Product Development

LAIRD

ADL Radio Module Manual

Document p/n: 9S02-7897-A001 Rev.A1

Revision History

Date	Revision	Description	Signature / Date	
2010-10-06	EM1	Initial draft	Prepared	Pierre Montreuil
			Verified	
			Approved	
2010-10-06	EM2	General revision. Removed LQI measurement Updated the configuration section (section 5)	Prepared	Pierre Montreuil
			Verified	
			Approved	
2012-01-30	A	Fig 4.8 and 4.9 - Remove remaining references to LQI from drawings. Table 4.2 – Rename ESC_END for ESC_SOF [LaB] Added demodulated analog output on pin 48 and GND on pin 50	Prepared	Pierre Montreuil
			Verified	
			Approved	
2017-07	A1	Final	Prepared	H. Lin
			Verified	
			Approved	

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78970 TRX module meets Part 90 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices is required. In order to comply with FCC Certification requirements, the Original Equipment Manufacturer (OEM) must fulfill the following requirements.

1. The system integrator must place an exterior label on the outside of the final product housing the 78970TRX Module. The figure below shows the contents that must be included in this label.
2. 78970 TRX modules may only be used with the antennas that have been tested and approved for use with the module.

Labeling Requirements

The OEM must make sure that FCC labeling requirements are met. This includes a clearly visible exterior label on the outside of the final product housing that displays the contents shown in below.
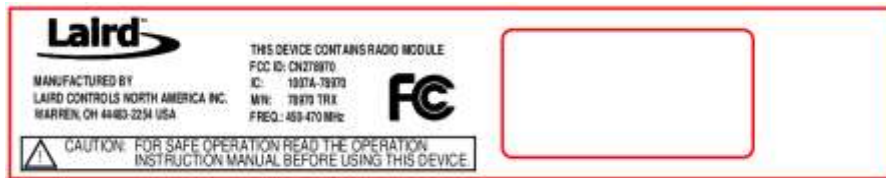
WARNING: The 78970 TRX modules have been tested by the FCC for use with other products without further certification (as per FCC Section 2.1091). Changes or modifications to this device not expressly approved by Cattron-Theimeg could void the user's authority to operate the equipment.

NOTICE: OEM's must verify the final end product complies with unintentional radiators (FCC Section 15.107 and 15.109) before providing a declaration of conformity for their final product to Part 15 of the FCC Rules.

NOTICE: OEM's must verify the separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.

NOTICE: The 78970 TRX modules have been certified for mobile and fixed radio applications. If the module will be used for portable applications, the device must undergo SAR testing.

RF Exposure WARNING: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTICE: The preceding statement must be included as a CAUTION statement in OEM product manuals in order to alert users of FCC RF Exposure compliance.

78970 TRX is designed for use in countless wireless applications requiring long range communications with low energy consumption. To ensure that the final product complies with the all of the regulatory requirements for the Modular Grant the following integration instructions should be followed. 78970 TRX is limited to OEM installation ONLY. The OEM integrator is responsible for ensuring that the end-user has no manual instructions to remove or install the module.

FCC Part 15.105(b) Warning Statement
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: - Reorient or relocate the receiving antenna.   - Increase the separation between the equipment and receiver.   -Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.   -Consult the dealer or an experienced radio/TV technician for help.
IC RSS-GEN, Sec 7.1.2 Warning Statement- (Required for Transmitters)
ENGLISH: Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.
FRENCH: Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.
IC RSS-GEN, Sec 7.1.2 Warning Statement- (Required for Transmitters w/ detachable antennas)
ENGLISH: This radio transmitter (IC: 1007A-78970,Model Number: 78970TRX) has been approved by Industry Canada to operate with the antenna types listed   below with the maximum permissible gain and required antenna impedance for each antenna type 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.
FRENCH: Le présent émetteur radio (IC:1007A-78970, Numéro de modèle: 78970TRX) a été approuvé par Industrie Canada pour fonctionner avec les types d'antennes énumérés ci-dessous ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antennes non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.
IC RSS-102, Sec 2.6 Warning Statements
ENGLISH: The applicant is responsible for providing proper instructions to the user of the radio device,

and any usage restrictions, including limits of exposure durations. The user manual shall provide installation and operation instructions, as well as any special usage conditions, to ensure compliance with SAR and/or RF field strength limits. For instance, compliance distance shall be clearly stated in the user manual.

FRENCH:
Le requérant est responsable de fournir les instructions adéquates pour l'usage de l'équipement radio, ainsi que toutes les limitations, incluant les durées maximales d'exposition. Le manuel utilisateur doit fournir les instructions d'installation et d'opération, ainsi que toutes les conditions d'utilisation particulières, pour assurer la conformité avec les limites d'exposition aux champs électromagnétiques radiofréquences et/ou SAR.

Only the antenna gain less than 2.15dBi may be used with the equipment.

Only the following authorized antennas may be used with the equipment:

Splatch patch antenna , 50Ohm, Gain:-3dBi

¼ wave whip antenna, 50Ohm, Gain:-0dBi

½ wave dipole PCB antenna, 50Ohm, Gain: 2.15dBi

PCB loop antenna, 50Ohm,-2dBi

PCB wire antenna, 50Ohm, Gain -5dBi

1. Introduction

1.1 Purpose

A new family of RF module is being developed by Cattron. This family includes high-selectivity radios covering several RF bands used world-wide for remote control applications. They are built around a common architecture, and present a uniform host interface definition. The host interface is used for data communication and radio configuration.

1.2 Scope

This document describes the host interface signal definitions, timings, operation mode, available functionalities, and provide details about its integration to Unity products. This document does not cover RF specifications or power supply specifications.

1.3 Applicability

Applies to ADL family members, P/N 2PCA-7897-xxxx

1.4 Definitions, Acronyms

1.4.1 Definitions

1.4.2 Acronyms

2. Features Summary

The ADL design addresses in first place Unity applications requirements. Its interface however is general enough to allow compatibility to other legacy Cattron products.

- Direct electrical compatibility to Unity RF interface – The interface is defined for natural integration to Unity product line.

- Data interface - support for synchronous and asynchronous serial link.

- Stand-alone operation for production test – The ADL can interface almost directly to a PC serial port for testing (no need for CPU board); only a TTL/RS232 translator is required.

These different aspects are covered in the rest of this document.
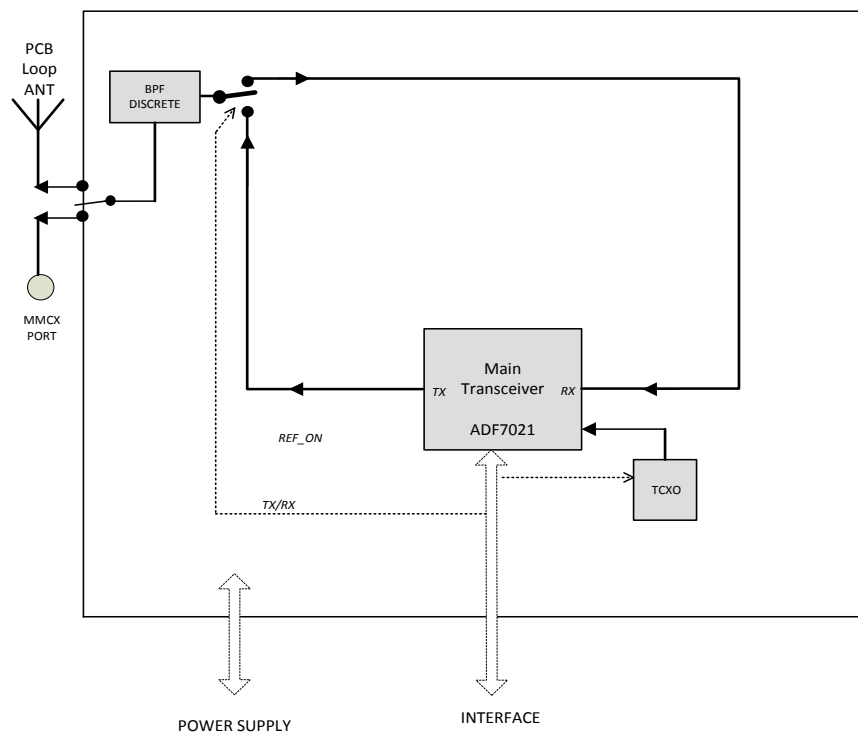
Figure 2.1 - ADL Module Block Diagram

- The TCXO provides the reference frequency to transceiver chip

- When the module is in RX mode, the RF switch is set to RX enable. The RF signal is sent to transceiver chip via a bandpass filter. The transceiver chip will decode the rf signal to digital signal and pass to the control interface

- When the module is in TX mode, the digital signal will be send to transceiver chip. After the RF signal will be delivered through RF switch and radiated via either MMCX RF port or embedded PCB loop antenna

3. Host Interface Definition

3.1 Pins Assignment

Description	IO	Signal	Pin Number		Signal	IO	Description
			49	50	GND		*Ground*
			47	48			
			45	46			
			43	44			
			41	42			
I2C clock / SPI clock	IO / O	I2C_SCL / SPI_SCK	39	40			
			37	38	I2C_SDA / SPI_PDO	IO / O	*I2C Data / SPI data output*
			35	36			
	O	RXD	33	34	LOCK/MUXOUT		
		PDI	31	32	PDO		
			29	30			
3.3V DC supply	I	3V3	27	28	4V5	O	*monitor*
Receive data	O	RXD	25	26	TXD	I	*Transmit Data*
RX Enable	I	!RX_EN	23	24	CS2	I	*SLE*
Chip Enable	I	CS1	21	22	GND		*Ground*
			19	20	DCLK	O	*Data Clock*
			17	18			
			15	16			
			13	14			
			11	12			
			9	10			
			7	8			
			5	6			
			3	4			
			1	2			

Table 3.1 – Host Interface pins assignment

3.2   Signals Description

Pin Nb	Signal Name	I/O	Description	Category
22, 50	GND		System ground	Power supply
27	3V3	Input	3.3 V power supply voltage input (Vcc)	Power supply
23	!RX_EN	Input	Receive Enable (active low). Used to place the RF module in received mode	Data Transmission
			*Note: when !TX_EN and !RX_EN are asserted simultaneously, the module is placed in STANDBY mode (low power consumption, internal registers conservation)	
24	SLE	Input	Transmit Enable (active low). Used to activate telegram transmit process	Data Transmission
25	RXD	Output	Receive Data.	Data Transmission
26	TXD	Input	Transmit Data	Data Transmission
20	DCLK	Output	Data Clock. Active when serial port is configured in Synchronous Mode	Data Transmission
21	CS1	Input	Used to configure the Data transmission signals RXD and TXD for module configuration. Asserting can be done in IDLE state only. Active low	Configuration interface
38	I2C_SDA SPI_PDO	Bidi / Output	If configuration interface configured for: I2C: I2C SDA signal (data) SPI: PDO (Peripheral Data Out)	Configuration interface
39	I2C_SCL SPI_SCLK	Bidi / Input	If configuration interface configured for: I2C: I2C SCL signal (clock) SPI: SCLK (Serial Clock)	Configuration interface

Table 3.2 - Host Interface signals description

4.   ADL Configuration Concept

All LRM configuration and status parameters are accessible through addressable registers.

- All parameters can be read in any of the following state: IDLE, RX, TX

- All writable parameters can be written in the following state: IDLE only

In order to facilitate adaptation to different platforms, the ADL configuration registers can be accessed using anyone of three methods: I2C, SPI or serial asynchronous with ASCII strings.

The definition of the configuration registers is given in reference [3]. This section addresses the basic description of all these three methods.

4.1   Stand-Alone Test Mode

The LRM can be operated in stand-alone mode for production/service tests. In this case, only a 3.3VDC supply is needed, and a RS232/TTL transceiver (like Cattron FLASHBOX) to connect to a PC serial port.
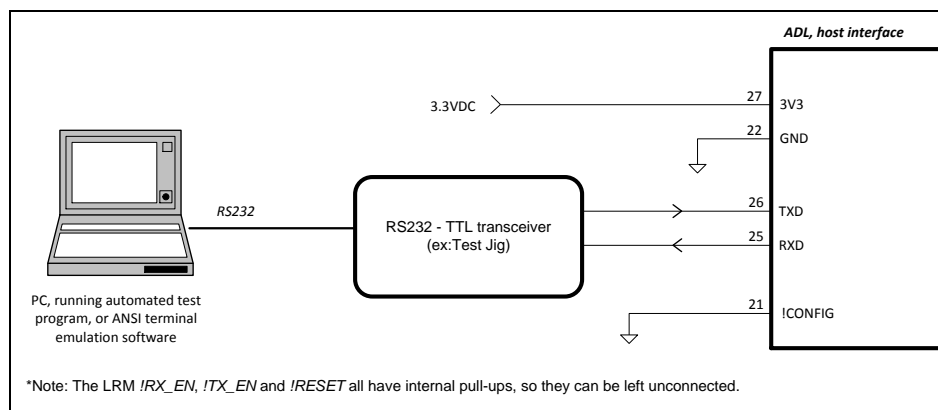

Figure 4.1 - ADL connection for stand-alone operation

The LRM will support several built-in test modes to ease testing from a PC. For example
a. Transmission Tests
- Generation of different type of carrier: unmodulated (CW), or modulated with "101010.." or pseudo-random sequence
- Automatic generation of test RF frames with predefined content
b. Reception Tests
- Measure PER (packet error rate) when receiving the predefined test RF frames
- Measure RF input level

More details about the test modes can be found in reference [9P13-7949-A001].

5.   Test-Specific Parameters

Parameter	Min	Typ.	Max	Unit	
TEMPERATURE RANGE	-40		+70	C	
POWER SUPPLIES Vdd	2.9		3.5	V	
TRANSMIT CURRENT		35		mA	at 11dBm
RECEIVE CURRENT		25		mA	
Sensitivity (2FSK, DR = 4.8 kbps, Dev=2.4KHz)		-115		dBm	
frequency range	450		470	MHz	
Channel spacing		12.5		KHz	
RX Saturation	0			dBm	
TX conducted power	0		11	dBm	
TX occupied bandwidth @99%		8.5		KHz	
Size		2.10x1.45x0.35		In.	
Weight	0.4			oz	