

Freescale Semiconductor

User's Guide

WCT1000 A11 Reference Design System User's Guide

1 Introduction

This document describes how to use the 5 W low power wireless charger transmitter WCT_A11 reference board designed by Freescale. The A11 Reference solution is compliant with the WPC Qi V1.1 specification. It is a low cost reference solution which can be easily customized through the FreeMASTER GUI tool.

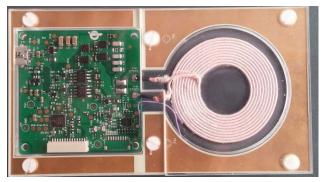


Figure 1 WCT_A11 reference board

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2 System Features

The WCT_A11 reference board has these features:

- Reference design that is compliant with low-power WPC Qi version 1.1 specification
- Integrated digital demodulation in chip
- Supports multiple types of Rx modulation signals (AC capacitor, AC resistor and DC resistor)
- Supports FOD and supports four types of Foreign Object protection
- Supports Resonance Shift FOD (RS FOD)
- Supports the Qi 1.1 receiver with 5 V DC@1A output power capability
- Super low standby power
- Full bridge topology with the freqency modulation power control strategy
- LED for Rx and Tx alignment indication
- Input voltage/current, coil current sensing for protection
- FreeMASTER GUI tool to enable customization and calibration

3 Package Checklist

Table 1 Package checklist

Name	Count
A11 Tx board with Tx coil	1
JTAG/UART debug board and cable	1
5V/2.4A DC power adapter	1

4 System Block Diagram

A11 Tx runs with Rx as shown in this figure to transfer power from the primary to the secondary side.

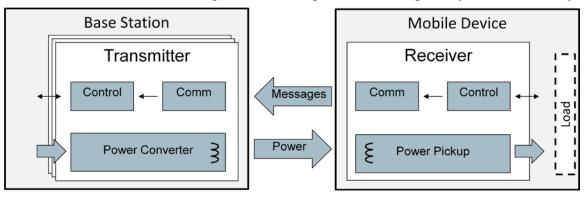


Figure 2 Wireless Charging system overview

Get WPC Qi information from: www.wirelesspowerconsortium.com/developers/.

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5 Hardware Description

5.1 Reference board block diagram

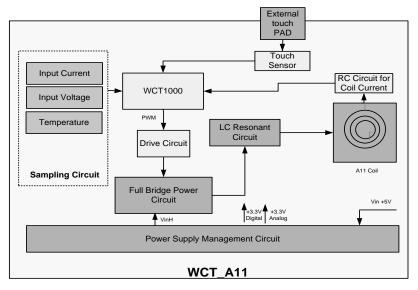


Figure 3 WCT_A11 board block diagram

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5.2 Modules explanation

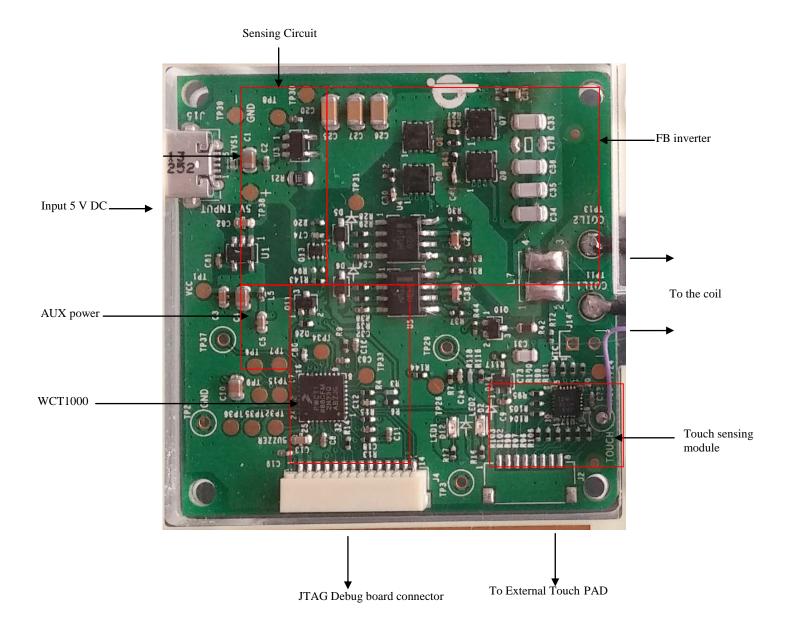


Figure 4 WCT_A11 board modules overview

• Controller

Freescale WCT1000 chip is the central controller of the WCT_A11 board. It has rich I/O modules with low power consumption. It processes communication signals, controls power transfer start/stop, and controls a full bridge PWM inverter for output power control. These are the I/O modules used in this application:

• Two PWM channels for full bridge DC/AC inverter control



- o Three Timers for system timers and communication
- ADC for input voltage and current, coil current sampling
- GPIOs for pre-drivers control, low power, and LED control
- SCI for serial port debugging
- o I2C for touch sensor MPR121 control
- Inverter

The full bridge PWM control inverter converts 5 V DC input voltage to a higher AC voltage. The PWM frequency follows the WPC Qi specification, in the range of 110 KHz–205 KHz. The PWM duty is 50%, and starts duty control (50%–10%) when frequency is 205 KHz. Lower frequency gets a larger output power. Input voltage range: 4.5–5.5 V DC

Output voltage range: 5–20 V AC

Communication

The communication of 2 kbps signal is demodulated from high frequency coil current AC signal (110 KHz–205 KHz). The RC sensing circuit gets resonant coil current and inputs to ADC for sampling. Digital demodulation module processes the input samples and extracts communication packets.

• Touch sensing for low power mode

The board supports super low power mode with Freescale touch technology. When it is not charging, the controller shuts down the analog circuit power and activates the MPR121 touch sensor. WCT1000 runs in the LPSTOP mode to wait for the wakeup signal from touch. The user should connect an external electrode (placed around Tx coil) to TP28 or J2 on the board to enable touch. For details about the MPR121 sensor, navigate to <u>freescale.com</u> and search for "Touch Sensors".



6 Getting Started

Freescale provides a SW package to modify WCT_A11 functions. The user can modify the system parameters or configurations to maintain system functionalities. For example, when either the Tx coil or main power components are changed, the user should calibrate to start the FOD. This document describes the basic debugging environment on WCT1000. For A11 software details, see the *WCT1000 TX Library User Guide* (WCT1000LIBUG).

6.1 System developing environment

Tx board debugging uses CodeWarrior and the FreeMASTER tool.

- 1. Set up the debugging connection as shown in Figure 5. The debugger and debugging board is between the PC and Tx board.
- 2. Connect a debugger (USBTAP or P&E-Multilink FX) to the JTAG port of a debugging board, and connect the debugging board to a Tx board through a 14-pins cable.

Figure 5 shows the connection and Figure 6 shows the real image.

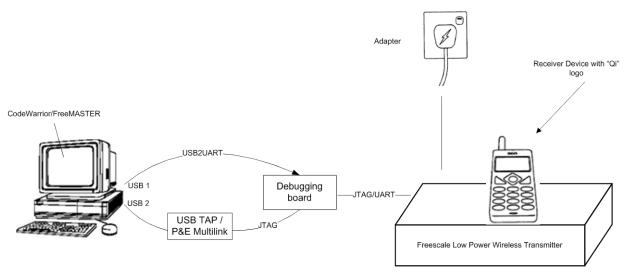


Figure 5 Debugging connections



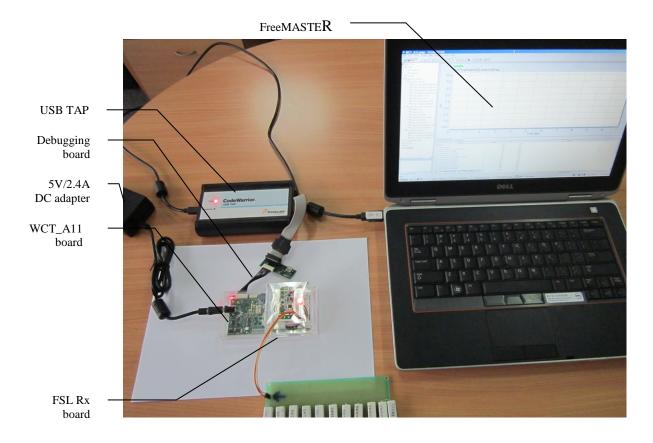


Figure 6 Developing environment

For details about the USB TAP debugger, see <u>freescale.com</u> and then search for "USB TAP for Once DSC".

For details abut the P&E-Multilink FX debugger, see <u>freescale.com</u> and then search for "U-MULTILINK-FX". It will take you to the "U-MULTILINK-FX: Universal Multilink FX High-Speed Development Interface" page.



6.2 Downloading and debugging firmware with CodeWarrior 10 IDE

6.2.1 Connecting the JTAG debugger

After CodeWarrior version 10 is installed, connect the Freescale MCU JTAG debugger, USB TAP, or P&E Multilink to the A11 board. The cable plug-in direction is shown in these figures.



USB to PC

Figure 7 Debugger connections



When the debugger is plugged onto the PC, the device can be found in Windows "Device Manager", as shown in these figures.



USB TAP



P&E Multilink

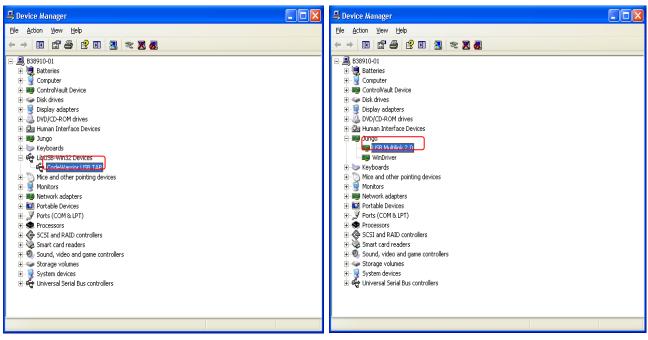


Figure 8 USB TAP debugger plugged in

Figure 9 P&E multilink debugger plugged in



6.2.2 Downloading an existing WCT1000 project with CodeWarrior version 10

To download an existing WCT1000 project with CodeWarrior version 10, perform these steps:

1. Set the CodeWarrior version 10 Workspace.

Open CodeWarrior version 10, and set the workspace to WCT1000 example project, wpt-tx.

🥦 Workspace Launch	ier 🛛
Select a workspace	
CodeWarrior Developmen Choose a workspace folde	t Studio stores your projects in a folder called a workspace. er to use for this session.
Workspace: D:\User	Browse
	Select Workspace Directory
Use this as the default	Select the workspace directory to use.
	Cancel
Pac.	🗑 🛅 SourceInsight
	H C Spec
🗾 🎽 TI	System Volume Information Temp
	E Test
-LMP_ER	🗉 🗁 Tools
	Comparison of the second
	Folder: User
	Make New Folder OK Cancel

Figure 10 Setting the CodeWarrior version 10 workspace (1)

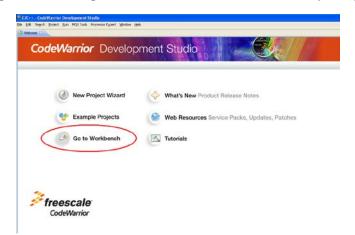


Figure 11 Setting the CodeWarrior version 10 workspace (2)



- 2. Update the MWCT1xxx service pack.
 - a. Download the CW MCU v10.5 Wireless Charging MWCT1xxx Service Pack:
 - b. Go to freescale.com and search for "CodeWarrior for MCU 10.5 Updates".
 - c. Install the service pack in CW10:
 - d. Select "Help -> Install New Software" from the tool bar.

🥦 Install		• X
Available Software Select a site or enter the location of a site.		
Work with: ⁰ type or select a site	Find more software by working with the <u>"Available Software Sites"</u> p	Add preferences.
type filter text		
Name	Version	
There is no site selected.		
Select All Deselect All		
Details		÷
Show only the latest versions of available software	Hide items that are already installed	
Group items by category	What is <u>already installed</u> ?	
Show only software applicable to target environment		
Contact all update sites during install to find required software		
(f)	< Back Next > Finish	Cancel

Figure 12 Updating the MWCT1xxx service pack (1)

e. Select "Add -> Archive" to set the path of the upgrade patch.

🎾 Add Re	pository	X
Name:		Local
Location:	jar:file:/C:/Users/b46685/Desktop/com.freescale.mcu10_5	Archive
?	ОК	Cancel

Figure 13 Updating the MWCT1xxx service pack (2)



f. Select "MCU v10.5 DSC Service Packs" and click "Next" to install the patch.

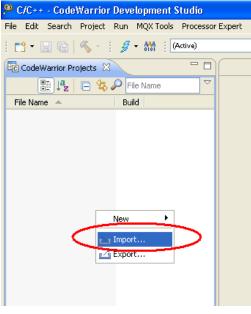
🥦 Install	
Available S	
Check the i	items that you wish to install.
Work with:	file:/D:/workspace/MCU/MCU_SP/com.freescale.mcu10_5.MWCT100x_MWCT1101_MWCT1200.win.sp/buildRepo - n 👻 🛕dd
	Find more software by working with the <u>"Available Software Sites"</u> preferences.
type filter te	xt
Name	Version
<u>Select Al</u> Details	MCU v10.5 DSC Service Packs
	12
Show only	y the latest versions of available software 🔲 Hide items that are already installed
☑ <u>G</u> roup iter	ms by category What is <u>already installed</u> ?
Show only	y software applicable to target environment
☑ Contact a	Il update sites during install to find required software
?	< <u>B</u> ack <u>Next</u> <u>Finish</u> Cancel

Figure 14 Updating the MWCT1xxx service pack (3)

g. Restart Code Warrior10 automatically after installation is completed, and then the MWCT1xxx Service Pack can be used.



- 3. Import the project.
 - a. Right-click in the "CodeWarrior Projects" window and choose "Import" to import an existing project, as shown in these figures. If the "CodeWarrior Projects" window is not displayed, open it through Window -> Show View -> CodeWarrior Projects.





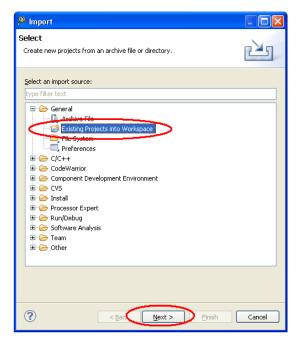


Figure 16 Importing a project (2)



b. Select the project directory, as shown in these figures.

🥦 Import	
Import Projects Select a directory to sea	rch for existing Edipse projects.
 Select root directory Select archive file: 	Browse
Projects:	Browse For Folder
Copy projects into Working sets	Select root directory of the projects to import
Working sets:	Folder: WCT1000_A11_V3.3 Make New Folder OK Cancel
?	<pre>Seck Next > Finish Cancel</pre>

Figure 17 Importing a project (3)



c. Select the project found by CodeWarrior version 10.

🔑 Import	
Import Projects Select a directory to search for existing Eclipse p	rojects.
Select root directory: D:\User\WCT1000_V2 Select archive file: Projects:	2.0_Beta\wpt-tx Browse Browse
WCT_A11_Demo (D)User\WCT1000_V2	:.0_Beta\wpt-tx\example\' Select All Deselect All Refresh
Copy projects into workspace Working sets Add project to working sets	
Working sets:	Sglect
? < <u>B</u> ack №	ext > Einish Cancel

Figure 18 Importing a project (5)

- 4. Build a project.
 - a. Click the project name in the project window shown below, and select build configurations -> Debug or Release build. Debug build includes more debug information.

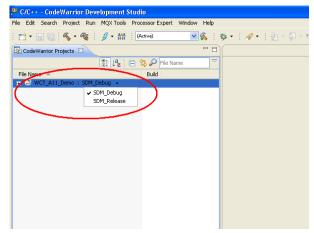


Figure 19 Building a project (1)



b. Right-click the project name, "WCT_A11_Demo : SDM_Debug", and then select "Build Project", "Clean Project", or "Close Project". You can also perform build from "Project".

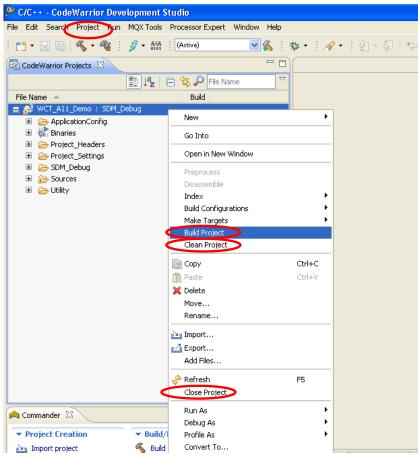


Figure 20 Building a project (2)



- 5. Download the project.
 - a. After the project is built, the MCU binary files are generated to a folder, with the same name as the build configuration name, "SDM_Debug".
 - b. Download the project from the "Debug" drop-down list, or from "Run -> Debug".
 - c. In "Download Configurations", select a download configuration according to your build configurations and debugger type, USB TAP, or PnE Multilink.

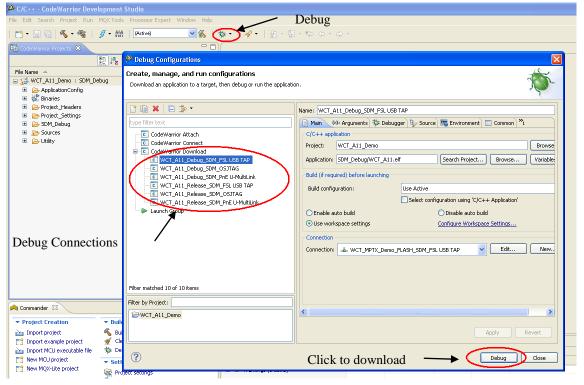


Figure 21 Downloading the project



d. After the project is downloaded, the MCU stops at startup code. Press F8 to release the MCU.

Go Pause Stop Step	Watching windov	w for Vari	ables, Registers, Memory, and Breakpoi	ints
Dubug: WCI_A11_DomoGYrajerij dtill gy/Startury Cald/USC 6F227cc_1nit.anmCode/Working Development Starting for Search 2014 and 2014 a	Image: The second sec	St Memory Bit Module Value 0x0000000 0x0000000 0 Value 0x00000000 Value 0x00000000 0 Value 0x000000000 0 0 0 0		
B MCSMR07n.jm.im II S:Plinit_HCSGR027not_ISR_JMW_RESET:	15	- 0	El Deassenbly 2 C do 2 do 2 do 2 do 2	
62 ; ensure 74-0 (requir 63 ; ensure 54-0 (requir 64 ; ensure 51-0 (requir 65 ; 66 ; ensure 12-0 to disk 67 ; setup the mOI register for linear addressing 69 move.v #-1,x0	le harvard architecture ed for C)		57 bbfeet ANL BODE,omt ; ensure NL-1 A 58 nop 59 nop 59 nop 60 bbfet #0x1000,008 50 bbfet #0x10e,000 60 bbfet	 Disassembly
Importanter St. Important Important <th< th=""><th></th><th></th><th></th><th></th></th<>				
(c)	6			

Figure 22 Project downloaded

6.2.3 Downloading an existing WCT1000 bin file (.s) with CodeWarrior version 10

To flash an .s file, perform these steps:

1. From the Flash Programmer drop-down list, select "Flash File to Target".

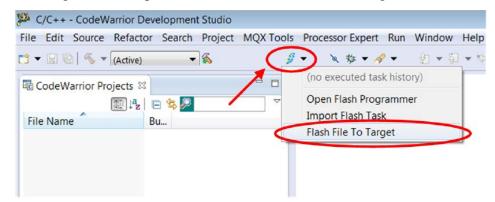


Figure 23 Selecting Flash File to Target



2. Click "New" to create a new connection.

Erase and program flash devices. Please specify a target task name.	
Connection Connection:	- Edit New
Flash Configuration File	
MWCT1000.xml	▼ Browse
Unprotect flash memory before erase	
File to Flash File:	Browse
Offset: 0x 0	
✓ Save as Target Task Task Name:	
•	Erase Whole Device Erase and Program Close

Figure 24 Creating a new connection

3. Enter a connection name and click "New" to create a target.

Hardware or Simulator Connection S Connection name is not unique for the selected profile.				
Parent profile:	B46685-11			•
Name:	WCT_A11_USB_TAP	>		
Template:	None		•	Apply Defaults
Target: Connection type:		•	Edit	New
(?) < Ba	ick Next >		inish	Cancel

Figure 25 Creating a target



4. Enter a target name, and then select "MWCT1000" from the "Target type" drop-down list.

Hardware or S	Simulator Target e" is undefined.		
Parent profile:	B46685-11		•
Name:	WCT_A11		
Description:			
Template:	None	-	Apply Defaults
Target type:		*	Edit
	⊳ dsc.MC56F844xx	<u>^</u>	
	b dsc.MC56F845xx		
	b dsc.MC56F847xx		
	▲ dsc.MWCT10xx		
	MWCT1000		
	MWCT1001		
0	MWCT1003		Cancel
J	MWCT1101	-	Cancel

Figure 26 Selecting MWCT1000

5. Select "Execute reset" and "Initialize target", set the initialization file path to the CodeWarrior version 10 installation folder, and select "MWCT1000.tcl" for the WCT1000 chip. The general path is:

C:/Program files/Freescale/CW10.5/CW MCU v10.5/MCU/lib/wizard_data/DSC/DataBase/init_files

	Simulator Target I for a hardware-based or simulated target.	
Parent profile:	B46685-11	
Name: Description:	WCT_A11	
Template:	None	▼ Apply Defaults
Target type:	MWCT1000	▼ Edit
Initialization	Memory	
Execute r	out of reset	v10.5\MCU\lib\wizard_data\DSC\DataBase\init_file(MWCT1000.tc)
		Enables target initialization via script
?		< Back Next > Finish Cancel

Figure 27 Setting the initialization file path



6. Set the memory configuration file path. For the WCT1000 chip, it is MWCT1000.mem, located under the CodeWarrior version 10 installation folder. Then, click "Finish".

The general path is:

C:/Program files/Freescale/CW10.5/CW MCU v10.5/MCU/lib/wizard_data/DSC/DataBase/mem_files

	Simulator Target n name is not unique for the selected profile.	
Parent profile:	B46685-11	•
Name:	WCT_A11	
Description: Template:	None	Apply Defaults
Target type:	MWCT1000	▼ Edit
Initialization	Memory	
Memory	configuration E\Program files\Freescale\CW10.5\CW MCU v10.5\MCU\lib\wizard_data\DSC\DataBase\mem_files\W	/CT1000.mem 🛄
?	< Back Next > Finish	Cancel

Figure 28 Setting the memory configuration file path

7. Select "USB TAP" or "P&E DSC Multilink/Multilink Universal/Cyclone Pro/OSJTAG" for the connection type. Then click "Finish".

rent profile: B46685-11 me: WCT_A11_USB_TAP scription: mplate: None		
escription:		
NI NI		
mplate: None	-	Apply Defaults
rget: 🖥 WCT_A11	₹ Edit	New
onnection type USB TAP		•
Connection Advanced USB TAP USB serial number: BDM settings BDM clock speed (kHz): 1000		
CCS server		
Automatic launch Server port number: 41475		
CCS executable:		
Manual launch		
Server hostname/IP: 127.0.0.1		
Server port number: 41475		
✓ Connect server to TAP		

Figure 29 Setting the connection type



8. Set the Bin file path. Before downloading, you can save the configuration to the workspace for next-time downloading. Click "Erase and Program".

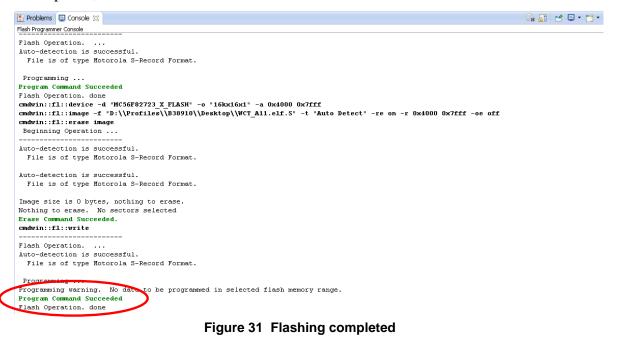
Note: The file path should contain only English letters. Otherwise, the flash cannot recognize it.

For the new board, "Erase Whole Device" should be executed when you select "WCT_A11.elf" as the Bin file.

	ogram flash d er interface for F	evices. ash Programmer					
Connection	-						
Connection:	- WCT_A11_U	ISB_TAP		•	Edit		New
Flash Configu	uration File						
MWCT1000.3	xml					•	Browse
Unprotect	flash memory b	efore erase					
File to Flash File:	workspace loc://	VCT A11 Demo/SDN	M_Debug/WCT_A11.elf.S}	<u>, </u>			Browse
Offset: 0x 0		File size is 0xf8c0 b					
🕢 Save as Ta	-						
Task Name:	Flash_A11						
?			Erase Whole Device	rase and	Program		Close

Figure 30 Setting the bin file path

9. The flashing progress is displayed in the CodeWarrior version 10 console window. After flashing is completed, reset the board to run the WCT1000.





6.2.4 Using the FreeMASTER GUI for calibration

Freescale provides the FreeMASTER GUI tool to calibrate and tune parameters. FreeMASTER configuration file WCT_A11.pmp is saved under /wpt-tx/example. See the *WCT1000 A11 Reference Design Calibration User's Guide* (WCT1000CALUG) for calibration. See the *WCT Runtime Debug User's Guide* (WCT1000RTDUG) for A11 parameters tuning. For the FreeMASTER tool, see freescale.com/Freemaster.

WCT_A11n.pmp - FreeMASTER							
e Edit View Explorer Item Project To		a fact colori					
🎢 🖬 🚳 💽 📴 😭 🎒 🦛 🔶 🖞							
Power Loss							
	WCT GUI	for Low	Power	5\N/ A11	Ту	- <u>**</u>	
🕰 power loss 📲 debug			FOwer	JWAII	1	freescale semiconductor	
Rx Rx	Debug System Params	Coil Params	Calibration	NVMraw		hex 🔿 dec 💿	
🔆 Frequency 🔆 Calculated Currents	Debug System Parants	COILParallis	Calibration	NVMIdW			
Raw Currents	Common for all	Read Write	SetDef	ault			
	Digital Ping	rioda milo	00.00	duit			
	Frequency (Hz)	Devel March	175000	This paramotor dofi	nos the coil froque	nov to be used during	
	Frequency (Fiz)	Read Write	175000		vice detection).NC specification of 17		
	Pulse Duration (ms)	Read Write	65			time the Ping frequency vice detection. Value 0 to	
	Ping Interval (ms)	Read Write	400			time between attempts to on. Value 0 to 65535.	
	Analog Ping						
	Frequency (Hz)	Read Write	175000	This parameter defi Analog Ping operat 4294967295.		ncy to be used during tection). Value 0 to	
	Min Coil Current (ADC counts)	Read Write	5	Ping has detected a	a fault in the resona ount is not greater	than this value, the unit will	
	Coil Current Threshold (% change)	Read Write	5			above which an Analog device presence. Value 0	
	Duty Cycle (%)	Read Write	50	This parameter defi Ping operations. Va		to be used during Analog	
	Pulse Duration (#	Read Write	₩З	This parameter defi	nes the number of	cycles that the coil shall	
	<						
	control page						
	SignalStrength		148	Value DEC	Unit 100	Period	
	RunTimeParams[0].byPercentPowerUsed		93	DEC	100		
	RunTimeParams[0].wMeasuredCoilCurrent		1601 5207	mA V	300		
	RunTimeParams[0].wMeasuredInputVoltage RunTimeParams[0].dwMeasuredInputCurre		5207	v mA	300		
	RunTimeParams[0].wOverCurrentLimit		20641	DEC	200		
	RunTimeParams[0].wDeviceFaultStatus RunTimeParams[0].wMaxHalfWatts		0 10	DEC	100		
	Run TimeParams[U].wMaxHalfWatts Run TimeParams[0].wActiveDutyCycle		10	DEC	100		
	RunTimeParams[0].wFreqStep		50	Hz	200		
			50 127542	Hz Hz	200		

Figure 32 FreeMASTER GUI tool



To set up a FreeMASTER connection to the target board, perform these steps:

1. Set a symbol file for your project.

Select a symbol file from FreeMASTER Project -> Options -> MAP Files, as shown in the following figure.

Optio	ns	
Com	m MAP File	es Pack Dir HTML Pages Demo Mode
Defa	ault symbol fi	e: \WCTxxxx\WCTA11demo\MPTX1\SDM_Debug\WCT_A11.elf
<u>F</u> ile I	format:	Binary ELF with DWARF1 or DWARF2 dbg format. 💌EditDej
-	of all valid ool files:	.\\WCTxxxx\\WCTA11demo\MPTX1\SDM_Debug\\WCT_A11.el <u>New</u> Del View
		Note: The file selected in the list will be used as default symbol file when the project is opened
		On Load Let the user select starting symbol file Synchronize variables each time the symbol file loads List errors (variables using undefined symbols) Always C Except after project load
		OK Cancel Apply Help

Figure 33 Selecting a symbol file



2. Configure the USB TAP debugger.

Select "JTAG/OnCE" in Freemaster Project -> Options -> Comm as shown in the following figure.

Options	×
Comm MAP Files Pack Dir HTML Pages Demo Mode	
Communication	- I
◯ Direct RS232: Port: COM4 💌 Speed: 9600 💌 Timeouts	1
Plug-in Module FreeMASTER CodeWarrior-CCS JTAG/OnCE Communicatio	
Connect string: addr=localhost;core=56F8xxx Configure	
\Box Save settings to project file ∇ Save settings to registry, use it as default.	
Communication state on startup and on project load	
Open port at startup Open port at startup	
C Store port state on exit, apply it on startup	
Store state to project file, apply upon its load Advanced.	
OK Cancel Apply Hel	p

Figure 34 Options dialog box



3. Configure the P&E Multilink FX debugger.

Select "FreeMASTER BDM JTAG/OnCE" in Project -> Options -> Comm as shown in the following figure.

Options	×
Comm MAP Files Pack Dir HTML Pages Demo Mode	
Communication	
O Direct RS232: Port: COM4 💌 Speed: 9600 💌 Timeouts	
Plug-in Module: FreeMASTER BDM JTAG/EOnCE Communication Plug-in (5)	
Connect string: drv=0;ptype=3;pnum=1;devid=PE5750206 Configure	
\square Save settings to project file \square Save settings to registry, use it as default.	
Commu <u>n</u> ication state on startup and on project load	
Open port at startup Open port at startup	
Store port state on exit, apply it on startup	
Store state to project file, apply upon its load <u>Advanced</u>	
OK Cancel Apply Help	

Figure 35 Options dialog box

6.2.5 Enabling or disabling board functions

Freescale provides full-featured wireless charging functions on the reference board. If you do not need a function, you can disable it with the definitions in the header file or with the parameters in the FreeMASTER GUI.

These header files are used to enable or disable functions, and configure a low-level driver.

/lib/MPTX_A1/wct_a11/wct_hal_cfg.h

/example/WCTxxxx/WCTA11demo/MPTX1/Sources/application_cfg.h, peripheral_cfg.h

In application_cfg.h, you can configure these functions:

- Low power mode enable/disable #define LOW_POWER_MODE_SUPPORTED TRUE // FALSE for calibration or debug on FreeMASTER GUI.
 Low power mode by Touch enable/disable
- #define LOW_POWER_MODE_BY_TOUCH TRUE // FALSE if touch sensor is not needed.
- Low power mode by Analog Ping enable/disable #define LOW_POWER_MODE_BY_ANALOG_PING TRUE // FALSE if low power mode when analog ping is not needed.
- Sound enable/disable #define SOUND_SUPPORTED TRUE // FALSE if sound is not needed.
- FOD enable/disable #define FOD_ENABLE TRUE // FALSE if you don't want FOD working.
- Freemaster support enable/disable



#define FREEMASTER_SUPPORTED TRUE // FALSE if you don't want Freemaster working.

Note: Low power mode by Touch mode and low power mode by analog ping, only one can work at a time.

6.2.6 Enable RS FOD function

RS-FOD (Resonance Shift FOD) is one optional solution to detect FO in standby mode, when Rx is not on the surface of Tx. This can ensure that the charging never starts power transfer if FO is present. It does not belong to Qi 1.1, so the feature is disabled in the demo image. However, you can enable it by the following steps if the feature is required. Additionally, the feature cannot work with the touch sensor feature simultaneously.



The steps of enabling this function are as follows:

1. Right-click the project, and choose "Properties".

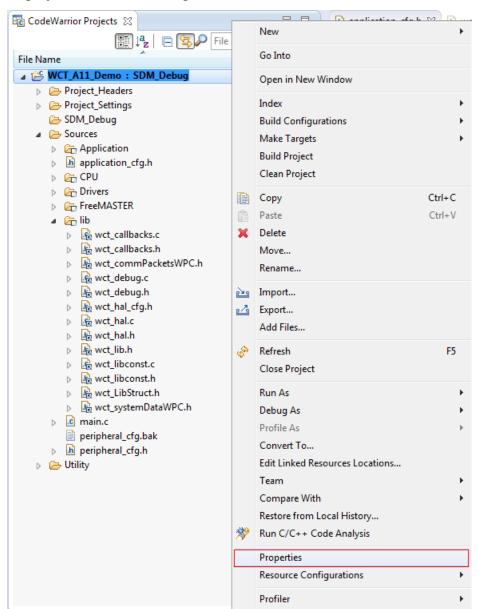


Figure 36 Choosing the properties of project



2. Choose C/C++ Build -> Setting -> DSC Linker -> Input, as shown in the following figure.

Properties for WCT_A11_Demo		X
type filter text	Settings $\diamond \star$	> • •
 Resource Builders C/C++ Build 	nhguration: [3UM_Uebug [Active]	<u>15</u>
Build Variables Discovery Options Environment Logging Settings; Tool Chain Editor ▷ C/C++ General Project Herences Run/Debug Settings	Tool Settings	8
	Second Strengthered Stren	
3		h +

Figure 37 Finding the additional libraries option

3. Double click "…/…/wct_mp1_SDM_Debug.lib" in "Additional Libraries", and change to "wct_mp1_RSFOD_SDM_Debug.lib". Then click "Save" and exit.

🥦 Edit file path	
File:	
"\${ProjDirPath}////lib/MPTX_A1/wct_mp1_RSF0	OD_SDM_Debug.lib"
Relative To: ProjDirPath	Variables
	Workspace
	File system
	OK Cancel
	Cancel

Figure 38 Modifying the relevant library

4. Set the macro RESONANCE_SHIFT_FOD to TRUE in wct_libconst.h, and confirm that macro LOW_POWER_MODE_BY_TOUCH in application_cfg.h is FALSE. Rebuild the project to make the RS FOD work.



6.3 Test

6.3.1 Signals on the board

Main signals on the A11 board are shown in this figure.

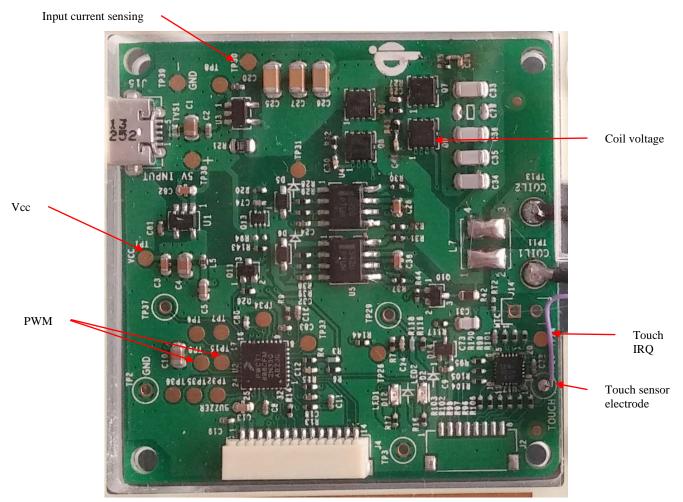


Figure 39 Test points on WCT_A11

- TP1: Vcc, controller input voltage 3.3V
- TP4: AUXP_Ctrl, power shut down signal when idle state
- TP8: Input current sensing
- TP26: Coil current sensing
- TP9&15: PWM1&2, PWM signals to pre-driver
- TP13: LC-Resonant voltage on the coil
- TP24: Touch_IRQ, wake up signal from touch sensor when receiver put on
- TP28: Touch sensing signal to an external electrode



6.3.2 Test environment

Set up the WCT_A11 test environment as shown in this figure by using the DC power supply and electronic load for input source and output load. Get the system efficiency by measuring the input and output power.

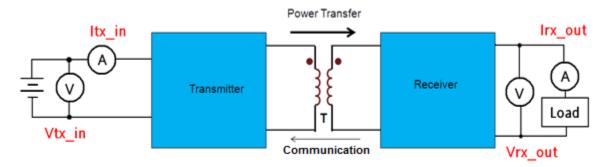


Figure 40 Test environment

WCT1000 A11 Reference Design System User's Guide, Rev. 3.3, 09/2014



6.3.3 Measurements

These are the examples to measure signals on the board.

1. Measure the signals when the Tx board works under ping and stand-by states, when Tx wakes up for charging, and from charging to power stop.

Ch1: Rx communication signal Ch2: TP4 AUX power on/off

Ch3: TP10 Coil voltage Ch4

Ch4: Coil current

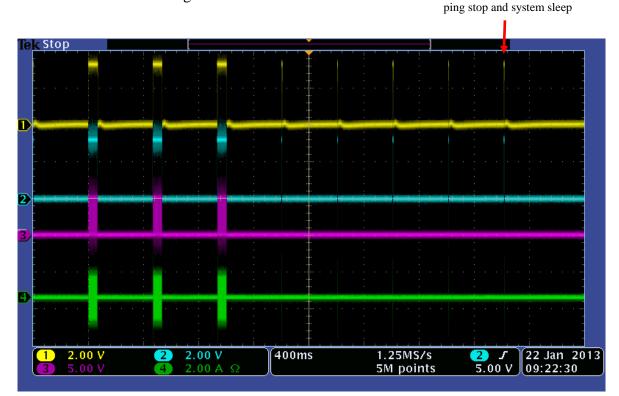


Figure 41 Signals from ping to sleep

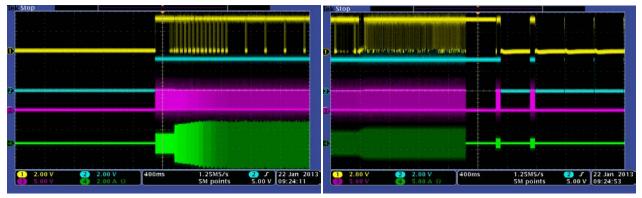




Figure 43 Signals when power stops

The AC signal frequency changes to adjust the output power when the load changes.



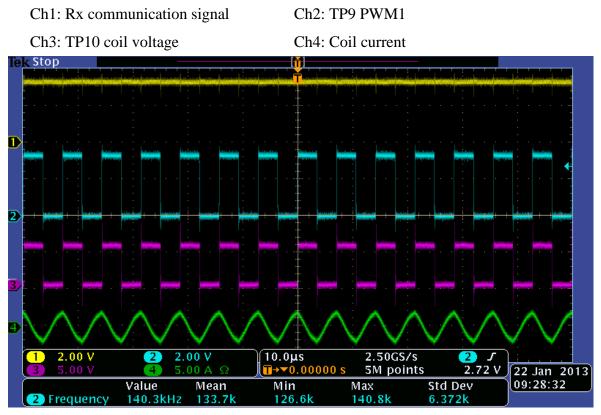


Figure 44 PWM frequency on 0.5 W power output

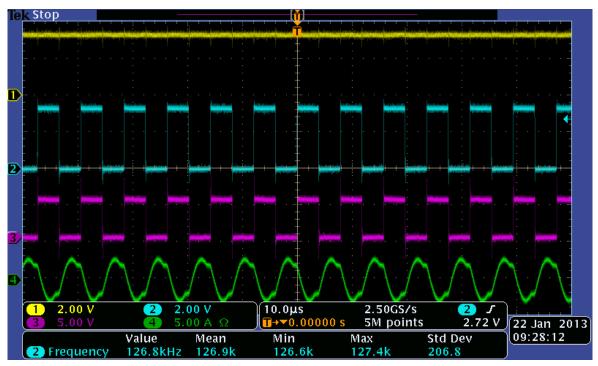


Figure 45 PWM frequency when 5W power output



2. System response measurement for load dump and load step test.

Ch1: Rx communication signal

Ch2: TP9 PWM1

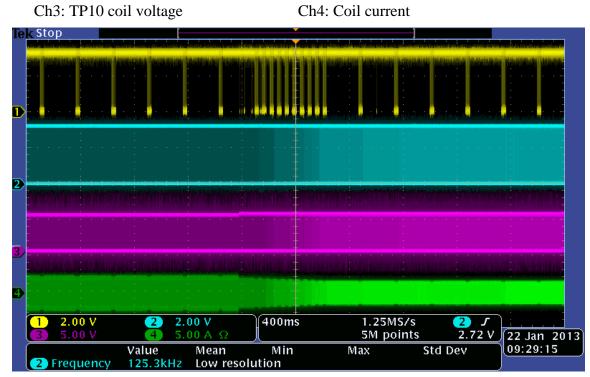


Figure 46 System response on load dump

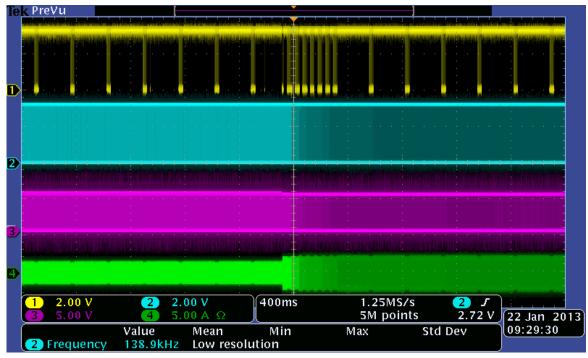


Figure 47 System response on load step



7 References

- Freescale wireless charging solution page: <u>freescale.com/wirelesscharging</u>
- Freescale MPR121 touch sensor page: <u>freescale.com/webapp/sps/site/taxonomy.jsp?code=SNSPROXIMITY</u>
- Freescale CodeWarrior 10 IDE page: <u>freescale.com/codewarrior</u>
- Freescale Freemaster tool page: <u>freescale.com/Freemaster</u>
- WPC page: <u>www.wirelesspowerconsortium.com</u>
- WCT1000 Documents:
 - o WCT1000 A11 Reference Design System User's Guide (this document)
 - o WCT1000 TX Library User's Guide (WCT1000LIBUG)
 - WCT Runtime Debug User's Guide (WCT1000RTDUG)
 - WCT1000 A11 Reference Design Calibration User's Guide (WCT1000CALUG)
 - o WCT1000 V3.3 Release Notes (WCT1000RN)



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