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Technical Specification

Document No.:	10109298AF
Product:	X30 – SDX30 – RFID & Radio Antenna Details
Assembly Number:	Assembly number: RFID PCB - 10070580 RFID USB STATUS PCA 10070579 RFID USB STATUS PCB

Document Revision History

Rev.	Date:	Author	Description
AA	06/11/2017	Robert Gruszka	First Issue
AB	11/05/2018	Stephen Coats	Added Block Diagrams for RFID Circuits
AC	01/08/2018	Stephen Coats	Added Frequency to block diagrams
AD	12/04/2019	Robert Gruszka	Added section with R and C changes
AE	23/04/2019	Robert Gruszka	Expanded section with R and C changes with side-by-side comparison
AF	20/10/2020	Robert Gruszka	Removed section 17 (components' changes), Updated schematic screenshot and embedded documents: Schematic and BOM



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1 Introduction

This document is the technical description of the X30 RFID Radio circuits & antenna. It describes the technical aspects Radio circuit & antenna design and layout. This document is the technical description of the X30 RFID board. It describes the technical aspects of the PCB assembly and should be read in conjunction with the schematic for the PCB, document 10070581.

2 General description

The X30 RFID PCB is a six-layer board with all of the functionality required to control the RFID functionality of the printer – Advance Consumable Management. In addition, the PCB provide additional functions: transfer through USB communication for external devices, LED, and switch signals to front membrane.

Circuit comprises following sections:

- Voltage regulator and power rails
- Microcontroller
- RFID transceiver
- RF switch
- USB channel
- LED and switch signals transfer
- EMC chassis/Earth connection

3 Operational Description

An RFID tag is fitted to each ribbon waste spool and contains the set-up information of the ribbon as required by the printer.

The printer reads the RFID tag during the calibration process and 'pairs' with the ribbon when a new ribbon is installed. The RFID is only read / write when new ribbon and only read during a calibration either when cassette is inserted OR when the power is turned on.

The RFID radio frequency is 13.56MHz with a maximum power limit of 200mW (Limited by the TRF7960 IC)

The radio signal is generated by TEXAS INSTRUMENT integrated circuit - TRF7960RHBT. It is provided to antenna through RF switch PEREGRINE SEMI - PE42440MLBB-Z. The RF system operates on single standard RFID system frequency at 13.56MHz. The power of the RF is limited to a maximum 200mW by the TEXAS INSTRUMENT integrated circuit - TRF7960RHBT.

We use OOK modulation. But not in Direct Mode. It's a software configuration.

From TRF7960 datasheet:

Modulator and SYS_CLK Register (0x09) to the appropriate clock speed and modulation:

– **0x21 for 6.78-MHz clock and OOK (100%) modulation (our config)**

– 0x20 for 6.78-MHz clock and ASK 10% modulation

– 0x22 for 6.78-MHz clock and ASK 7% modulation

– 0x23 for 6.78-MHz clock and ASK 8.5% modulation

– 0x24 for 6.78-MHz clock and ASK 13% modulation

– 0x25 for 6.78-MHz clock and ASK 16% modulation



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4 Power rails and voltage regulator

4.1 Power rails

Power rail	Voltage	Supplied circuits	Power provide by:
+5V	+5V	RFID chip (U3)	Regulated on main pcb
VDD-X	+3.3V	Microcontroller (U2), RF-switch (U1)	U10 voltage regulator
USB+5V	+5V	USB power for USB external device	Regulated on main pcb
0V	0V	Ground reference for all circuits apart USB	Main pcb
USB-0V	0V	Ground power bus for USB external device	Main pcb

4.2 Voltage regulator

U10 is a LDO linear voltage regulator to provide power for Microcontroller and RF Switch.

Input voltage: +5V

Output voltage: +3.3V

5 Microcontroller

Microcontrollers operation comprises two main functions:

- bidirectional communication to main pcb via UART lines (READER-RX and READER-TX)
- bidirectional communication to RFID chip via 8-bit parallel bus – It contains commands related to operation of external RFID chip

6 RFID transceiver

Commands from microcontroller are converted to NFC protocol and send to external RFID chip through RF switch. Operating frequency is 13.56MHz.

7 RF Switch

Only one antenna is fitted to each printer. Depend on the version of the printer the antenna may be fitted to either X1 or X2 connector. RF Switch provides RF power signal to correct connector to provide signal to fitted antenna. The switch is controlled by microcontroller using MUX-0 and MUX-1 lines.

8 USB channel

RFID PCB provides USB communication between main pcb and external USB device. The signal together with USB power is transferred from X3 pin1-4 to X4.

9 LED and switch signals transfer

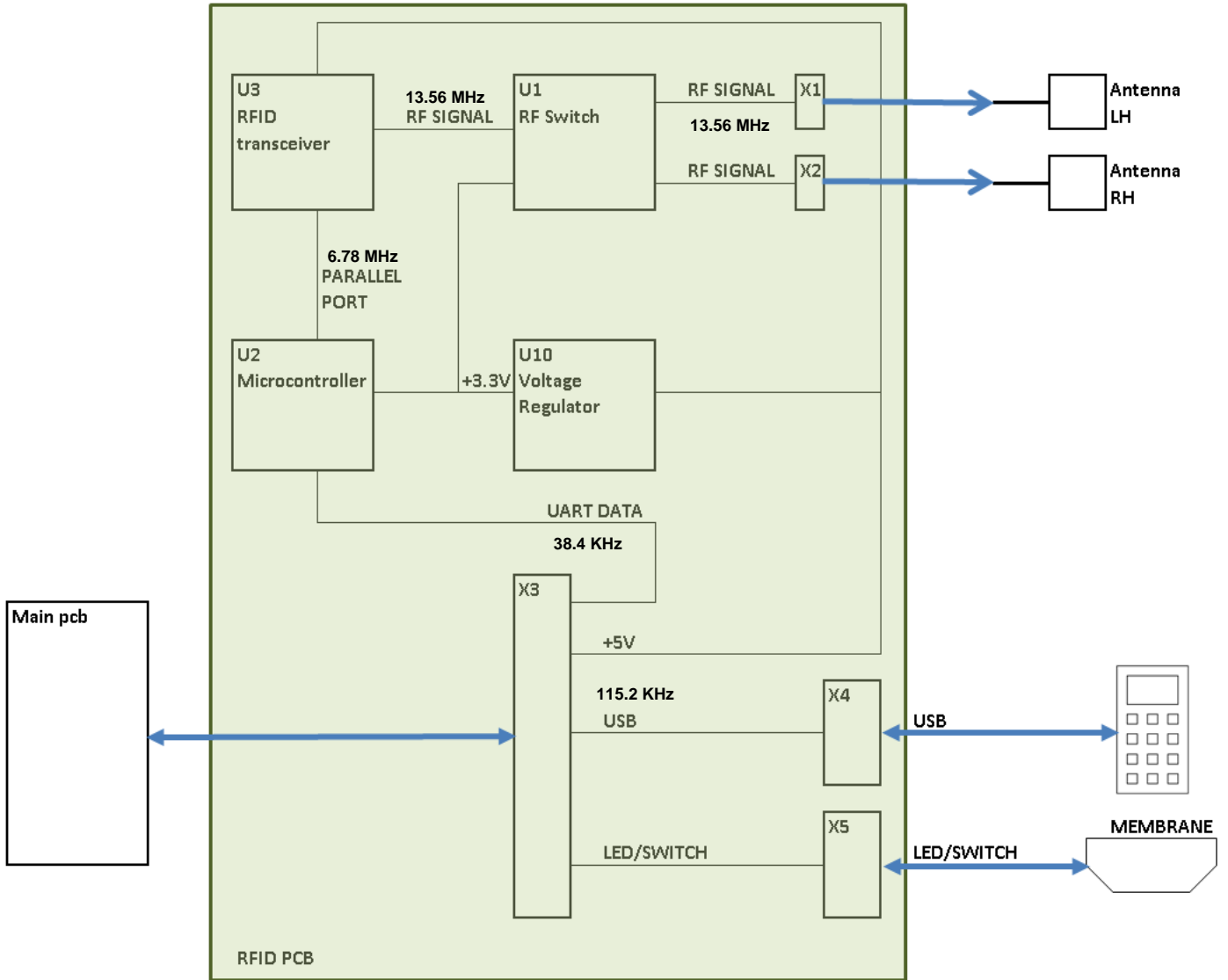
As additional function pcb provides signal transfer for LEDs and switch on front membrane. The communication is between X3 pins13-16 and X5

10 EMC chassis/Earth connection

Connection to chassis/Earth is provided by EMC contacts X7-X11. These contacts are positioned at the edge of the pcb to ensure electrical conductivity between main chassis and Earth track/plane on the pcb.

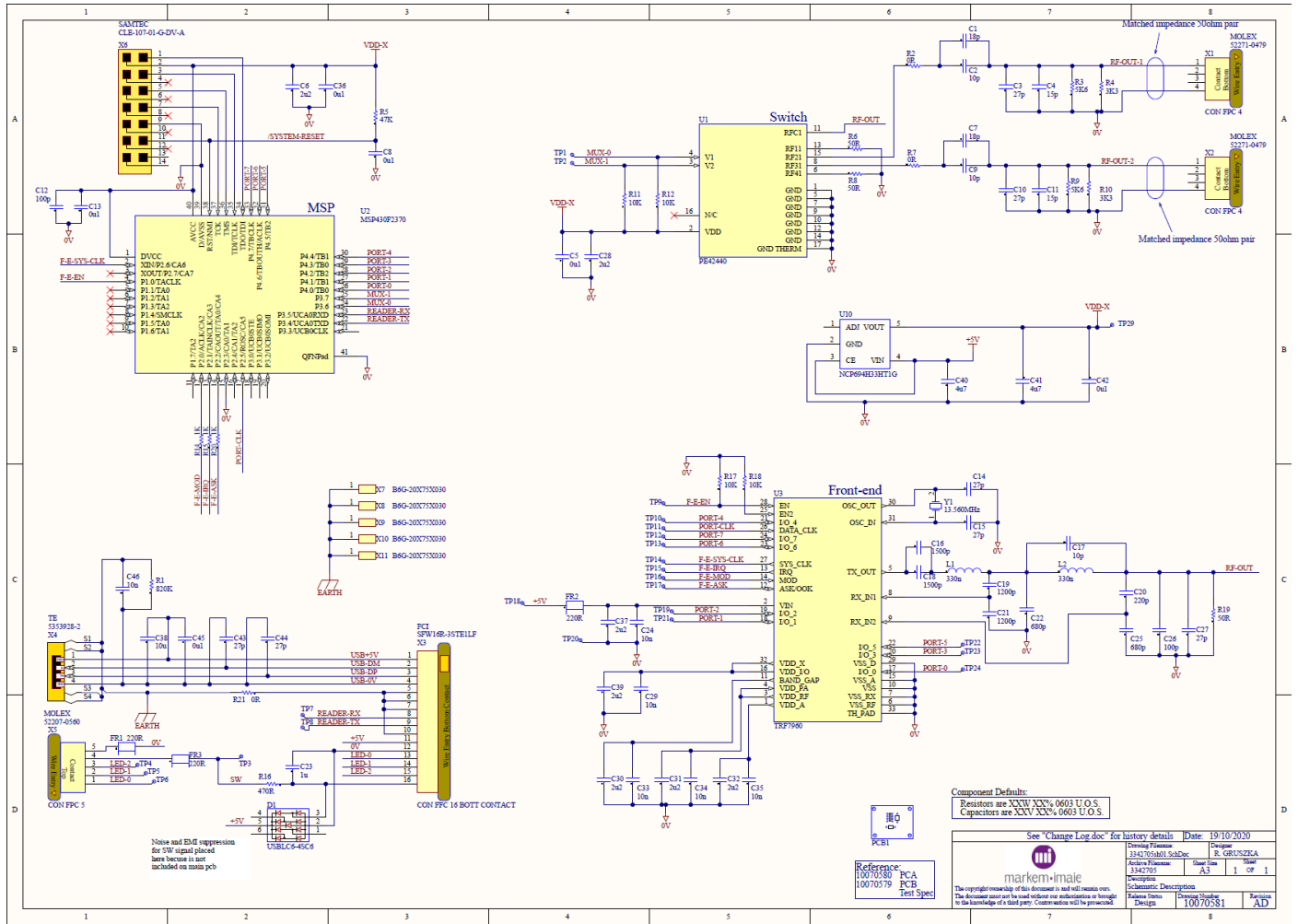


11 RF Block diagram








12 RF Schematic Diagram



13 Assembly & BOM

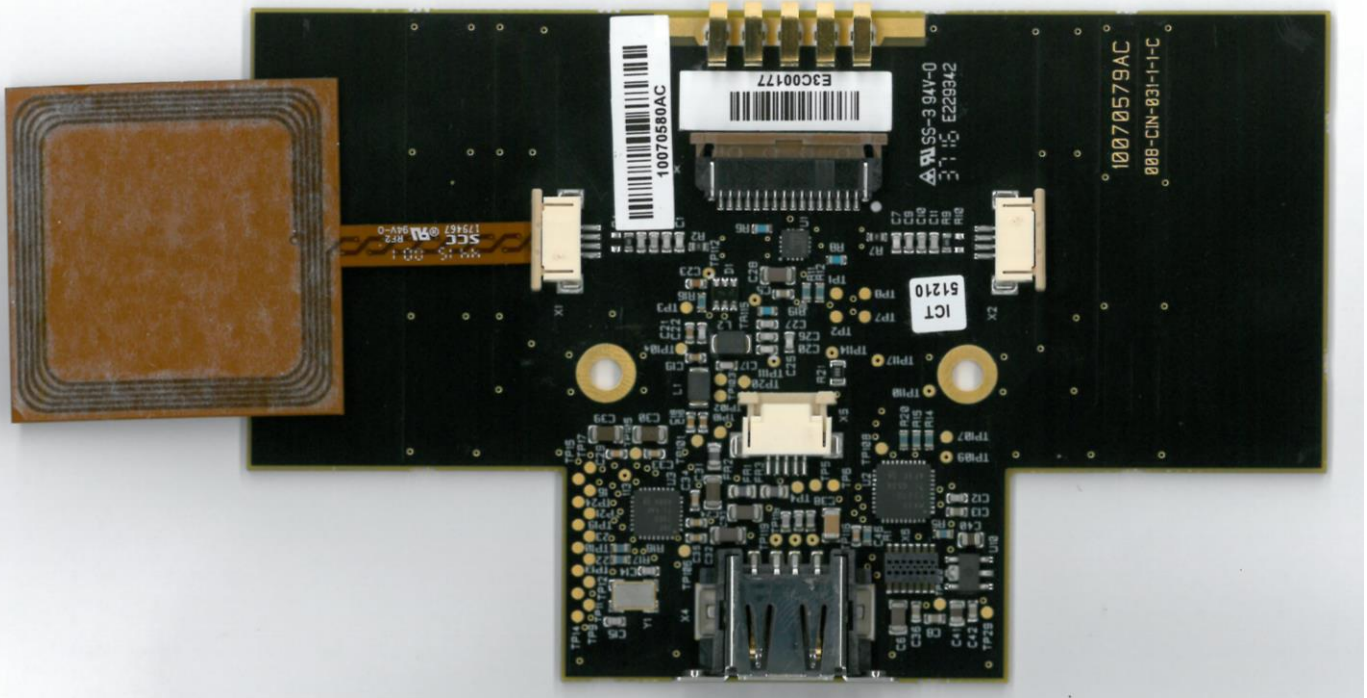
Markem Assembly Number	Description	Schematic	BOM
10069343	RFID antenna	 10069343-AA-PDF.zip	N/A (No Parts)
10070580	RFID USB STATUS PCA	 10070581AD.PDF	 10070580AG.1.xlsx



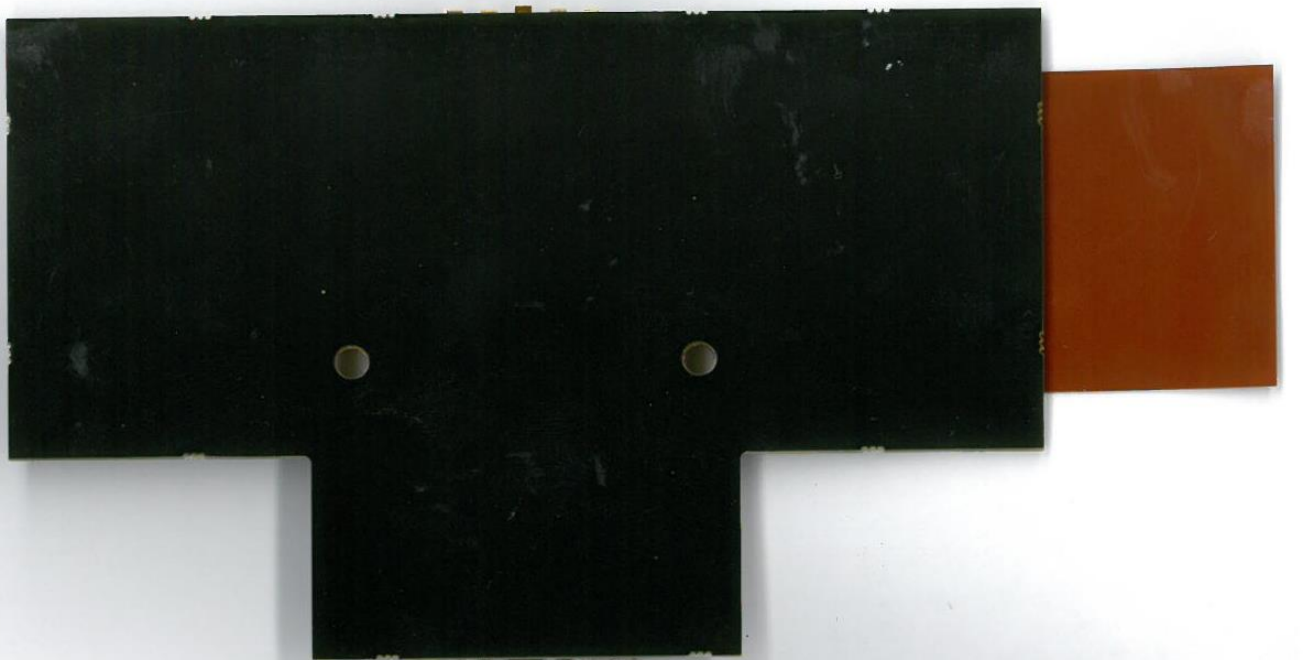
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14 RF PCBA Layout

Top Side (Components + Attached Antenna)



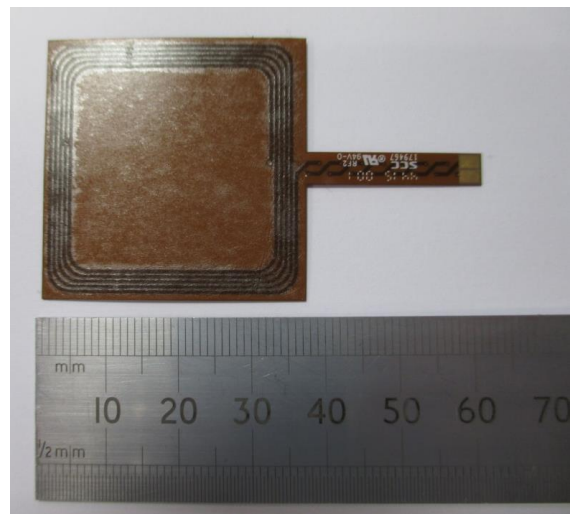
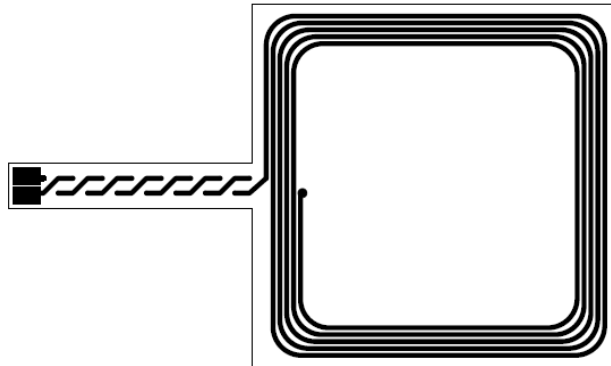
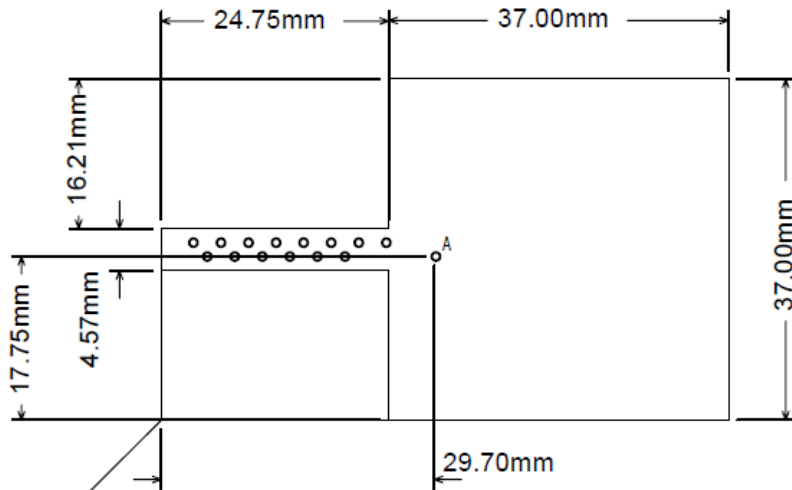
Bottom





15 Antenna Design

The loop antenna contains 5 turns and the antenna size is flat flexible pcb 37x37mm with tail 24.75mm long, 4.57mm wide





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16 Antenna Connectors

The antenna connection is via a Flat Printed Circuit (FPC) connector. This connector used is non standard for antenna use and therefore by its type fulfils the FCC 15.203 antenna requirements.

