applicable

Trace antenna designs

Not applicable

RF exposure considerations

20 cm separation distance and co-located issue shall be met as mentioned in "Summarize the specific operational use conditions".

Product manufacturer shall provide below text in end-product manual

"This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body."

Antennas

Brand	Model	Type	Gain	Connector	Remarks
Laird Connectivity	001-0001	Dipole	2	RP-SMA Female	For BT
Laird Connectivity	NanoBlue-IP04 (MAF94045)	PCB Dipole	2	IPEX U.FL	For BT
Laird Connectivity	001-0014	Flex PIFA	2	IPEX U.FL	For BT
Laird Connectivity	DBA6927C1	Dipole	2.2 @1710~1910 MHz 0.5 @699~787 MHz	U.FL	For LTE
Laird Connectivity	EFF6925A3S	Flex	3.7 @1710~1910 MHz 1.9 @699~787 MHz	U.FL	For LTE

Brand	Model	Type	Gain	Connector	Remarks
ASC	RFDPA131000SMTB803	Dipole	1.5 @1850~1910 MHz 3.04@1710~1755 MHz 0.38@824~849 MHz -0.22@699~717 MHz 1@777~787 MHz	U.FL	For LTE
Laird Connectivity	110-00665	Stamped Metal	2.6 @1710~1910 MHz 0.9 @699~787 MHz 2.6 @2400~2480 MHz	NA	For LTE and BT

Label and Compliance Information

Product manufacturers need to provide a physical or e-label stating

"Contains FCC ID: SQG-PINNACLE1" with finished product

Information on Test Modes and Additional Testing Requirements

LTE: Simulator is required to link up and set the module to transmit at specific frequency, output power level under operation mode.

BT: Test tool is UwTermia, ver: 7.94

Additional Testing, Part 15 Subpart B Disclaimer

The module is only FCC authorized for the specific rule parts listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Industry Canada Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference
- (2) This device must accept any interference, including interference that may cause undesired operation of the device

Cet appareil contient des émetteurs / récepteurs exempts de licence qui sont conformes au (x) RSS (s) exemptés de licence d'Innovation, Sciences et Développement économique Canada. L'opération est soumise aux deux conditions suivantes:

- (1) Cet appareil ne doit pas causer d'interférences
- (2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant provoquer un fonctionnement indésirable de l'appareil

Radiation Exposure Statement:

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.

This device is intended only for OEM integrators under the following conditions:

- 1) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 1 condition above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes:

- 1) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

The final end product must be labeled in a visible area with the following: "Contains IC:3147A-PINNACLE1".

Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 3147A-PINNACLE1".

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

This radio transmitter (IC: 3147A-PINNACLE1) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 3147A-PINNACLE1) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Brand	Model	Type	Gain	Connector	Remark
Laird Connectivity	001-0001	Dipole	2	RP-SMA Female	For BT
Laird Connectivity	NanoBlue-IP04 (MAF94045)	PCB Dipole	2	IPEX U.FL	For BT
Laird Connectivity	001-0014	Flex PIFA	2	IPEX U.FL	For BT
Laird Connectivity	DBA6927C1	Dipole	2.2 @1710~1910 MHz 0.5 @699~787 MHz	U.FL	For LTE
Laird Connectivity	EFF6925A3S	Flex	3.7 @1710~1910 MHz 1.9 @699~787 MHz	U.FL	For LTE
ASC	RFDPA131000SMTB803	Dipole	1.5 @1850~1910 MHz 3.04@1710~1755 MHz 0.38@824~849 MHz -0.22@699~717 MHz 1@777~787 MHz	U.FL	For LTE
Laird Connectivity	110-00665	Stamped Metal	2.6 @1710~1910 MHz 0.9 @699~787 MHz 2.6 @2400~2480 MHz	NA	For LTE & BT

Europe – EU Declaration of Conformity

This device complies with the essential requirements of the Radio Equipment directive: 2014 / 53 / EU. The following test methods have been applied in order to prove presumption of conformity with the essential requirements of the Radio Equipment directive: **2014 / 53 / EU**:

EN 300 330 V2.1.1

EN 300 328 V2.2.2

EN 301 908-1 V11.1.1

EN 301 908-13 V11.1.2

EN 62311:2008; EN 50385:2017; EN 50665: 2017

Draft EN 301 489-1 V2.2.3

Final draft EN 301 489-3 V2.1.1

Draft EN 301 489-17 V3.2.2

Draft EN 301 489-52 V1.1.0

EN 62368-1

Max. power information:

Frequency	Max. EIRP power (dBm)
BT LE	2402~2480 MHz
	10

	LTE Band	Max. conducted power (dBm)
Cat-M1	LTE B1	22
	LTE B3	23
	LTE B8	22.5
	LTE B20	23
	LTE B28	23.5
NB-IoT	LTE B1	22
	LTE B3	23
	LTE B8	22.5
	LTE B20	23
	LTE B28	23

SW version: BHL78xx.3.7.2.3

The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20 centimeters.