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CLRC663, MFRC630, MFRC631, SLRC610 PC-Serial RS232 and low power card detection Quick Start Guide

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Application note COMPANY PUBLIC

Document information

Info	Content
Keywords	CLRC663, MFRC630, MFRC631 and SLRC610, RedBoard quick start guide
Abstract	The document provides information on powering the evaluation board and executing scripts with the CLRC663, MFRC630, MFRC631 and SLRC610 test program.



Revision history

Rev	Date	Description
1.1	20120717	CLRC663 Derivates added
1.0	20111212	Initial version

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1. Introduction

The "CLRC663 Serial Test Program" is provided as an executable application with a graphical user interface. In principal it is build on very low level – just offering read and write register operations. It can also be operated with MFRC630, MFRC631 and SLRC610. To improve readability, in the subsequent text the whole product family is referenced as "CLRC663 family".

The software can be used to communicate with CLRC663 family on register level. By the use of script files, single register operations are executed to configure the IC for a certain operating mode. The script files have the extension *.*jcf*.

Note that the CLRC663 family Serial Test Program is intended to show the chip functionality only on a very basic level.

In the following steps the PC serial and the LPCD is described by using the CLRC663 red board.

For MFRC630, MFRC631 and SLRC610 the protocol settings have to be set with load protocol, because the registers are locked.

Obviously not all scripts are useful on every derivate, e.g. the ISO 15693 inventory script will not find any tags in case the ISO 14443-only derivate chip MFRC631 is used.

Important: Read the LPCD section to correctly operate the low power card detection mode.

The following script files are provided:

• **RC663_ISO14443A_4byteUID.jcf** - returns the UID of an ISO14443-3A card. Only 4byte UIDs are retrieved for this script.

→CLRC663, MFRC631 and MFRC630

- RC663_ISO14443B_ReqB.jcf returns the UID of an ISO14443-3B card →CLRC663 and MFRC631
- RC663_ISO15693_Inventory.jcf performs an ISO15693 Inventory command
- →CLRC663 and SLRC610
- RC663_Felica_ReqC.jcf act as passive PICC Target →CLRC663
- LPCD_ModeConfig_Part1.jcf configures the board to LPCD
- LPCD_DetectPICC_Part2.jcf runs LPCD mode with prior defined settings

1.1 Getting Started

Please connect the CLRC663 RedBoard to the RS232 interface and power it up using the enclosed switched power supply.

The input voltage must be 7.5 Volts (or higher).

The polarity of the connector plug of power supply is not relevant.

The Baudrate must be set to 115200.

1. Start the *CLRC663 Serial RS232 Test Progra*m by clicking on the executable file. It is a standalone program, no further installation is required. An empty window opens as outlined in Fig 1:

R0663 Senial RS 232 Test Proy File Script Action Log Senial Opern	rdani Action <u>Colect.C</u> Over de <u>Marne</u> : Rajidari JAN	Hop Prizett JCF Riskost JCF	Action Window
Connend Line		<u>Prosec</u>	Command Window Status Window
		-	——— Trace Window
		¥	

The *CLRC663 Serial RS232 Test Program* is a simple User Interface (UI) utility for register-based access to the RC663 hardware using the serial interface.

2. The RS232 COM port has to be configured: Port/Settings...

Choose the appropriate RS232 COM port for your serial communication, **Verify** (checks if the port is used or not) your selection and press **Apply**.

Fio Schiel Action Log		Hop Procett <u>UCF</u> Raload <u>U</u> CF
Connected Line Operation Statue [NULL DDIFT: [0000] 0 N	RS 232 Port Parameters Serial Port Uerification & Status Umknown Unknown Unknown	Apply Broacc

- 3. Use the **Open** button to establish the communication channel. An indicator of correct settings is the changing of all buttons but Open from inactive to active state.
- 4. By pressing **Select JCF** a window with all delivered scripts is opened. For this first try, please choose the file "**RC663_ISO14443A_4byteUID**".

Image: Construction of the pane: *_jof Image: Construction of the pane: Construction of the pane: Construction of the pane: *_jof Image: Construction of the pane: Construction of the pane: Construction of the pane: *_jof Image: Construction of the pane: Construction of the pane: Construction of the pane: *_jof Image: Construction of the pane: Construction of the pane: Construction of the pane: *_jof Image: Construction of the pane: Construction of the pane: Construction of the pane: Construction of the pane: Construction of the pane: Construction of the pane:	Look jn:	C663 Scr	ipts	•			
BDB File name: *.jcf Open My Network Files of type: Command File Cancel	My Pecent Documents Desktop My Documents	RC663_Felic RC663_ISO RC663_ISO RC663_ISO	al_ReqC.jcf 4443A_4byteUID.jcf 44438_ReqB.jcf 15693_Inventory.jcf				
	ATPGHKMIKIN BOBS My Network Places	File <u>n</u> ame: Files of <u>type</u> :	*.jcf Command File		•	<u>O</u> pen Cancel	

It might be useful while investigating the different modes to open the files in a text editor, too, due to inline documentation which will not be displayed in the trace window.

5. Put a MIFARE Classic 1k on the Demo-Board and start the communication by using the **Process JCF** button.

		-
Serial	Action	
Open	Select ICE Override Name:	Process JCF
		Reload <u>J</u> CF
<u>C</u> lose	Register I/O	
All to 115 kbps		
Command Line		
		Process
		<u></u> iocess
Operation Status		
D:\tocopy\RU663\.jcf		
COM1: 115200 O N		
, -		
//<		
//< Get UID, Apply cascade	2 level-1	
//<		
SR 2E 08	// (Status: 0x0000)	
3R OC OO	// (Status: 0x0000)	
SR 00 00	// (Status: 0x0000)	
SR OZ BO	// (Status: 0x0000)	
SR UG 7F	// (Status: 0x0000)	
SR U7 7F (({ Noite Colore and int	// (Status: UXUUUU)	
//< write "Select" cma int 2D of 92	0 FIFU (SEL=93, NVB=20)	
SR 03 53 SD 05 20	// (Status: 0x0000)	
SP 00 07	// (Status: 0x0000)	
SR 08 18	// (Status: 0x0000)	
SR 09 42	// (Status: 0x0000)	
GR 07 // data ==	= 60 // (Status: 0x0000)	
SR 08 00	// (Status: 0x0000)	
SR 09 00	// (Status: 0x0000)	
GR 06 // data ==	= 7C // (Status: 0x0000)	
GR 07 // data ==	= 20 // (Status: 0x0000)	
//< Read FIFO, Expected -	Complete UID (one PICC in HF)	
GR 04 // data ==	: 05 // (Status: 0x0000)	
GR 05 // data ==	: 32 // (Status: 0x0000)	
GR 05 // data ==	: 23 // (Status: 0x0000)	
GR 05 // data ==	: A8 // (Status: 0x0000)	
CD OF // doto	<pre>9C // (Status: 0x0000)</pre>	
GR 05 // daca	25 // (Status: 0x0000)	
GR 05 // data ==		
GR 05 // data == GR 05 // data == //< Read Error register 7 02	00 (/ /#===== 0=0000)	
GR 05 // data == GR 05 // data == //< Read Error register GR 0A // data ==	= 00 // (Status: 0x0000)	
GR 05 // data == //< Read Error register GR 0A // data == //< ================================	: 00 // (Status: 0x0000)	
GR 05 // data == //< Read Error register GR 0A // data == //< ================================	= 00 // (Status: 0x0000)	
GR 05 // data == //< Read Error register GR 0A // data == //< ================================	- 00 // (Status: 0x0000)	_
GR 05 // data == //< Read Error register GR 0A // data == //< ================= //< Send HaltA cmd //< ===================================	= 00 // (Status: 0x0000) ================================	
GR 05 // data == //< Read Error register GR 0A // data == //< ================================	<pre>= 00 // (Status: 0x0000) ================================</pre>	
GR 05 // data == //< Read Error register GR 0A // data == //< ================================	= 00 // (Status: 0x0000) // (Status: 0x0000) C-16 appended to the data stream. // (Status: 0x0000) // (Status: 0x0000)	
GR 05 // data == //< Read Error register GR 0A // data == //< ================================	<pre>= 00 // (Status: 0x0000)</pre>	

All the possible commands (e.g. SR, RE...) used in the scripts are explained when selecting **Help/Commands**.

As mentioned above more details on the scripts can be viewed by opening the *.jcf file with a text editor.

The first comments of the script chosen: RC663_ISO14443A_4byteUID.jcf to compare it to the output of the trace window:

```
1
    CLL
2
    CHB 115200
3
4
    //> ------
5
    //> RC663 Script for (Iso14443-3A protocol):
    //> * ReqA
6
7
    //>
        * Get UID (Select: Casade level 1)
8
    //>
        * HaltA
    //>
9
10
    //> Note: Only one PICC shall be in HF
    //> ------
11
12
13
    //> ------
    //> RC663 ApplyProtocolSettings: IS014443A=01
14
    //> ------
15
16
    11
17
    //> Configure Timers
18
    11
19
    // Set Timer-0, T0Control Reg:
20
    // Starts at the end of Tx. Stops after Rx of first data. Auto-reloaded. 13.56
    MHz input clock.
21
      SR 0F 98
22
    // Set Timer-1, T1Control_Reg:
23
24
    // Starts at the end of Tx. Stops after Rx of first data. Input clock - cascaded
    with Timer-0.
25
       SR 14 92
26
27
    // Set Timer-2, T2Control_Reg: Timer used for LFO trimming
28
       SR 19 20
29
30
    // Set Timer-2 reload value (T2ReloadHi_Reg and T2ReloadLo_Reg)
31
       SR 1A 03
32
       SR 1B FF
33
34
   // Set Timer-3, T3Control_Reg:
    // Not started automatically. Not reloaded. Input clock 13.56 MHz
35
       SR 1E 00
36
37
38
    //> Configure FIFO Size=255 and Water-level
```

```
39
     // Set FifoControl_Reg, Fifo size=255 bytes. Flush FIFO
40
       SR 02 90
41
    // Set WaterLevel =(FIFO length -1)
42
43
       SR 03 FE
44
45
     // RxBitCtrl_Reg(0x0c)
                           Received bit after collision are replaced with 1.
46
       SR 0C 80
47
    // DrvMod reg(0x28), Tx2Inv=1
48
49
     GR 28
50
       SR 28 80
51
52
   // TxAmp Reg(0x29)
53
      SR 29 00
54
55
   // DrvCon Reg(0x2A)
56
       SR 2A 01
57
   // TxI Reg(0x05),(0x05)
58
59
       SR 2B 05
60
61
    // RxSOFD_Reg(0x34),(0x00),
62
          SR 34 00
63
64
    // Rcv_Reg(0x38),(0x12)
65
         SR 38 12
66
    11
67
     //> ------
68
     //> 2. LoadProtocol( bTxProtocol=0, bRxProtocol=0)
    //> ------
69
70
71
    //> Terminate any running command. Flush FiFo
72
       SR 00 00
73
       SR 02 b0
74
75
   // Clear all IRQ 0,1 flags
       SR 06 7f
76
77
      SR 07 7f
78
    //> Write in Fifo: Tx and Rx protocol numbers(0,0)
79
80
       GR 04
       SR 05 00
81
                  // Rx protocol=0
       SR 05 00
82
                  // Tx prot=0
83
    // Enable IRQ0 interrupt sources
84
85
    11
86
    // Idle interrupt(Command terminated), RC663_BIT_IDLEIRQ=0x10
87
       GR 08
88
       SR 08 10
89
```

90 // Enable Global IRQ propagation. 91 GR 09 SR 09 40 92 93 //> Start RC663 command "Load Protocol"=0x0d 94 95 SR 00 0D 96 97 ... 98 ...

Application note

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1.2 Command Line

Besides the script files, single commands can be handled, too. This can be done by typing e.g. **GR 0A** (Gets the status of register 0A (error register)) in the Command Line and execute it with **Process**. In principle all lines of the scripts provided could be fed into the command line sequentially, each followed with a **Process**.

1.3 Register I/O

The button Register I/O can be used to read from and write to certain registers.

2. LPCD mode

2.1 How LPCD works

The low power card detection mode is an energy saving mode intended for use cases where CLRC663 family is supplied by battery and not connected to mains.

The LPCD feature is INDEPENDENT from the actual smartcard/tag communication protocol used.

The LPCD works in two phases:

The standby phase, controlled with the wake up timer 4 which defines the duration of the standby of the CLRC663 family.

Second phase is the detection-phase. The values of the I and Q channel are detected and stored in the register map. (LPCD_I_Result_Reg, LPCD_Q_Result_Reg). This time period can be handled with Timer3. The value is compared with the min/max values in the registers (LPCD_IMin_Reg, LPCD_IMax_Reg; LPCD_QMin_Reg, PCD_QMax_Reg). If it exceeds a certain limit the LPCDIrq will be raised.

2.2 Getting LPCD mode configured on CLRC663 family

- Connect the CLRC663 Reader and execute the LPCD_ModeConfig_Part1.jcf without card in the field.
- Note the I and Q values. See Fig 5 for more details.

Serial	Action	
Dpen	Select JCF Dverride Name: LPCD_ModeConfig_Part1	Process JCF
<u>Close</u> All to 115 kbps	Register I/O	Reload JCF
Command Line		Process
Iperation Status		
C:\Data\work\RC663\RC663	\LPCD Neu\LPCD_ModeConfig_Part1.jcf	
TOM2: 115200 0 N		
soma, priazoo jo ja		
2 07 7F	// (Status: 0x0000)	*
Q DE 33	// (Status: 0x0000)	
R 00 01	// (Status: 0x0000)	
R 08 10	// (Status: 0x0000)	
R 09 62	// (Status: 0x0000)	
R 07 // dat	a == 4B // (Status: 0x0000)	
R 08 00	// (Status: 0x0000)	
R 09 00	// (Status: 0x0000)	
R 06 // dat	a == 20 // (Status: 0x0000)	
R 00 00	// (Status: 0x0000)	
	// (Status: 0x0000)	
R 02 B0	// (Status: 0x0000 Value	
R 02 B0 R 0E 03	// (Statue 0x0000) GIGO	
R 02 B0 R 08 03 R 39 00	// (Sestus: 0x0000)	
R 02 B0 R 0E 03 R 39 00 R 38 12		
R 02 B0 R 02 03 R 39 00 R 38 12 R 23 78	(Status: 0x0000)	
R 02 B0 R 02 03 R 39 00 R 38 12 R 23 78 R 07 //dat	a == 17 // (Status: 0x0000)	
R 02 B0 R 0E 03 R 39 00 R 38 12 R 23 78 R 23 78 R 07 //dat X Get I	a == 11 // (Status: 0x0000) a == 11 // (Status: 0x0000)	
R 02 B0 R 0E 03 R 39 00 R 38 12 R 23 78 R 23 78 R 07 // dat /< Get I R 42 // dat	a == 14 // (Status 0x0000) a == 14 // (Status 0x0000)	
R 02 B0 R 02 03 R 39 00 R 38 12 R 23 78 R 23 78 R 07 // dat /< Get I R 42 // dat	a == 11 // (Status: 0x0000) a == 14 // (Status: 0x0000) a == 14 // (Status: 0x0000)	
R 02 B0 R 0E 03 R 39 00 R 38 12 R 23 78 R 23 78 /< Get I R 42 // dat /< Get 0 R 43 // dat	a == 11 // (Status: 0x0000) a == 14 // (Status: 0x0000) a == 25 // (Status: 0x0000)	
R 02 B0 R 0E 03 3 39 00 1 38 12 2 23 78 2 07 // dat 2 Get I 2 42 // dat 2 Get Q 1 43 // dat 2 43 // dat	a == 14 // (Status: 0x0000) a == 14 // (Status: 0x0000) a == 25 // (Status: 0x0000)	

• Open the LPCD.xls Excel sheet and insert these values. The threshold values will be calculated accordingly for register 3F, 40 and 41. See Fig 6 for more details.

											(0	values	here	~	Q			25				
1												—				LOUE		_	14				
_	set 3F	1.18.4	Hex	45												bQMin			24		_		
		DIIVIAX	-	15	0	0	0			0	1		N.			bulviax			20				
				30	0	0	1			0	0	-	4			DIIVIIN			15				
-		Result of AND			0	0	0			0	0	<<	2			DIIVIAX			15		-		
-		Result of shift	-		0	1	0			0	0		R			TH value	es		1				
-		bQIMin	~	24	0	0	1			0	0	-	0				-	1.1	-				
U		Result	64		0	1	11	0 0	1	0	0					Reg	1	/alue					
1			-													Set 3F	6	54					
2			11					-				-				Set 40	ł	00	-		-		
5	set 40	1.11.4	Hex			~							-			Set 41	5	0.5	-				
4		bilviax	-	15	0	0	0			0	1		N.			-		T	-		_		
0		-		00	0	0	0 0			0	0	-	4										
0		Result of AND			0	0	0			U	0	<<	4					1					
1		Result of shift	-	0.0	0	1	0			10	0		8			A			-		-		
ö		bQIVIax	00	26	0	0	1			1	0	-	•		aet	thresh	o	d v	alu	es			
9		Result	66		0	1	1	5 1	1.1	1	0	-			for	Dogiet	or	20	10) 200	-	_	-
4			-												101	regist	CI	51	, 40	and	-		
1	a at 11		Linx		-			+	+	-	-				41	nere	-				1		
2	set 41	hiMay	пех	15	0	0	0	1 0	-	0	1		0										
2		DIIVIAX	-	10	0	0	0			1	4		N.				-		-				
+		Dogult of AND	-	3	0	0	0			0	1		e e										
G	-	Result of AND			0	1	0	0 0		1 0	0		0				-				-		
7		hMin	-	13	0	0	0	1 0		1	1		OH										
2		Docult	53	10	0	1	0	1 (1	1	-											
a		Result	55		-	-	0				-												
0			-						٠														
1			-							+							-						
2		1	-					+	+		-						-				-		
3			1							t													
A																							

• Open the **PCD_DetectPICC_Part2.jcf** file with an editor and fill in the calculated threshold values for 3F, 40 and 41.

```
//>
1
     //> Insert 2 ISO14443-3A Cards in HF.
2
3
     //> ------
4
5
     //
6
     // Example, Asumming Q=0x13, I=0x0C
7
     11
8
     11
         bQMin = Q-1; // 0x12
9
     //
          bQMax = Q+1; // 0x14
10
    11
        bIMin = I-1; // 0x0b
    //
11
          bIMax = I+1; // 0x0d
12
    //> 1. Set QMin register = bQMin | ((bIMax & 0x30) << 2));</pre>
13
14
     SR 3F 64
15
16
    //> 2. Set QMax register = bQMax | ((bIMax & 0x0C) << 4));</pre>
17
     SR 40 66
18
     //> 3. Set IMin register = bIMin | ((bIMax & 0x03) << 6));</pre>
19
```

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20 SR 41 53 21

```
22 //> Prepare LPCD command, power down time 10[ms]. Cmd time 150[µsec].
```

- Save the **PCD_DetectPICC_Part2.jcf** file with the new values and execute with the "RC663 Serial" program. The executed script should stay in a loop until a card is detected in the field.
- A correct detection is indicated when bit5 (LPCD_Irq) in register 07 is set. See Fig 7 for more details.

Serial	Action		Party and a state of the state	
Dpen	Select JCF	Overnde <u>N</u> ame:	LPCD_DetectPICC_Part2	Process JCF
				Beload JCE
Close	Register I/O			
All to 115 kbps				
Command Line				
				Process
12				
Operation Status				
C:\Data\work\RC663\RC6	63\LPCD Neu\LPCD_DetectPICC	Part2.jcf		
lanua larrar la la				
CUM3: 115200 0 N				
GR 00 // d	ata == 40 // (Status: (×0104)		
GR 00 // d	ata == 40 // (Status: 0	x0104)		
GR 00 // d	ata == 01 // (Status: 0	x0000)		
GR 07 // d	ata == 08 // (Status: 0	x0000)		
GR 00 // d	ata == FF // (Status: (x0000)		
GR 00 // d	ata == CO // (Status: C	x0000)		
GR 00 // d	ata == 00 // (Status: 0	x0000)		
GR 07 //d	ata == 68 // (Status: (x0000)		
SR 00 00	// (Status: 0	x0000)		
SR 08 00	// (Status: 0	x0000)		
CD 06 // 4	// (Status: 1	×0000)		
SP 02 B0 // a	AUA 20 // (Status: (×0000)		
GR DA // d	ata == 00 // (Status: 0	×0000)		
SR 39 00	// (Status: (x0000)		
GR 38 // d	ata == 52 // (Status: 0	x0000)		
SR 38 12	// (Status: 0	x0000)		
GR 23 // d	ata == 9F // (Status: 0	x0000)		
SR 23 5F	// (Status: 0	x0000)		
//< Check if LPCD-Ir	ql(bit5) is set. PICC de	tected in PLCD	sequence.	
GR 07 // d	ata == 38 // (Status: 0	x0000)		
//< DONE				

Important note: If the program terminates unexpectedly without a card in the field, then a higher "TH value" in the calculation is required. Therefore, iteratively increase cell "Q8" in the LPCD.xls by one and try with the new threshold values.

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RATP/Innovatron Technology

3.4 Trademarks

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Application note

COMPANY PUBLIC

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