



# DLP-RFS1280

## 2.4GHz DATA RADIO

**\*\* PRELIMINARY DOCUMENT-SUBJECT TO CHANGE \*\***

### **FEATURES:**

- 2.40GHz-2.48GHz Operation
- +11.5dBm Output Power
- 4+ Mile Range (Line of Sight)
- U.FL Antenna Connector for External Antenna
- LORA, GFSK and FLRC Modulation Modes
- On-Board Chip Antenna
- FCC/IC/RED Modular Approvals in Place
- Single 3.3-Volt Power Supply
- Development Kit Available
- Demonstration Source Code Available for Use with the NUCLEO-L073RZ microcontroller development board (purchased separately)

### **APPLICATION AREAS:**

- Real-Time Security
- Body-Worn Medical Telemetry
- Battery-Powered Home Automation
- Electric/Water/Gas Automated Meter Reading
- Industrial Monitoring and Control
- Active RFID
- Long Range, Battery-Powered, Multi-Hop Sensor Networks

## 1.0 INTRODUCTION

The DLP-RFS1280 is a low-cost module for transmitting and receiving digital data via radio frequency. All of the DLP-RFS1280's electronics (including an antenna) reside on a single PCB, and all operational power is derived from a single supply voltage.

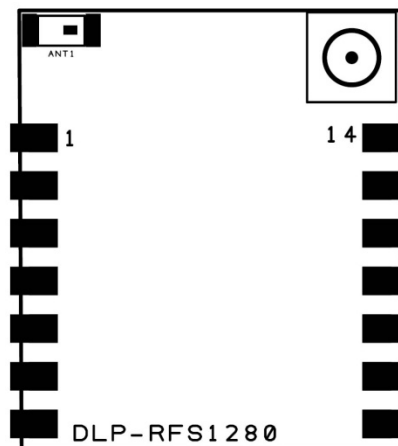
The transceiver design consists of a Semtech SX1280 low-power, integrated UHF transceiver and an antenna switch for selecting between the on-board chip antenna and an optional external antenna. The hardware is designed for maximum range and optimal battery life.

## 2.0 ELECTRICAL SPECIFICATIONS

Supply Voltage	1.8-3.7V
Frequency Range	2.402-2.48GHz
Output Power	14mW (+11.5dBm) Maximum (Conducted)
TX/RX Range	Greater than 5 Miles (Antenna-Type Dependent)
Protocol	Multiple
Communications Interface	SPI
Operational Power – Transmit	24mA
Operational Power – Receive	4.8mA-5.6mA Depending Upon the Operating Mode
Operational Power – Sleep	1uA (Deepest Sleep Mode)
Antenna Connector	u.fl*
Operating Temperature	0-70°C

\*Please see the Antenna Section for important regulatory details.

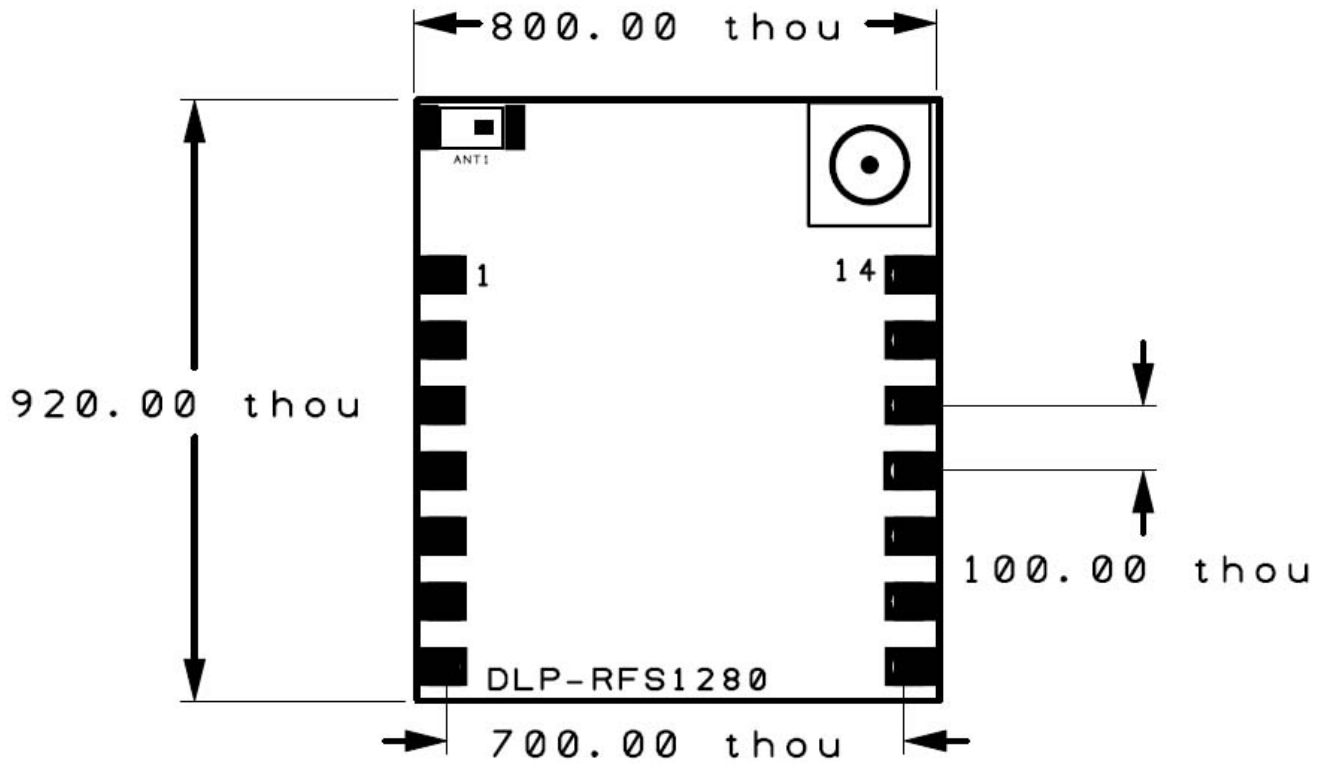
## 3.0 IO PINS



IO Pin Definitions	
1	GROUND
2	NRESET
3	BUSY
4	DIO1
5	DIO2
6	DIO3
7	MISO_TX
8	GROUND
9	3.3V POWER SUPPLY
10	MOSI_RX
11	SCK_RTSN
12	NSS_CTS
13	ANTSEL
14	GROUND

## 4.0 MECHANICAL

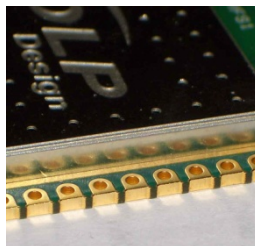
### 4.1 MECHANICAL DRAWING - Overall Dimensions: 0.8 x 0.92 x 0.135 In.



Note: thou = mils or 0.001 inches.

## 4.2 MOUNTING OPTIONS

The DLP-RFS1280 module can be either surface mounted to a printed circuit board or connected using 0.1-inch spaced headers (0.025 sq.-inch posts).



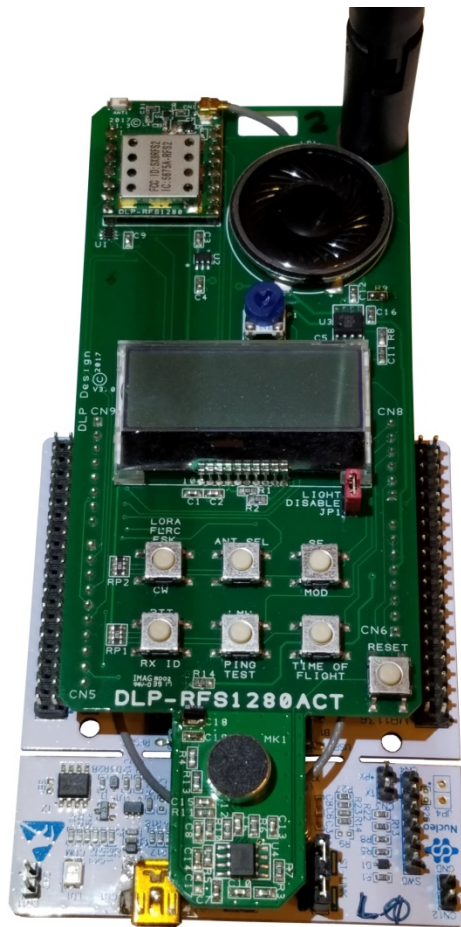
## 5.0 APPLICATION DEVELOPMENT

Demonstration source code written in the C programming language is available for free download upon purchase of the DLP-RFS1280 or DLP-RFS1280ACT demonstration platform. The code was developed using MBED and Keil uVision for the STMicrocontroller Nucleo microcontroller development module.

Source code for the demonstration software has been developed for the STM32L073RZ-based Nucleo board. Compiling the L073 source code may require the user to purchase the Keil compiler.

Additional information on the operation of the Semtech SX1280 transceiver IC is available in the datasheet for the SX1280.

## 6.0 DEMONSTRATION HARDWARE - EDK



This section describes how to operate the DLP-RFS1280ACT demonstration hardware (purchased separately). The DLP-RFS1280ACT includes a DLP-RFS1280 transceiver module that allows the user to easily verify normal operation of the transceiver and assists in helping them become familiar with the operational firmware.

Note: Flow diagrams for the demonstration code can be found at the end of this datasheet. Source code for the demonstration EDK is made available upon purchase of the DLP-RFS1280 or DLP-RFS1280ACT.

Power for this test platform can be provided by a phone charger battery (purchased separately) or a PC USB port using the included USB cable. The USB connector is a 5-pin, mini-USB connector.

For normal mode, press the RESET button. The system will be in Receive Mode waiting for packets to arrive. After each mode listed below, press RESET to return to idle state before proceeding to the next test mode.

## **6.1 TEST MODE:** For Carrier Wave (CW) Mode - No Modulation

### **6.1.1** Press Button 1 until LORA Mode is selected:



ME:17480 SF LORA  
YU:16422 12 CL

**6.1.2** Press and hold Button 1. While holding Button 1, press and release RESET. Continue to hold Button 1 until you hear a beep. Release Button 1, and the system will be transmitting at 2.4GHz on the internal chip antenna with no modulation.

- Be sure to turn the volume up (blue knob next to the speaker) if you cannot hear the beep.
- You can change to the external antenna by pressing Button 2 (ANT SEL). The display will show either a "C" for chip antenna or a "W" for whip antenna.
- You can change the carrier frequency to 2.44GHz by pressing Button 5 (LMH). Repeatedly pressing the LMH button will cycle through low (2.41GHz), medium (2.44GHz) and high (2.48GHz) carrier frequencies.

## **6.2 TEST MODE:** For CW Mode - With Modulation - LORA Mode

### **6.2.1** Press Button 1 until LORA Mode is selected:

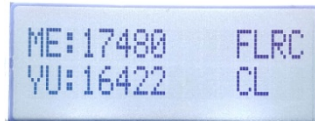


ME:17480 SF LORA  
YU:16422 12 CL

**6.2.2** Press and hold Button 3. While holding Button 3, press and release RESET. Continue to hold Button 3 until you hear a beep. Release Button 3 and the system will be transmitting at 2.4GHz on the internal chip antenna with LORA modulation.

### 6.3 TEST MODE: For CW Mode - With Modulation - FLRC Mode

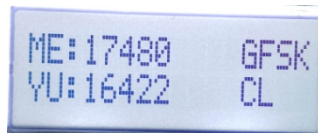
6.3.1 Press Button 1 until FLRC Mode is selected:



6.3.2 Press and hold Button 3. While holding Button 3, press and release RESET. Continue to hold Button 3 until you hear a beep. Release Button 3 and the system will be transmitting at 2.4GHz on the internal chip antenna with FLRC modulation.

### 6.4 TEST MODE: For CW mode - With Modulation - GFSK Mode

6.4.1 Press Button 1 until GFSK mode is selected:



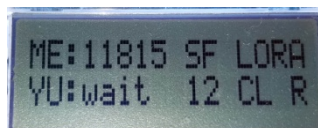
6.4.2 Press and hold Button 3. While holding Button 3, press and release RESET. Continue to hold Button 3 until you hear a beep. Release Button 3 and the system will be transmitting at 2.4GHz on the internal chip antenna with GFSK modulation.

## 6.5 PAIRING

Each Nucleo board has a unique serial number that is created by combining wafer data stored in silicon within the STM32 microcontroller. This serial number is generated after each reset, and is then presented on the LCD display of the DLP-RFS1280ACT. Pairing is the process of sending that unique serial number to another DLP-RFS1280ACT so that the two devices are linked for all product demonstrations that require two transceivers.



6.5.1 Press and hold Button 4. While holding Button 4, press and release RESET. Continue to hold Button 4 until you hear a beep. Release Button 4 and the LCD will display "wait" to indicate that the paired device's ID data is forthcoming.



**6.5.2** Press the RESET button on the transceiver to be paired. Immediately after the RESET button is released, the DLP-RFS1280ACT will transmit a packet containing its ID. This ID is received by the transceiver that is waiting. The ID is presented on the LCD and also stored to permanent memory so that it automatically loads after the next reset or power cycle. (This pairing process can be repeated if different transceivers need to be paired.)

## 6.6 RANGE TESTING

**6.6.1** Press Button 1 on each transceiver until LORA Mode is shown on the LCD display of both platforms.

**6.6.2** On Transceiver 1, press and hold Button 5. While holding Button 5, press and release RESET. Continue to hold Button 5 until you hear a beep, then release Button 5. Press and release RESET on Transceiver 2. At this point Transceiver 1 will be transmitting packets to Transceiver 2, which will beep with each received packet.

- Be sure to turn the volume up (blue knob next to the speaker) if you cannot hear the beep.
- A Range Test can be performed using any of three modulation modes: LORA, GFSK or FLRC.

## 6.7 PUSH TO TALK (WALKIE-TALKIE MODE)

The Push To Talk function is a rudimentary demonstration of packetizing and transmitting audio in LORA Mode using Spreading Factor 6. This demonstration is not intended to provide high audio quality.

**6.7.1** Press Button 1 on each transceiver until LORA mode is shown on the LCD display of both platforms.

**6.7.2** Press Button 4 (labeled “PTT”), and speak into the microphone. Maintain a distance of about 12 inches between your mouth and the microphone to avoid overdriving the microphone pre-amp circuit. Acquired audio will be reproduced on the paired transceiver. Make sure the volume control (blue knob) is turned up.

- You may have to reset both transceivers to initiate this demonstration.

## 6.8 RANGING

**6.8.1** Press Button 1 on each transceiver until LORA mode is shown on the LCD display of both platforms.

**6.8.2** On Transceiver 1, press and hold Button 6. While holding Button 6, press and release RESET. Continue to hold Button 6 until you hear a beep, then release Button 6. At this point Transceiver 1 will be performing the Ranging function with Transceiver 2, displaying the range in both feet and meters. Note that the most accurate results are obtained by using the whip antenna.

## 7.0 REGULATORY AGENCY CONSIDERATIONS

### 7.1 AGENCY IDENTIFICATION NUMBERS

This device complies with Part 15 of the FCC Rules.

Compliance with the appropriate regulatory agencies is essential in the deployment of all transceiver devices. DLP Design has obtained modular approval for this RF product. As such, an OEM need only meet a few basic requirements in order to utilize their end product under this approval. Corresponding agency identification numbers are listed below:

<u>PART NUMBER</u>	<u>US / FCC</u>	<u>CANADA / IC</u>
DLP-RFS1280	SX9RFS2	5675A-RFS2

### 7.2 EXTERNAL ANTENNAS

The DLP-RFS1280 is preapproved for use with both its on-board chip antenna and an external antenna (Part No. ANT-2.4-PML-UFL made by Antenna Factor / Linx). Connection to the external antenna is made via a u.fl connector.

### 7.3 FCC/IC REQUIREMENTS FOR MODULAR APPROVAL

Any modifications made to the DLP-RFS1280's printed circuit board, on-board antenna or pre-approved external antenna could void the user's authority to operate this equipment. Other external antennas can be used with the DLP-RFS1280 module so long as the maximum legal radiated power limit is not exceeded.

### 7.4 WARNINGS

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 undesirable operation.

This device is intended for use under the following conditions:

1. The transmitter module may not be co-located with any other transmitter or antenna; and,
2. The module has been approved using the FCC's "unlicensed modular transmitter approval" method.

As long as these two conditions are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end product for any additional compliance measures necessitated by the installation of this module (i.e. digital device emissions, PC peripheral requirements, etc.).

*Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio*



*exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

**Note:** In the event that these conditions cannot be met (i.e. co-location with another transmitter), then the FCC authorization is no longer valid, and the corresponding FCC ID may *not* be used on the final product. Under these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

## 7.5 OEM PRODUCT LABELING

The end product containing the DLP-RFS1280 must be labeled in a visible area with the following text:

**“Contains FCC ID: SX9RFS2”**

*L'étiquette d'homologation d'un module d'Innovation, Sciences et Développement économique Canada devra être posée sur le produit hôte à un endroit bien en vue, en tout temps. En l'absence d'étiquette, le produit hôte doit porter une étiquette sur laquelle figure le numéro d'homologation du module d'Innovation, Sciences et Développement économique Canada, précédé du mot « contient », ou d'une formulation similaire allant dans le même sens et qui va comme suit:*

**“Contient IC: 5675A-RFS2 est le numéro d'homologation du module.”**

## 7.6 RF EXPOSURE

This equipment complies with FCC and IC RSS-102 radiation-exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and a human body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

*Cet équipement est conforme aux limites d'exposition aux radiations fac et IC CNR-102 établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps. Cet émetteur ne doit pas être co-implanté ou fonctionner en conjonction avec toute autre antenne ou transmetteur.*

## 7.7 ADDITIONAL INFORMATION FOR OEM INTEGRATORS

The end user should not be provided with any instructions on how to remove or install the DLP-RFS1280. This device has been certified to operate with the antenna models listed below:

- On-board Chip Antenna
- Antenna Factor / Linx ANT-2.4-PML-UFL

## **8.0 DISCLAIMER**

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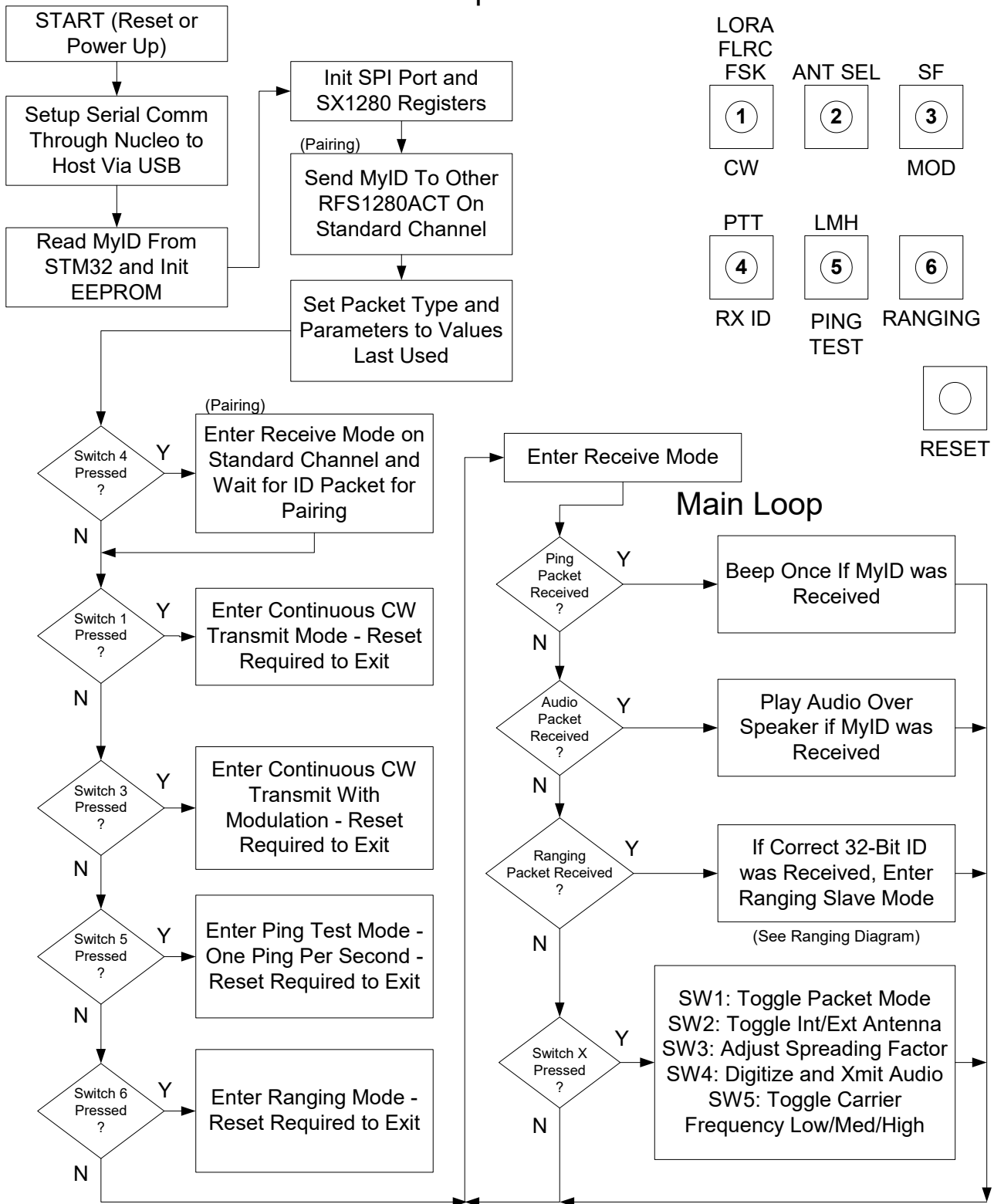
This document provides preliminary information that may be subject to change without notice.

## **9.0 CONTACT INFORMATION**

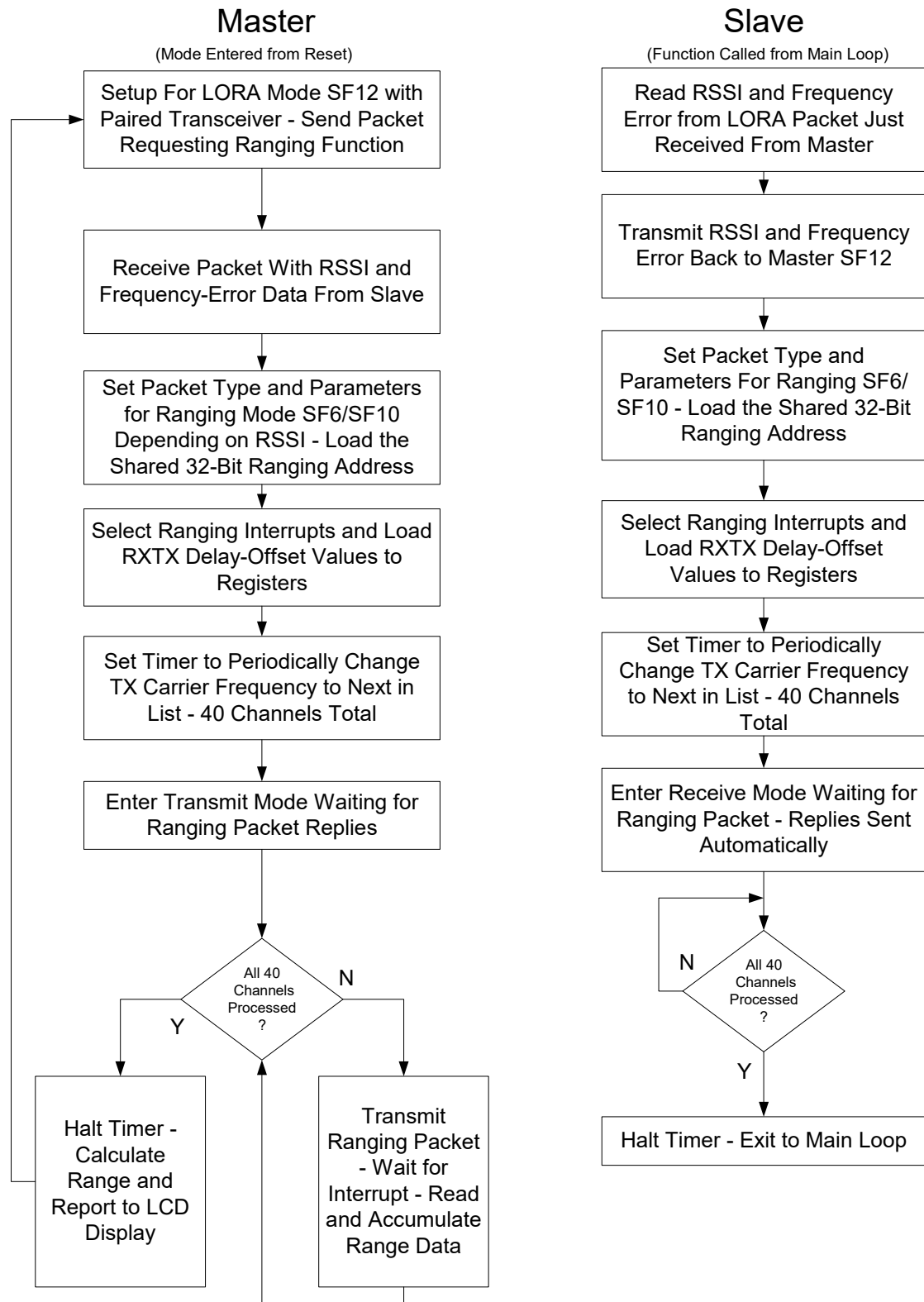
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# DLP-RFS1280ACT Demonstration Platform - Main Loop



# DLP-RFS1280ACT Demonstration Platform - Ranging



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