

# USB-B1 User Manual

V1.1

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# 1 Introduction

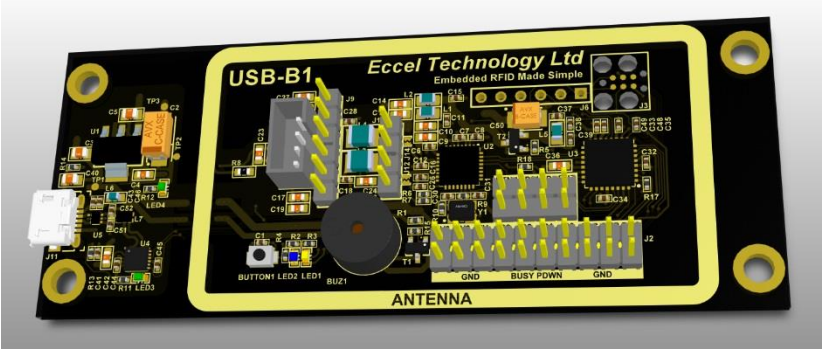
## 1.1 Device Overview

### Features

- Low cost RFID Reader with Mifare Classic, Ultralight and NTAG2 support
- Command interface via USB COM PORT with optional AES-128 encryption
- UART baud rate up to 921600 bps
- High transponder read and write speed
- -25°C to 85°C operating range
- 4 configurable GPIOs with interrupts
- 3 configurable PWMs
- Comparator
- ADC
- Current Output DAC
- AES-128 encryption engine
- Multiple internal reference voltages
- RoHS compliant

### Applications

- Access control
- Monitoring goods
- Approval and monitoring consumables
- Pre-payment systems
- Managing resources
- Connection-less data storage systems
- Evaluation and development of RFID systems



### Description

The USB-B1 module is an expansion of the RFID B1 module - the second in an evolving family of 13.56MHz sub assemblies from Eccel Technology Ltd (IB Technology). The product is designed with both embedded applications and computing / PLC platforms in mind. This product is an ideal design choice if the user wishes to add RFID capability to their design quickly and without requiring extensive RFID and embedded software expertise and time. An on board low power ARM microcontroller handles the RFID configuration setup and provides the user with a powerful yet simple command interface to facilitate fast and easy read/write access to the memory and features of the various transponders supported by this module.

## 1.2 System Overview

The USB-B1 device is an extension of our RFID B1 module. Below, In Figure 1.1 the System Diagram is presented.

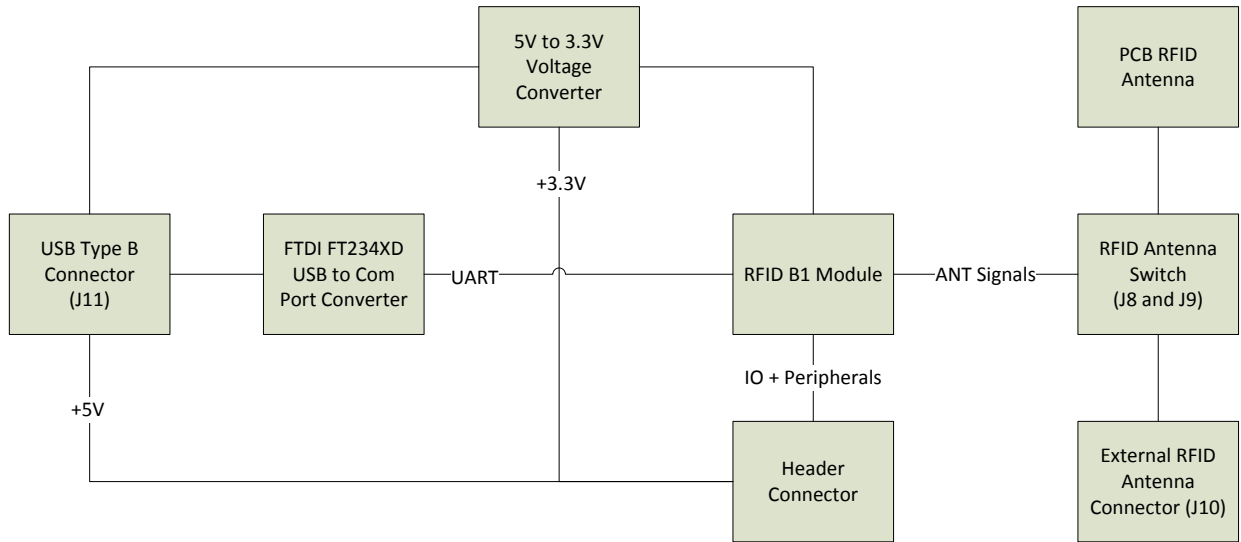
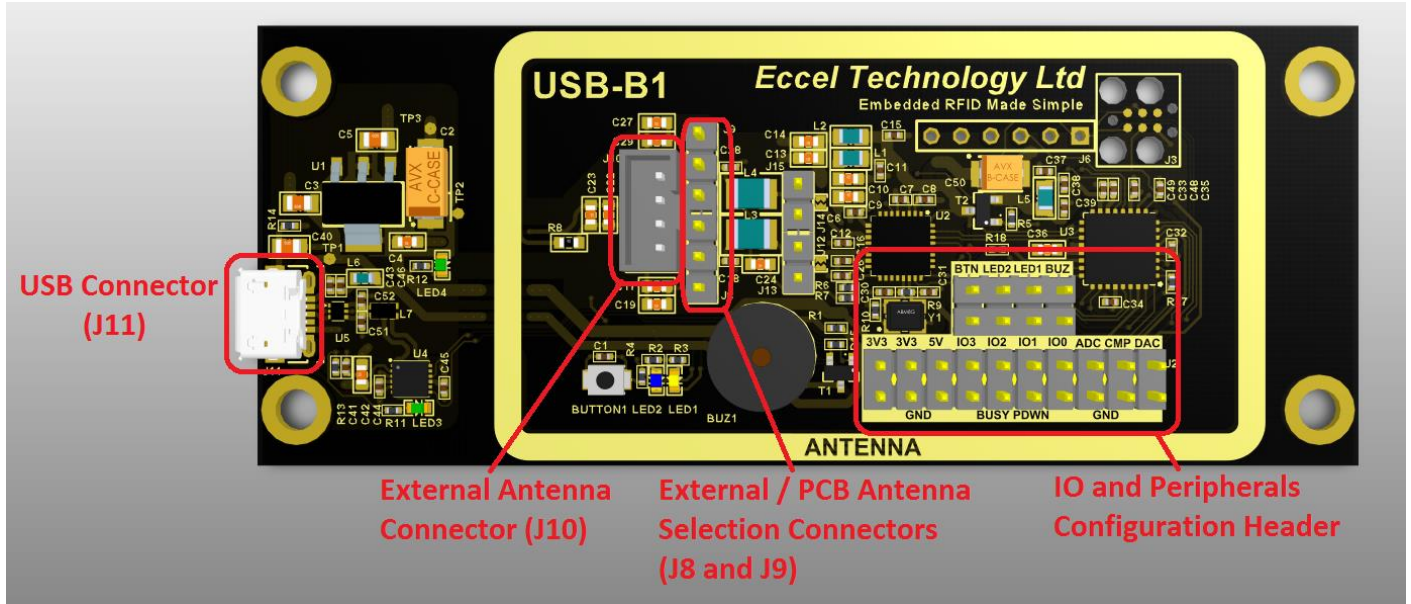


Figure 1.1 System Diagram

### 1.3 Connectors



Picture 1-1

In Picture 1-1 there are marked connectors available for the user when working with the USB-B1 device.

#### 1.3.1 USB Connector J11

The device provides communication and power via USB J11 connector. It is a micro USB type B connector. The USB port, connected to the FTDI FT234XD chip, provides USB to COM Port functionality. The user can configure the COM Port with a baud rate up to the maximum allowed by the RFID B1 module.

#### 1.3.2 External Antenna Connector (J10)

The user has the option to work with an external RFID antenna connected to the USB-B1 device. Connector J10 is where to plug in an external antenna. Eccel Technology Ltd provides a variety of RFID antennas which the user can use together with this device.

### 1.3.3 External / PCB Antenna Selection Connectors J8 and J9

To switch between the PCB antenna and an external antenna, two jumpers have to be used with the J8 and J9 connectors.

### 1.3.4 IO and Peripherals Configuration Header

The device PCB connects the pins on this header to all IOs and peripherals provided by the onboard RFID B1 module. Also, available are pins facilitating connection to an onboard buzzer, button and LEDs for use as required. To fulfil the needs required when connecting external electronics, a few pins are available providing +5V, +3.3V and GND signals.

## 2 Electrical Characteristics

### 2.1 Test Conditions

Typical device parameters were measured at an ambient temperature  $22^{\circ}\text{C} \pm 3^{\circ}\text{C}$  and using a power supply of 5V  $\pm 5\%$ .

### 2.2 Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit	Notes
$T_S$	Storage Temperature	-40	150	$^{\circ}\text{C}$	
$V_{\text{USBMAX}}$	USB Supply Voltage	0	5.5	V	
$V_{\text{IOMAX}}$	Input Pin Voltage	-0.3	3.5	V	
$I_{\text{IOMAX}}$	Output Pin Current	0	6	mA	
$I_{\text{ANT}}$	ANT1 and ANT2 Current	0	100	mA	Maximum continuous current. This depends upon the impedance of the circuit between ANT1 and ANT2 at 13.56MHz.
$I_{\text{3V3OUT}}$	+3.3V Output Current	0	500	mA	This parameter is also limited by the USB Power Supply current limit.

Table 2.1

## 2.3 Operating Conditions

Symbol	Parameter	Min	Max	Unit
$T_O$	Ambient Temperature	-25	85	°C
$V_{USB}$	USB Supply Voltage	4.5	5.5	V
$V_{3V3}$	+3.3V Generated Voltage	3.235	3.365	V

Table 2.2

## 2.4 GPIO

Symbol	Parameter	Min	Typ	Max	Unit	Notes
$V_{IOIL}$	Input Low Voltage			$0.3V_{3V3}$	V	
$V_{IOIH}$	Input High Voltage	$0.7V_{3V3}$			V	
$I_{IOMAX}$	Output Pin Current			$\pm 6$	mA	
$I_{IOLEAK}$	Input Leakage Current		$\pm 0.1$	$\pm 40$	nA	High impedance IO connected to $V_{3V3}$ or GND.
$R_{IOESD}$	Internal ESD Series Resistor		200		$\Omega$	
$V_{IOHYST}$	IO Pin Hysteresis	$0.1V_{3V3}$			V	

Table 2.3

## 2.5 Antenna Output

Symbol	Parameter	Min	Typ	Max	Unit	Notes
$f_{ANT}$	Antenna Signal Frequency		13.56		MHz	$\pm 30$ ppm (-20°C - 70°C).
$f_{ANTAG}$	Antenna Signal Frequency Aging	0		3	ppm	At 25°C.
$V_{ANTH}$	Antenna High Level Output Voltage	$V_{3V3} - 0.64$			V	$I_{ANT} = 80$ mA.
$V_{ANTL}$	Antenna Low Level Output Voltage			0.64	V	$I_{ANT} = 80$ mA.
$I_{ANT}$	ANT1 and ANT2 Current	0	60	100	mA	Maximum continuous current. This depends upon the impedance of the circuit between ANT1 and ANT2 at 13.56MHz.

Table 2.4

## 2.6 Flash

Symbol	Parameter	Min	Typ	Max	Unit	Notes
$C_{FE}$	Flash Erase Cycles Before Failure	20000			cycles	
$T_{FDR}$	Flash Data Retention Time	10			years	For ambient temperature < 85°C
		20			years	For ambient temperature < 70°C

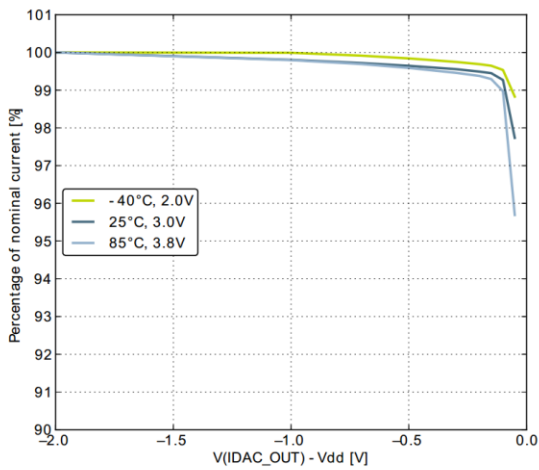
Table 2.5

## 2.7 IDAC

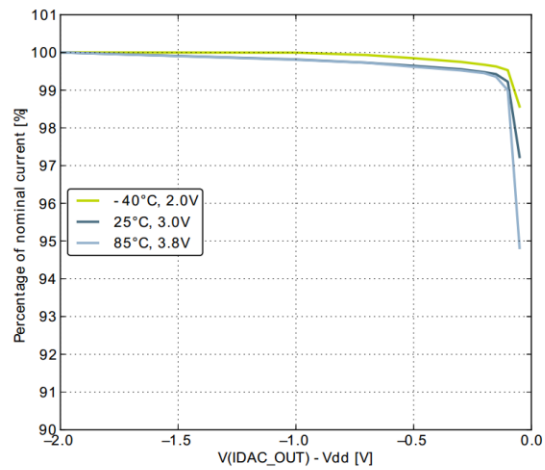
### 2.7.1 Parameters

IDAC Parameters									
Precision				Source			Sink		
Range No	Range [ $\mu$ A]	Step Size [nA]	Nominal Current [ $\mu$ A]	Current drop at Vdd - 100 mV [%]	Temperature coefficient [nA/°C]	Voltage coefficient [nA/V]	Current drop at 200 mV [%]	Temperature coefficient [nA/°C]	Voltage coefficient [nA/V]
0	<0; 1.6 >	50	0.85	0.79	0.3	11.7	0.3	0.2	12.5
1	(1.6; 4.7 >	100	3.2	0.75	0.7	38.4	0.32	0.7	40.9
2	(4.7; 16 >	500	8.5	1.22	2.8	96.6	0.62	2.8	94.4
3	(16; 64 >	2000	34	3.54	10.9	159.5	1.75	10.9	148.6

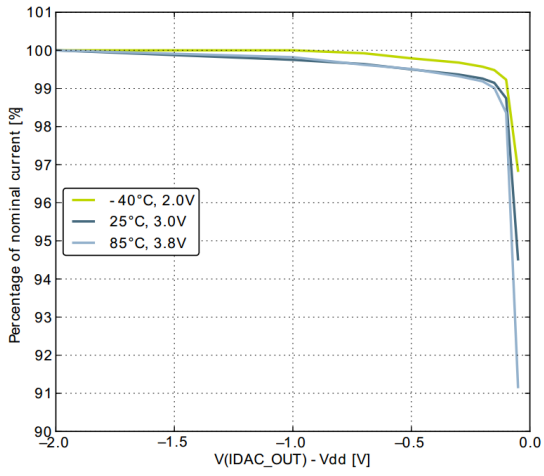
Table 2.6



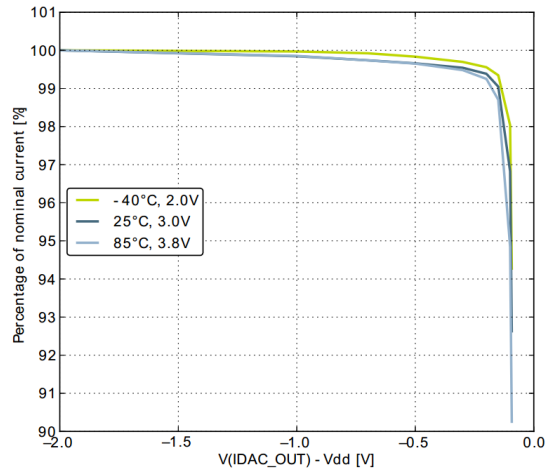
Range 0



Range 1

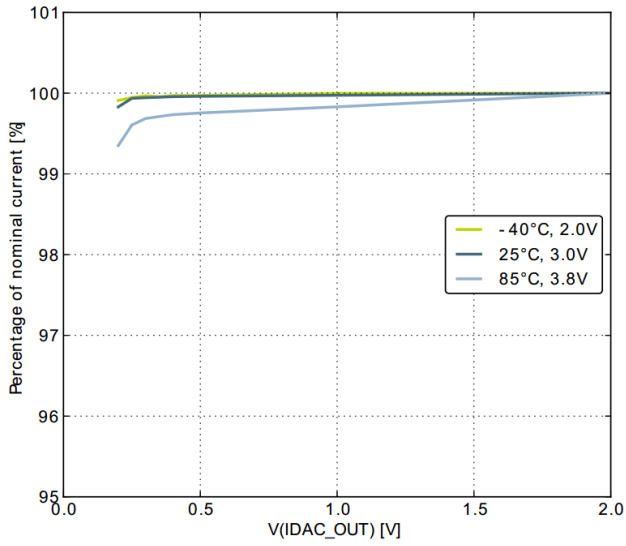


Range 2

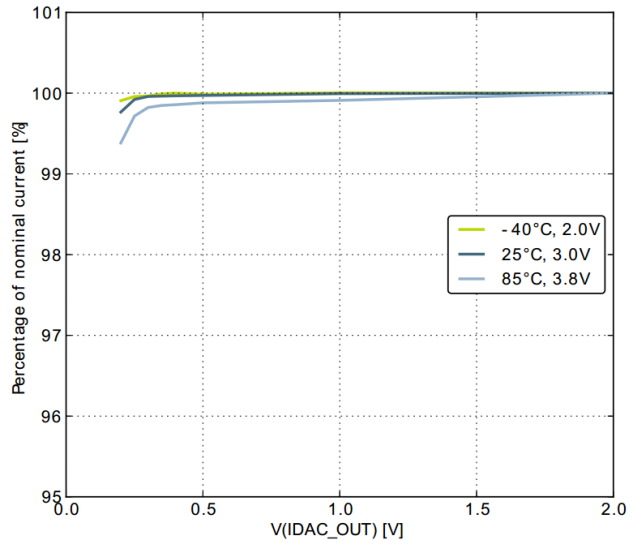


Range 3

Figure 2.1 Source Current

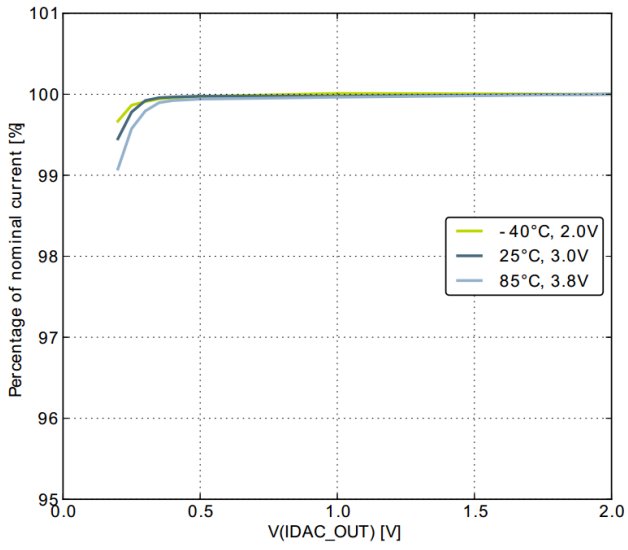


Range 0

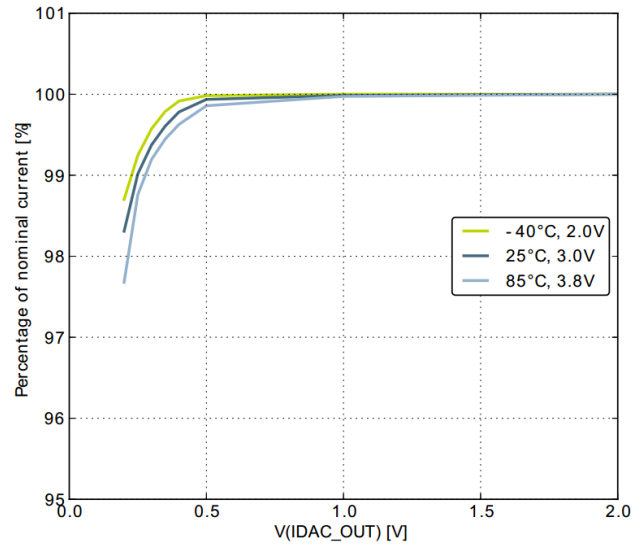


Range 1





Range 2



Range 3

Figure 2.2 Sink Current

2.7.2 Example Measurement (Error and Offset)

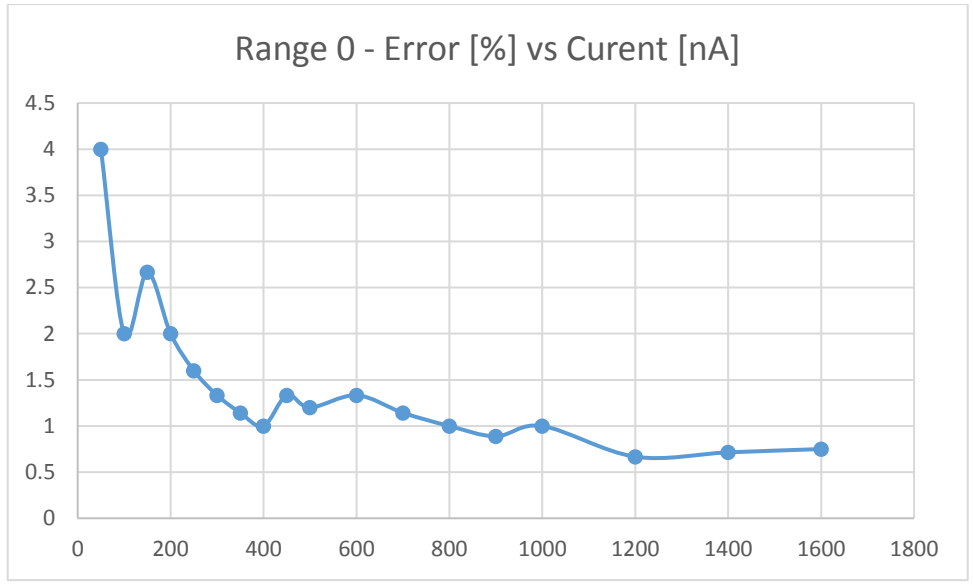


Figure 2.3 50kΩ Sourcing

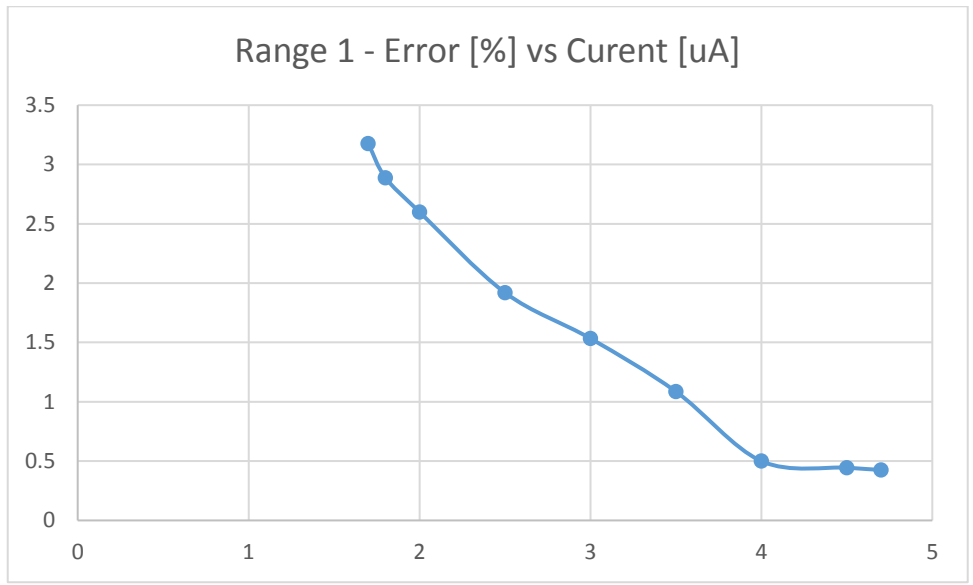


Figure 2.4 50kΩ Sourcing

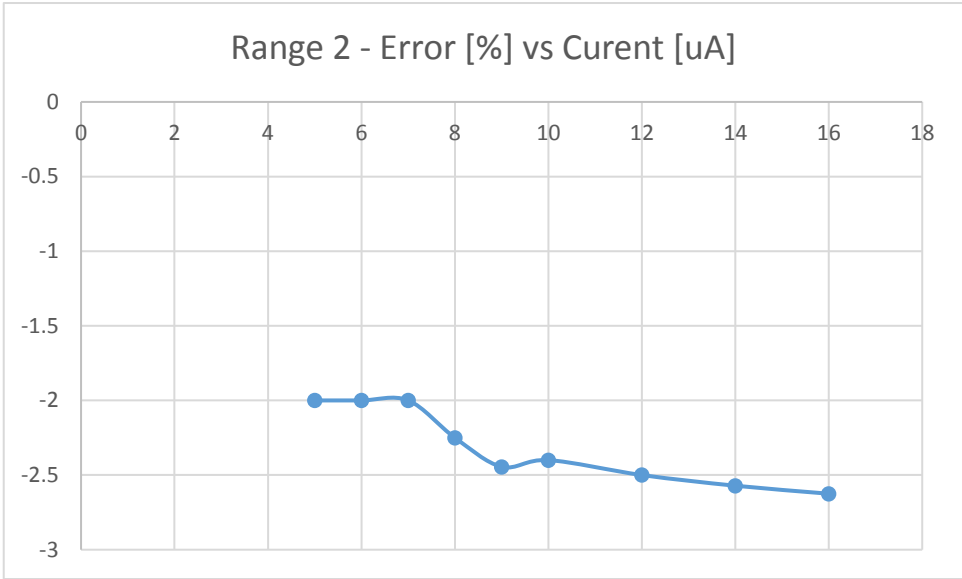


Figure 2.5 50kΩ Sourcing

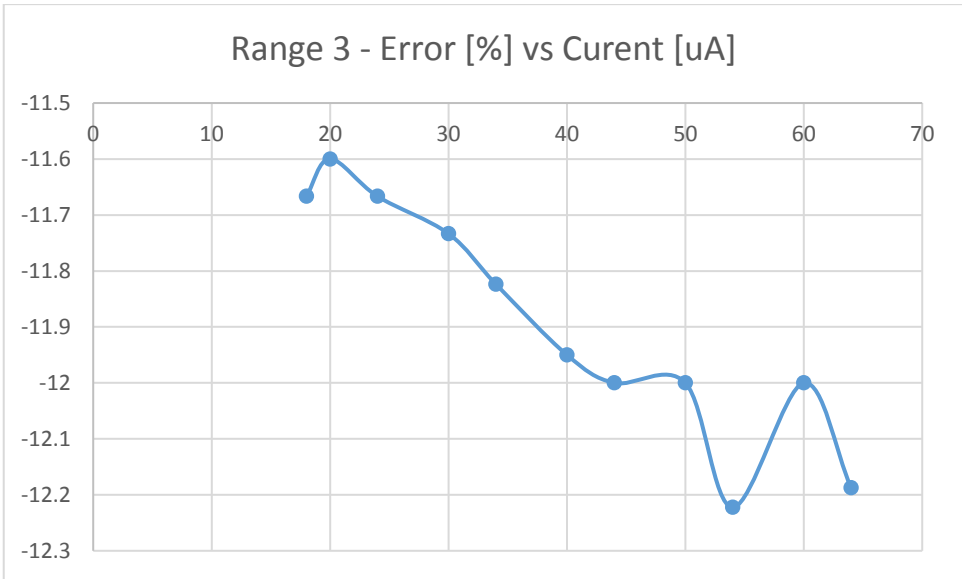


Figure 2.6 50kΩ Sourcing

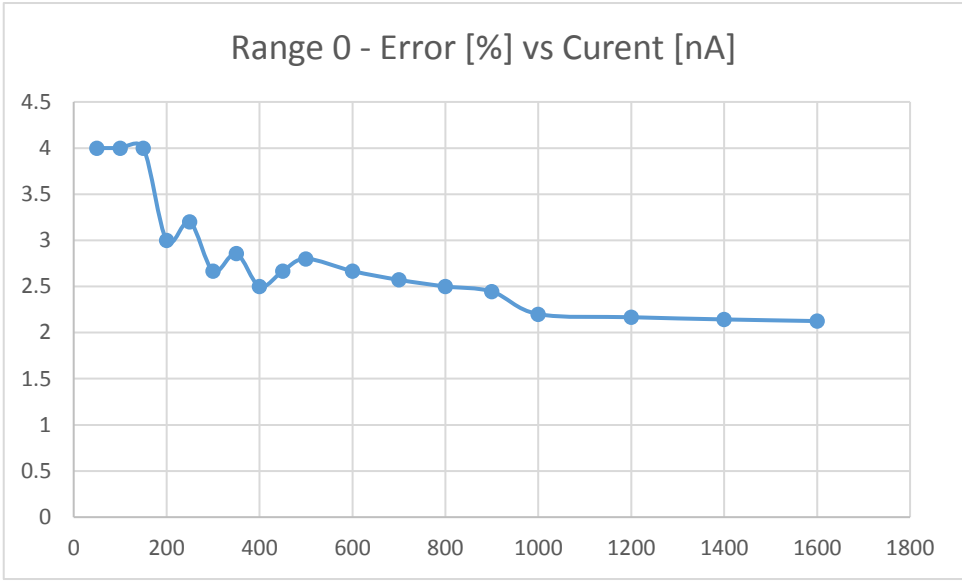


Figure 2.7 50kΩ Sinking

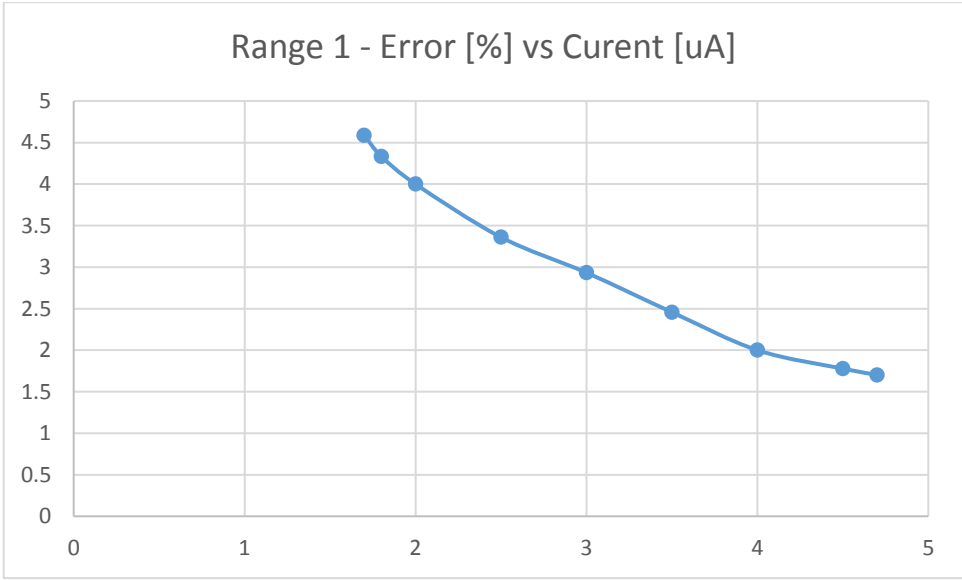


Figure 2.8 50kΩ Sinking

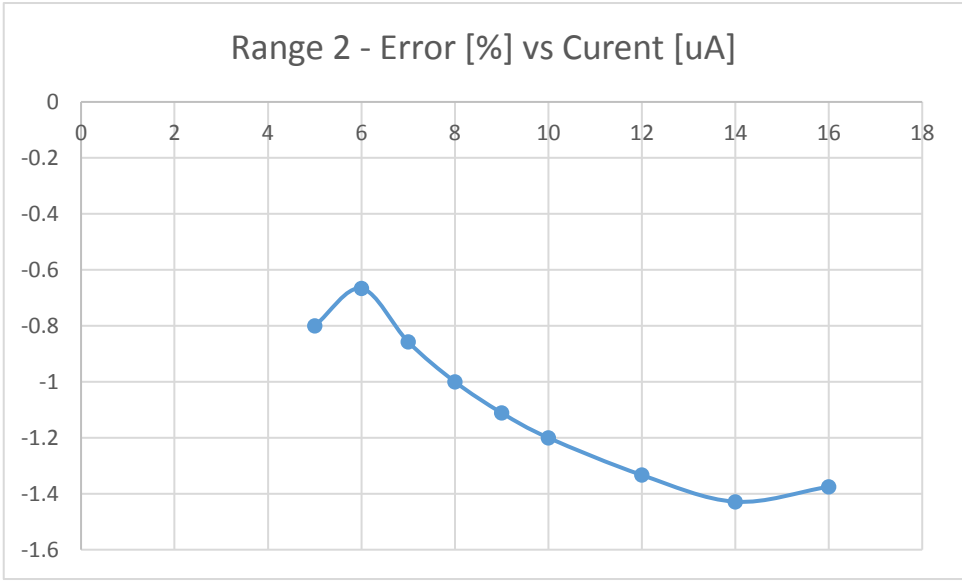


Figure 2.9 50kΩ Sinking

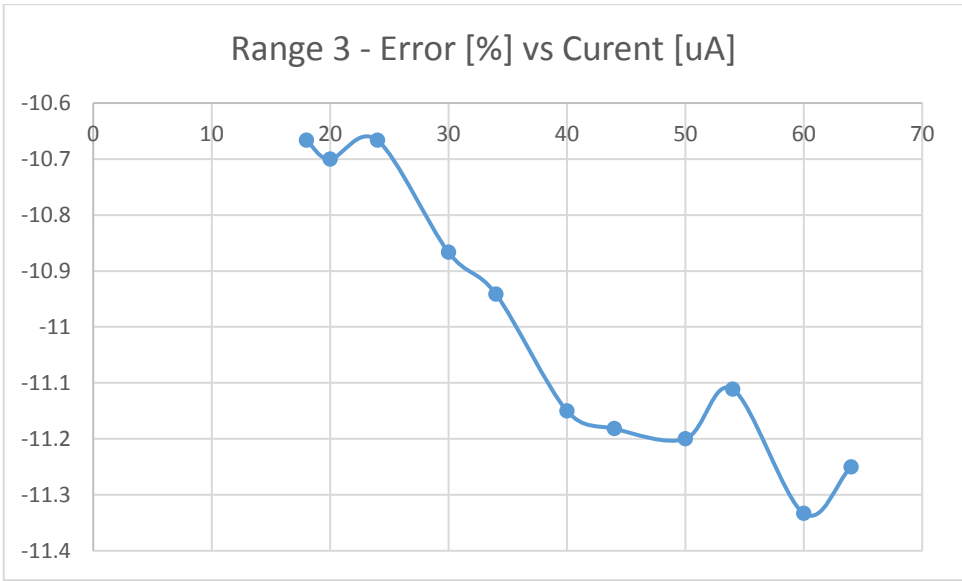


Figure 2.10 50kΩ Sinking

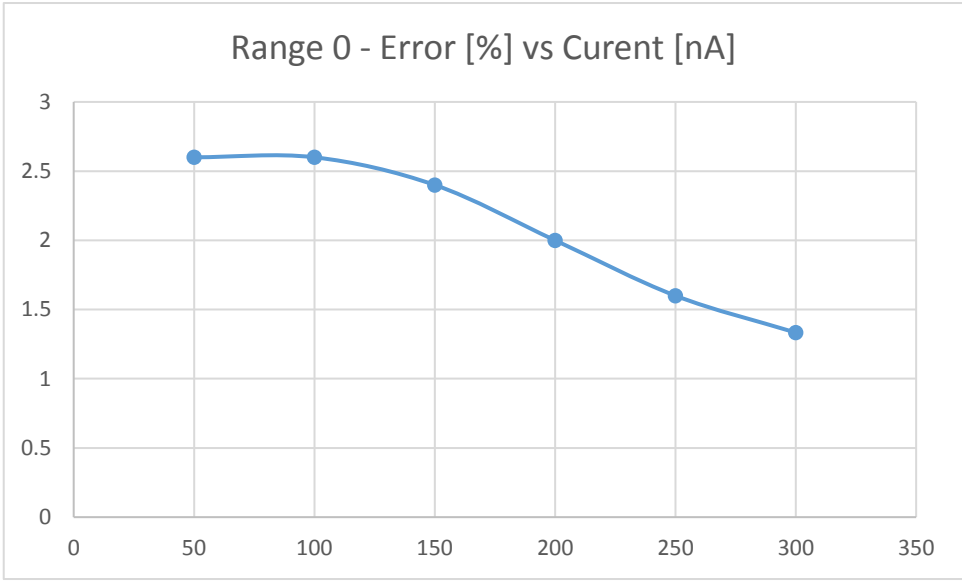


Figure 2.11 10MΩ Sourcing

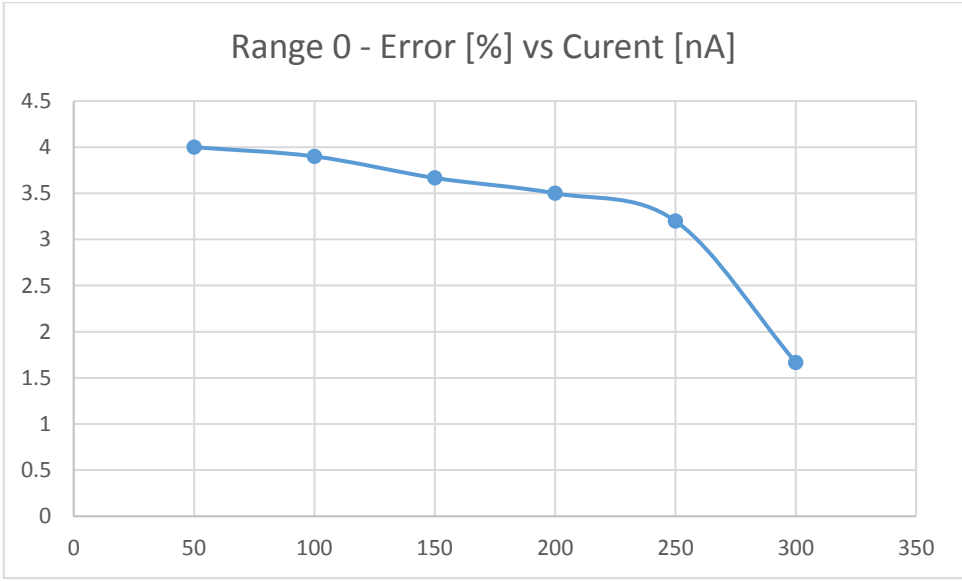


Figure 2.12 10MΩ Sinking

## 2.8 PWM

PWM Parameters				
Period		Frequency		
Minimum [ $\mu$ s]	Maximum [s]	Minimum [Hz]	Maximum [kHz]	Maximum Error [%]
4.81	3.19	0.313	207.9	3

Table 2.7

## 2.9 ADC

Symbol	Parameter	Min	Typ	Max	Unit	Notes
V <sub>ADCIN</sub>	Input Voltage Range	0		2.5	V	Internal 2.5V reference voltage used.
I <sub>ADCIN</sub>	Input Current			100	nA	
C <sub>ADCIN</sub>	Input Capacitance			2	pF	
R <sub>ADCIN</sub>	Input On Resistance	1			M $\Omega$	

Table 2.8

## 2.10 Comparator

Symbol	Parameter	Min	Typ	Max	Unit	Notes
V <sub>CMPIN</sub>	Input Voltage Range	0		V <sub>3V3</sub>	V	
V <sub>CMPOFST</sub>	Offset Voltage	-12	0	12	mV	
V <sub>CMPHYST</sub>	Hysteresis		50		mV	

Table 2.9

### 3 System and functionality

From the system and functionality point of view, the USB-B1 device gives the same features as the RFID B1 module, and the user should refer to RFID B1 User Manual when working with USB-B1. The FTDI chip expands communication interface to the on-board RFID B1 module and allows the board to be connected to a computer and communicate with the device via a USB Com Port. Most systems have built-in drivers for such a Com Port.

### 4 Mechanical Dimensions

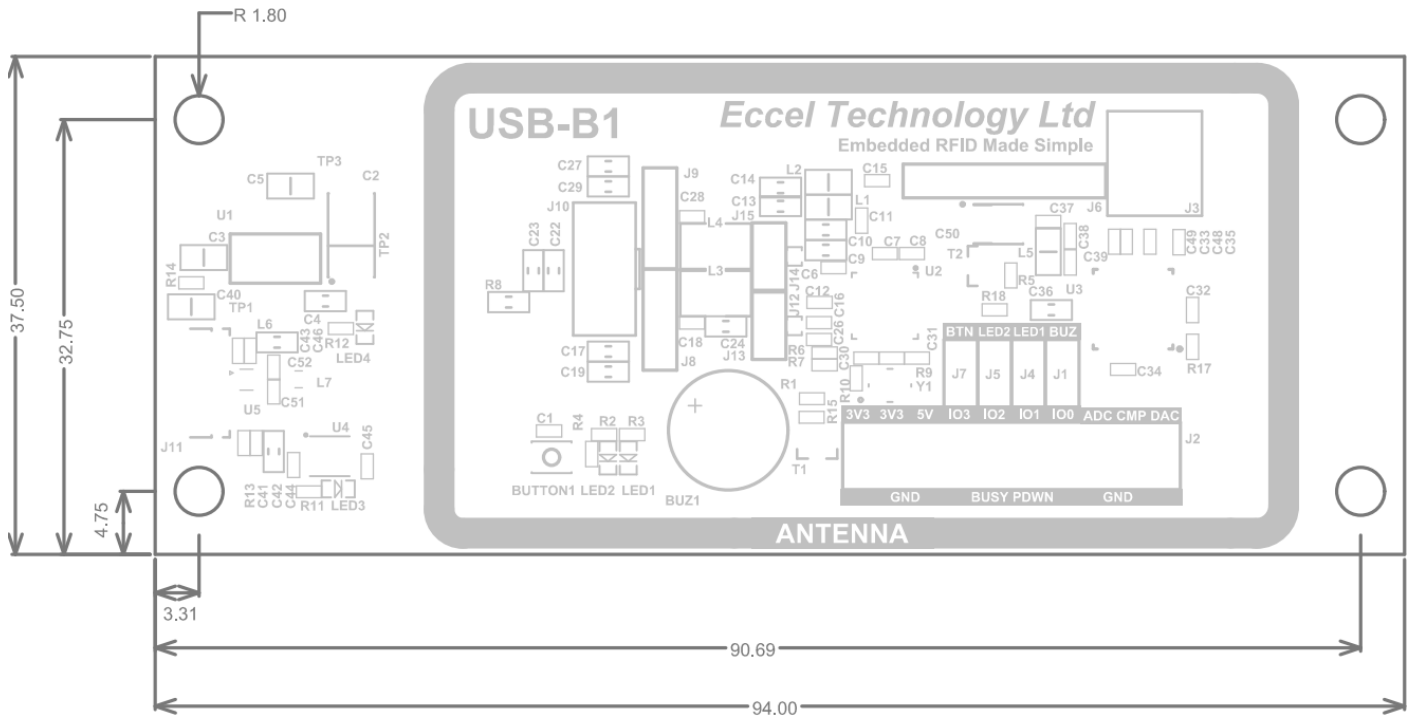


Figure 4.1