NXP Semiconductors
User's Guide

Document Number: WCT101XV10RTDUG
Rev. 0, 04/2019

WCT1012VLF/WCT1013VLH Consumer MP-A11 (WCT-15W1CFFPD) V1.0 Run-Time Debugging User's Guide

Contents

1 Introduction

NXP provides the FreeMASTER GUI tool for the WCT1012VLF/WCT1013VLH consumer EPP wireless charging solution (WCT-15W1CFFPD). The GUI based on the FreeMASTER tool can be used to fine-tune the parameters in a running state. For information on setting up the FreeMASTER connection, see the WCT1012VLF/WCT1013VLH Consumer MP-A11 (WCT-15W1CFFPD) V1.0 Wireless Charging Application User's Guide (document WCT101XVxxAUG).

2 Runtime tuning and debugging

2.1 NVM parameters

This section describes the configuration and tuning of the NVM parameters. The NVM parameters are initially stored in the Flash memory and copied from there to the NvmParams structure in RAM. Some parameters of the NvmParams structure are passed to the Wireless Charging Transmitter (WCT) library during initialization. The initialization data for the Flash-memory structure are stored in the *EEdata_FlashDefaults.asm* file.

The WCT GUI (based on the FreeMASTER tool) can be used to fine-tune the parameters. Use the same GUI to generate the assembler initialization data for the Flash-based configuration. Alternatively, you can use the WCT GUI to trigger the application and back up the actual RAM content of the data structure to the Flash.

The WCT GUI is prepared for the following application:

- *15W_MP/example/wct1013PD/wct1013pd.pmp*

Section 3 "NVM structure reference" provides detailed information about each configuration parameter. The same reference information is also available directly in the GUI tool, where the parameters can be changed at runtime.

2.1.1 Runtime access to NVM parameters

As outlined in the previous sections, the WCT GUI based on the FreeMASTER tool can be used to read and modify the parameters at run-time. The calibration parameters of the structure are modified immediately, so the Foreign Object Detection (FOD), Q-factor detection, and quick removal detection can be evaluated instantly. Other parameters for the library and protection are modified by the WCT GUI, but they do not take effect immediately. Modify these parameters in the debug mode, so that these parameters take effect when exiting the debug mode.

The NVM parameters are split to several tabs in the GUI view:

- Operation parameters
- Calibration

To make the fine-tuned configuration values permanent and default for the next application build, the whole structure is exported into the assembler syntax of the initialization data block. The generated data can be put to the *EEdata_FlashDefaults.asm* file directly and used as a new default configuration set.

In addition to the actual configuration values, the GUI also calculates proper checksum values to make the data block valid.

The exported initialization data block is available in the "NVMraw" tab in the GUI.

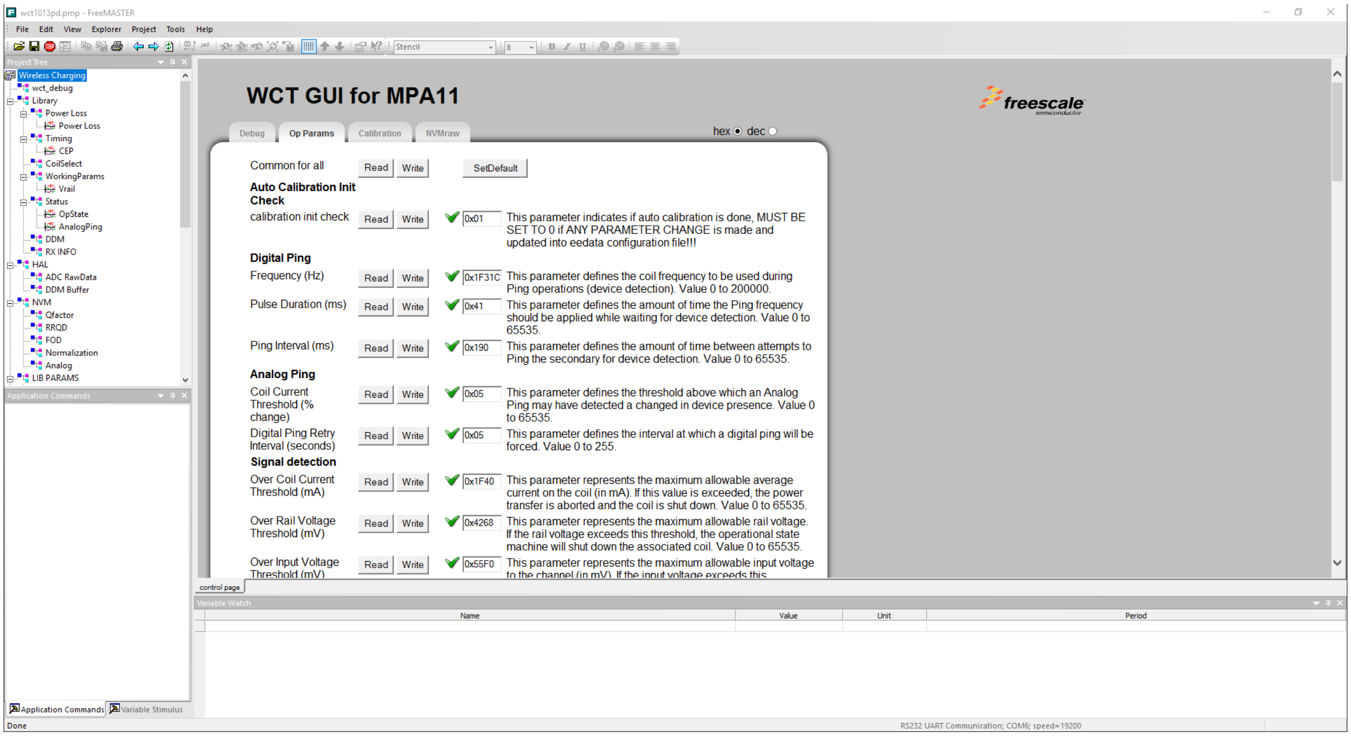


Figure 1. WCT GUI (1)

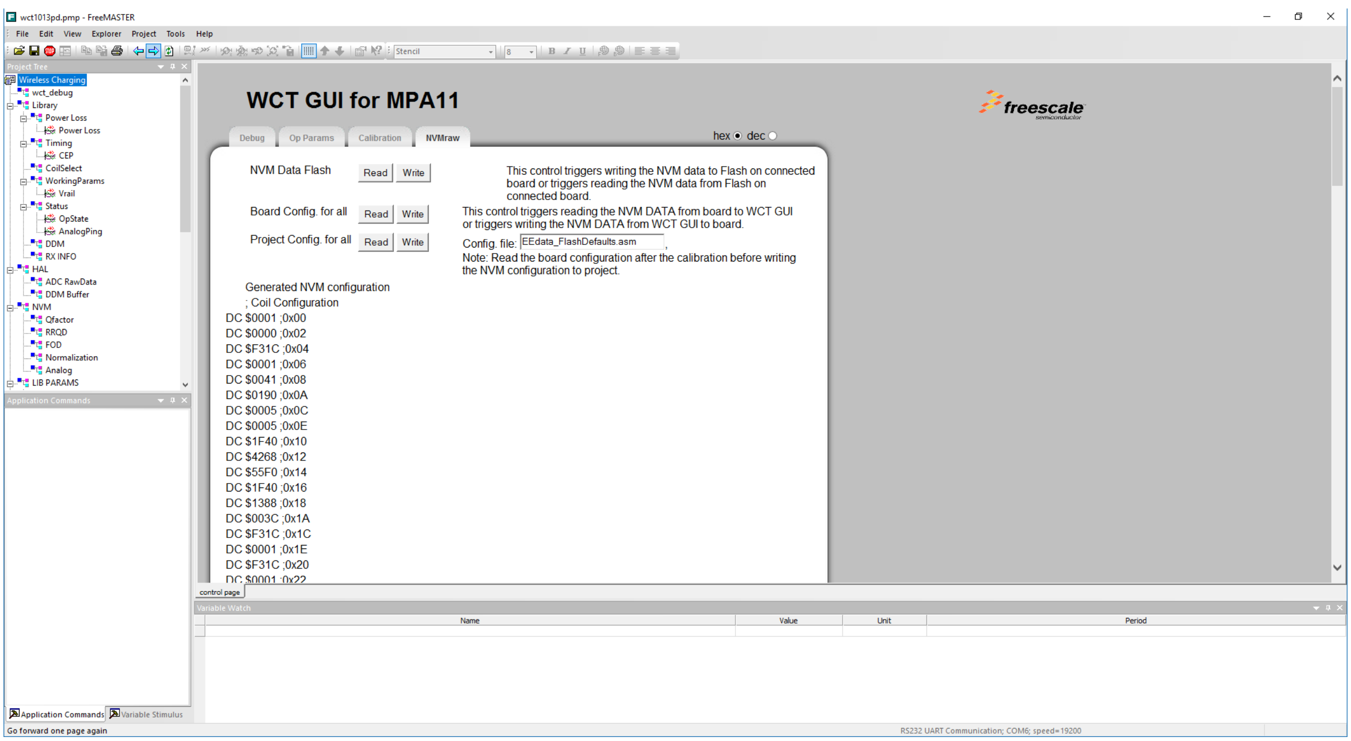


Figure 2. WCT GUI (2)

2.2 Tuning and debugging

The library is used together with the FreeMASTER visualization tool to calibrate the input values and observe the behavior of the wireless charging transmitter. The FreeMASTER tool connects to the target board via the UART or JTAG communication interfaces.

2.2.1 Data visualization

The FreeMASTER tool enables visualization of any variables or registers in the application running on the target system. This feature is useful for the wireless charging application to observe voltage and currents in real time using a graphical representation.

The FreeMASTER project file that comes with the library package contains pre-configured scope views with the most frequently used run-time parameters. The graphs and views are easily extended by more parameters or user-defined data.

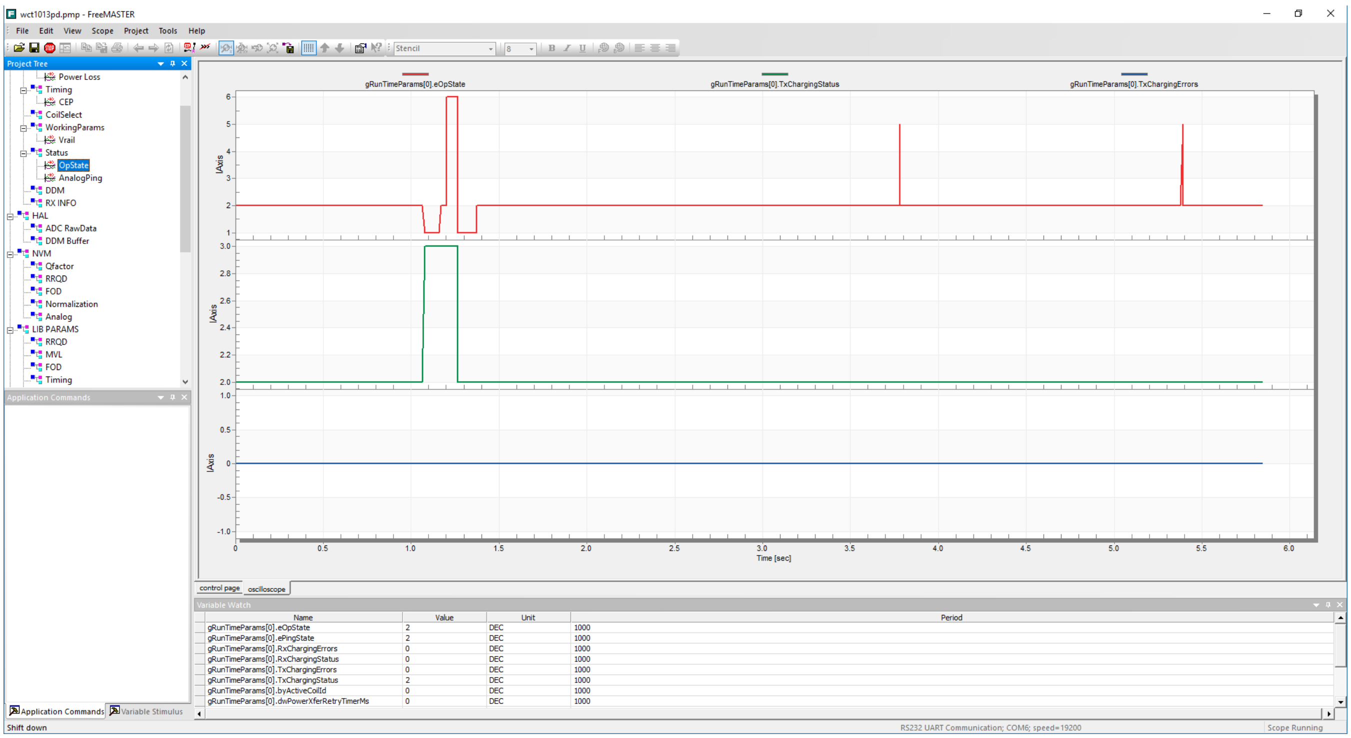


Figure 3. Data visualization

2.2.2 Debugging console

In addition to the FreeMASTER visualization, the WCT library provides an option to continuously dump the selected debugging information to the user console over the UART interface. The debug messages are sent to the UART whenever an important event occurs, if the appropriate message type is enabled.

The console UART port must be different from the UART port used for the FreeMASTER communication. If only one UART port is available, consider using an alternative communication interface for the FreeMASTER connection. Besides UART, FreeMASTER also supports the JTAG cable interface.

If SCI is used for the debugging console in the MP demo, the settings are as follows:

```
#define DEBUG_CONSOLE_SUPPORTED  (TRUE)
#define FREEMASTER_SUPPORTED          (FASLE)
```

The macros are defined in `example-> wct1013PD->Configure-> appcfg.h`.

```
#define QSCI_CONSOLE_INDEX     0
#define QSCI_FREEMASTER_INDEX  1
```

The macros are defined in `example->wct1013PD->driver->qsci.h`.

To use the FreeMASTER and the debug console at the same time, change the FreeMASTER communication interface to JTAG. The settings are as follows:

```
#define FMSTR_USE_SCI 0 /* To select SCI communication interface */
#define FMSTR_USE_JTAG 1 /* 56F8xxx: use JTAG interface */
```

The macros are defined in `example->wct1013PD->Configure-> freemaster_cfg.h`.

```
#define FREEMASTER_SUPPORTED                (TRUE)
```

The macro is defined in `example->wct1013PD->Configure->appcfg.h`.

2.3 Calibration

The library behavior and its parameters should be calibrated before the library can be successfully used.

The calibration procedure consists of these steps:

1. Rail voltage calibration
2. Input current calibration
3. Characterization parameters calibration
4. Normalization parameters calibration

All the steps require the low power to be disabled and the library running in the debug mode, except for the normalization parameters calibration.

All the calibration steps are used to get accurate power loss for the FOD. The power loss is calculated by the following equation. If P_Loss is bigger than the threshold, there must be a foreign object.

P_Loss = T_IN – T_Loss – R_IN

- The rail voltage calibration and input current calibration are used to get an accurate T_IN.
- The characterization parameters calibration is used to estimate the T_Loss.
- The normalization parameters calibration is used to get an accurate R_IN.

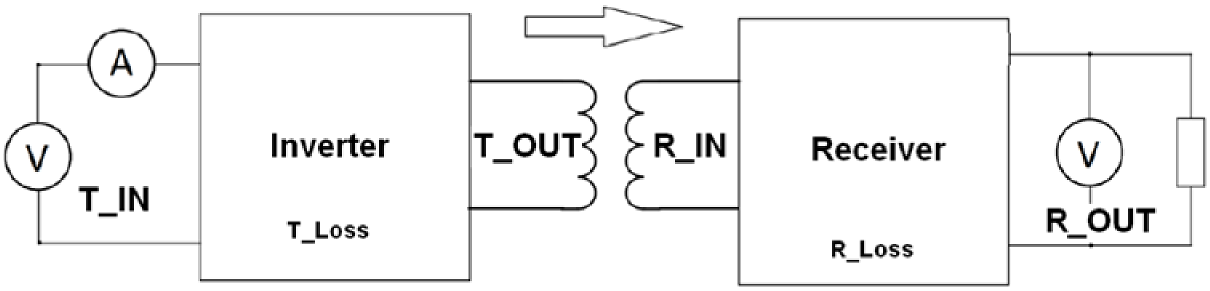


Figure 4. Calibration

NOTE

Before starting the calibration, read all the values to the NVM data. Click the "Read" button in the "Common for all" screen in the "OP Params" and "Calibration" tabs.

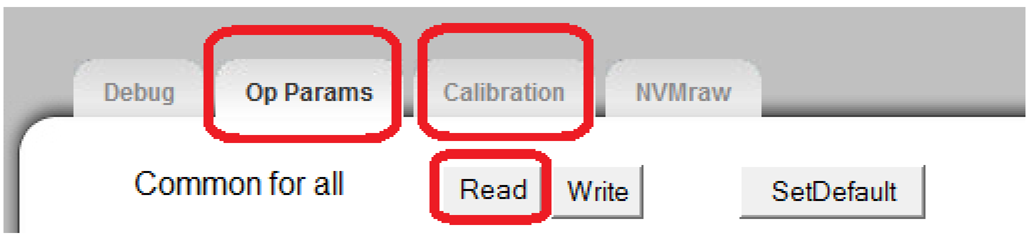


Figure 5. Reading NVM value

2.3.1 Rail voltage calibration

The process of rail voltage calibration is as follows:

Before the calibration, set LOW_POWER_MODE_ENABLE to FALSE in the example code. Then, the MCU runs at full speed even without charging, and the FreeMASTER GUI can respond quickly when the FOD calibration is performed in the debugging mode.

Before the TX is powered on, ensure that the RX is removed and the load is disconnected.

The calibration process of the rail voltage requires the library to run in the debug mode and without the RX and load.

Use the FreeMASTER GUI to do the calibration, and save the constant to the flash.

In the "Rail Voltage Calibration" area, click "Reset" and then "Enter". Set a different rail voltage value, click "Read", measure the rail voltage by a multimeter and fill the actual value into the "Real V" column. Then click "Move" and "Save".

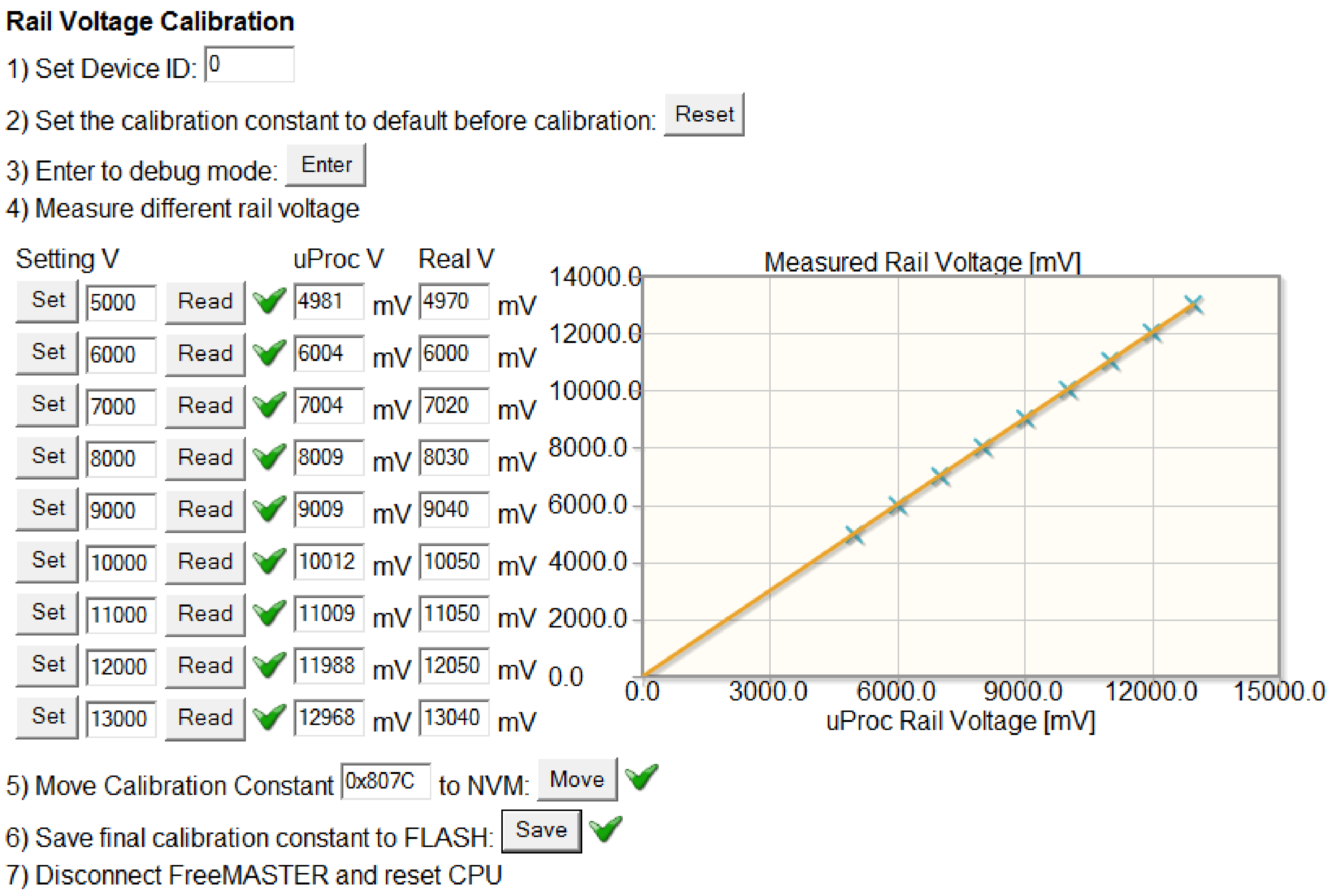


Figure 6. Rail voltage calibration

Read out the rail voltage calibration constant from the “Calibration” page of the FreeMASTER GUI to ensure that it is saved successfully.

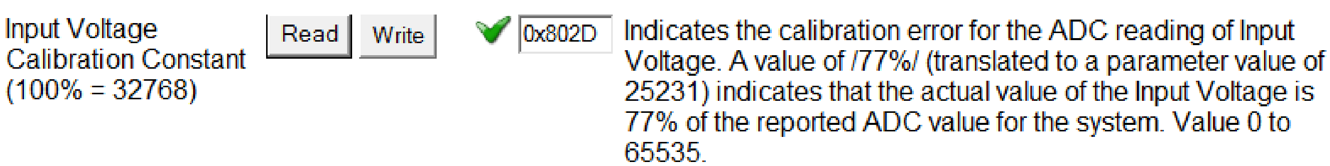


Figure 7. Read rail voltage calibration constant

2.3.2 Input current calibration

The process of input current calibration is as follows:

Power on the wireless charging TX board without the load connected.

The calibration process of the input current requires the library to be run in the debug mode and without the RX on.

Click “Reset”, “Enter”, and “Calibr”.

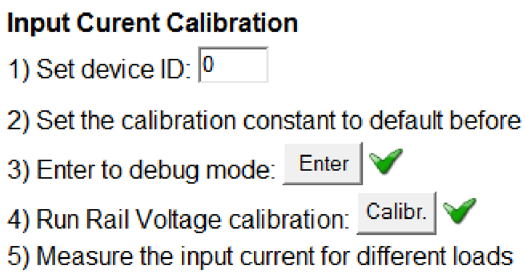


Figure 8. Input current calibration (1)

Add electronic load or resistors between the VRAILA and the ground to draw current. Make sure that the load is added after step 4. Otherwise, the input current cannot be read correctly.

Measure the actual current by a multimeter and fill the actual value into the "Real I" column and click "Read". Change the load current from 50 mA to 2000 mA. Repeat for all the other rows and then click "Move" and "Save".

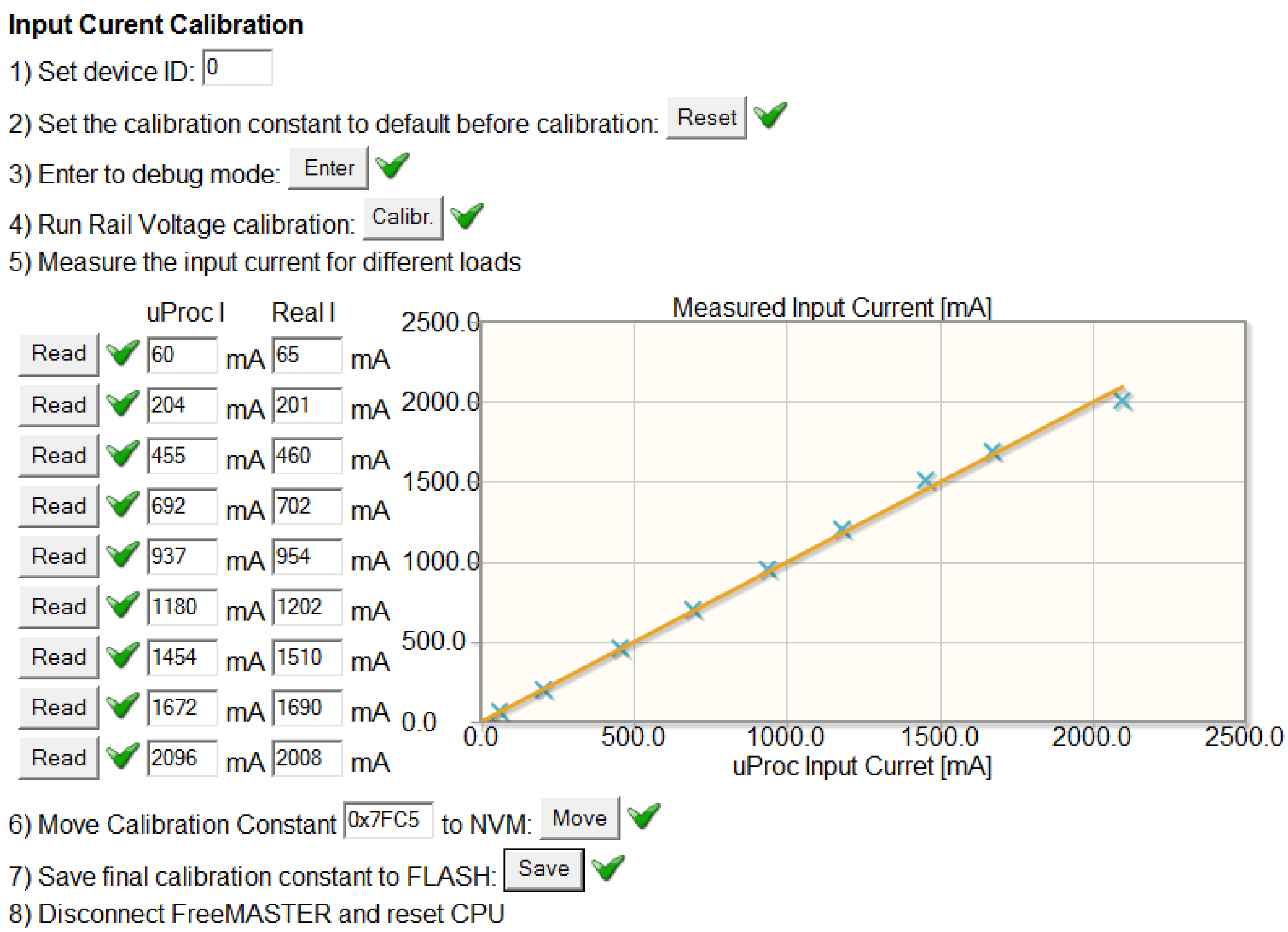


Figure 9. Input current calibration (2)

Read out the input current calibration constant on the "Calibration" page of the FreeMASTER GUI to ensure that it is saved successfully.

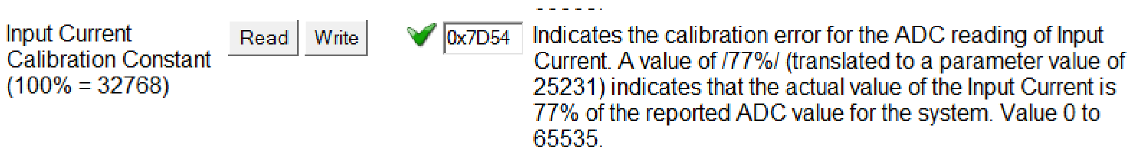


Figure 10. Read input current calibration constant

2.3.3 FOD calibration

The process of FOD calibration is as follows:

The calibration process of the foreign object detection algorithm requires the library to run in the debug mode and the finished calibration of the rail voltage and input current. The calibration must be done without the RX and load.

Follow the instructions of the rail voltage calibration process.

Follow the instructions of the input current calibration process.

Enter the coil ID, click "Enter" and "On", and then click "Set" and "Read" for each row. Then press "Off", "Move", and "Save".

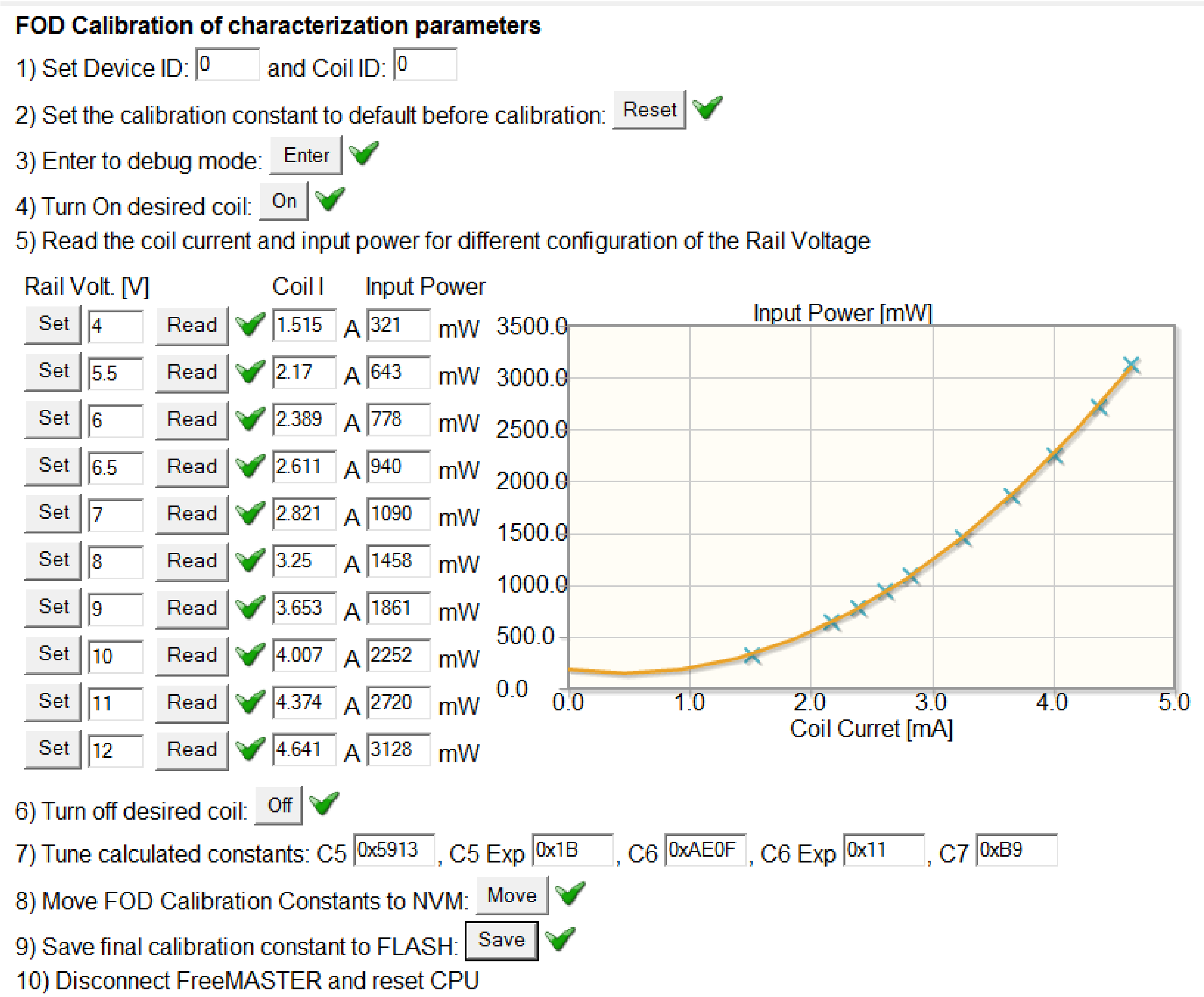


Figure 11. FOD calibration

NOTE

Pay attention to the coil current value when it is larger than 4 A and the rail voltage is still under 21 V. It is not recommended to raise the rail voltage. Instead, insert more rail voltage test points within the above-measured maximum rail voltage to guarantee safety.

Read out the power loss characterization parameters on the “Calibration” page of the FreeMASTER GUI to ensure that it is saved successfully.

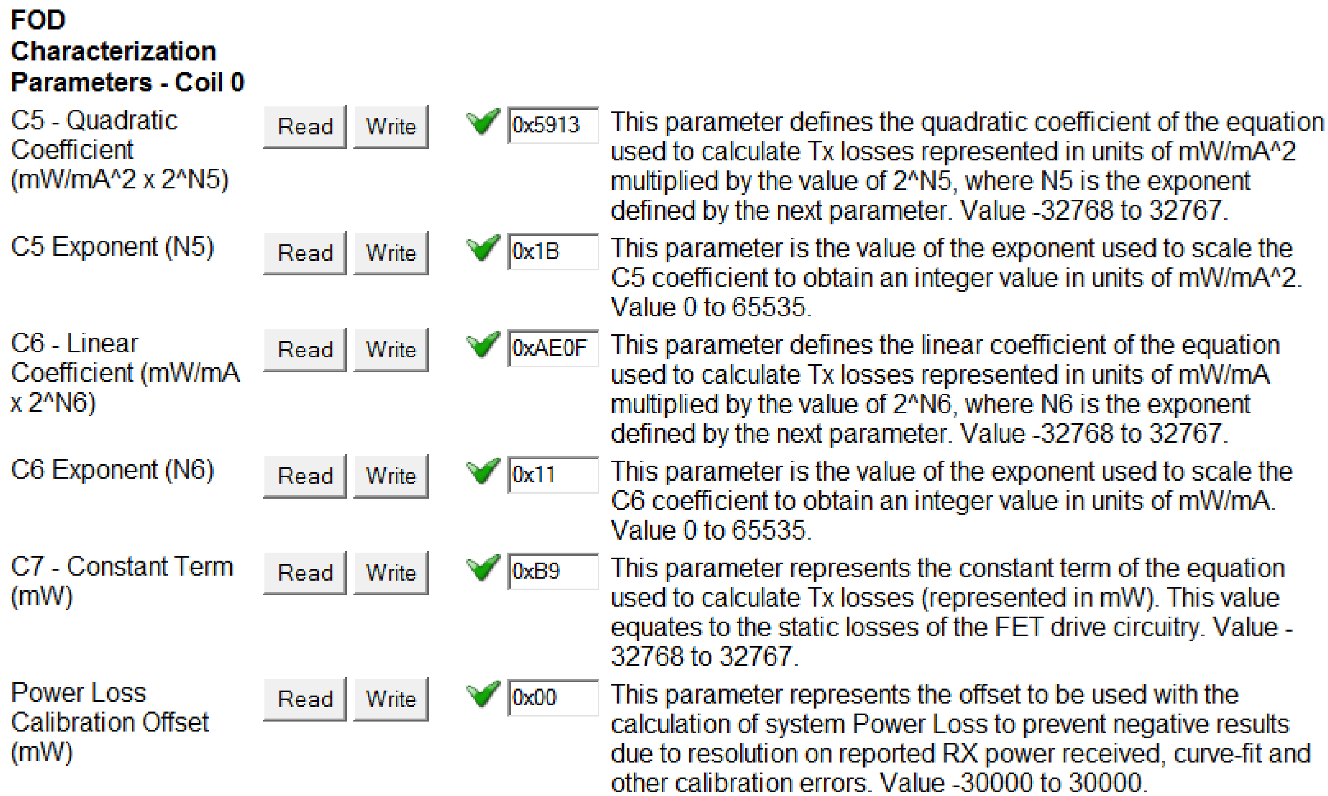


Figure 12. Read FOD characterization constants

Repeat the steps above for the remaining coils.

2.3.4 FOD normalization

The FOD normalization equalizes the power-loss curve, at which the loss value increases as the load increases. It may be higher than the threshold even without a foreign object present. To resolve the issue, NXP provides the normalization tool through the FreeMASTER GUI to fine-tune the FOD performance on the customer board.

The process of FOD normalization is as follows:

Make sure that the rail voltage, input current, and FOD calibration are done.

Follow the normalization steps on the FreeMASTER GUI, as shown in the following figure. Before the test, reset the parameter and exit the debug mode. Perform the test with a standard calibrated Qi 1.1 RX, such as TPR#5. The load range is from 50 mA to 1000 mA.

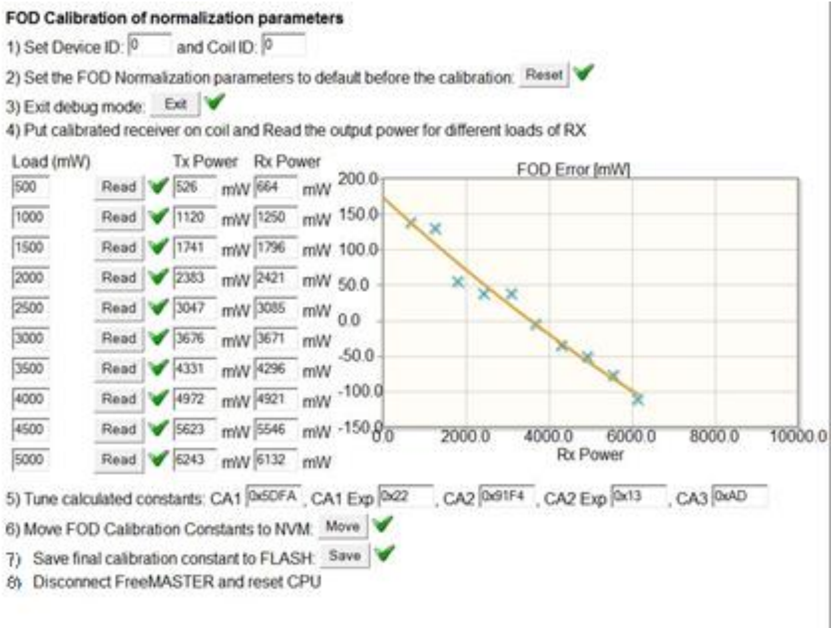
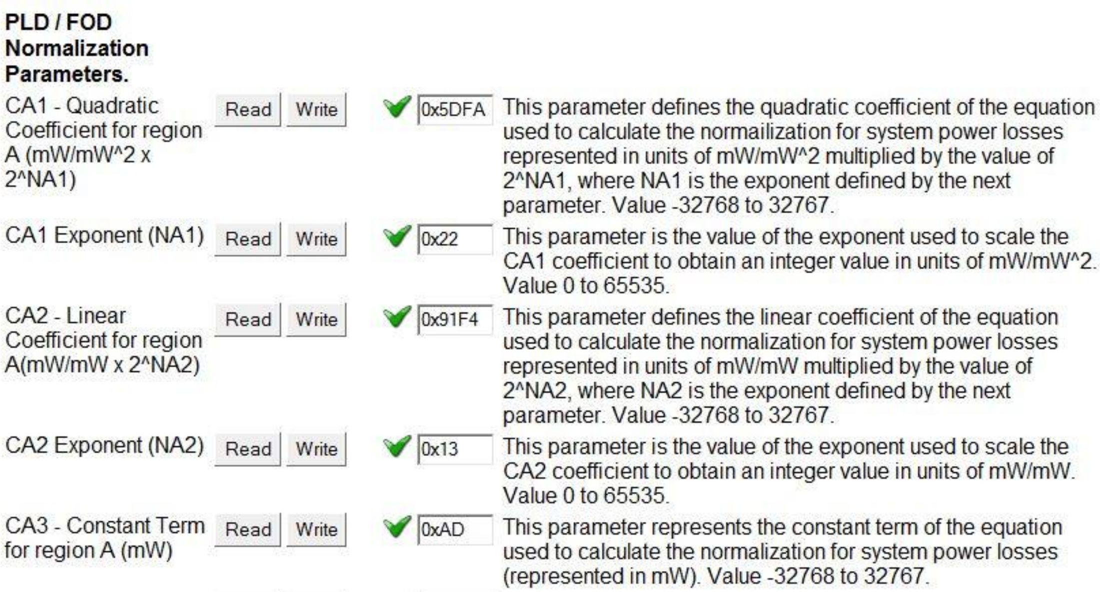


Figure 13. FOD normalization

After the above steps on the GUI are finished, read out the power loss normalization parameters on the "Calibration" page of the FreeMASTER GUI to ensure that it is saved successfully.



PLD / FOD Normalization Parameters.			
CA1 - Quadratic Coefficient for region A (mW/mW^2 x 2^NA1)	Read Write	0x5DFA	This parameter defines the quadratic coefficient of the equation used to calculate the normailization for system power losses represented in units of mW/mW^2 multiplied by the value of 2^NA1, where NA1 is the exponent defined by the next parameter. Value -32768 to 32767.
CA1 Exponent (NA1)	Read Write	0x22	This parameter is the value of the exponent used to scale the CA1 coefficient to obtain an integer value in units of mW/mW^2. Value 0 to 65535.
CA2 - Linear Coefficient for region A(mW/mW x 2^NA2)	Read Write	0x91F4	This parameter defines the linear coefficient of the equation used to calculate the normalization for system power losses represented in units of mW/mW multiplied by the value of 2^NA2, where NA2 is the exponent defined by the next parameter. Value -32768 to 32767.
CA2 Exponent (NA2)	Read Write	0x13	This parameter is the value of the exponent used to scale the CA2 coefficient to obtain an integer value in units of mW/mW. Value 0 to 65535.
CA3 - Constant Term for region A (mW)	Read Write	0xAD	This parameter represents the constant term of the equation used to calculate the normalization for system power losses (represented in mW). Value -32768 to 32767.

Figure 14. Read FOD normalization constants

NOTE

The FOD normalization described in this section is for a baseline RX (5 W). For the EPP RX (extension), the normalization is not necessary, because the power-loss FOD extension method has online calibration for accuracy.

2.3.5 Saving new NVM parameters to EEdata

After the calibration, the NVM parameters are updated. These new parameters must be used to update the *EEdata_FlashDefaults.asm* file, so that they can be flashed.

Set the "QF calibration init check" to 0 in the "Op Params" tab and click the "Write" button (as shown in Figure 15) to make sure that the automatic calibration for the Q factor conversion is done the first time the TX runs after flashing the image. Ensure that there is no object on the TX surface at the first time the TX runs after flashing the image.

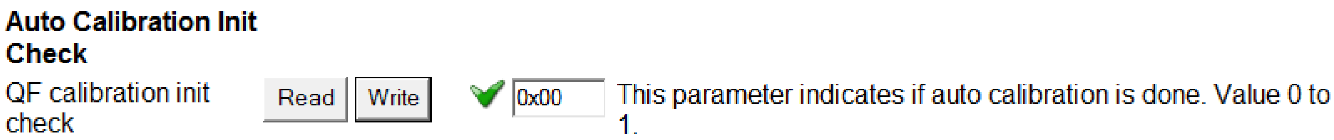


Figure 15. Setting auto calibration check to 0

Before saving the NVM parameters, read all the values to the NVM data, as shown in Figure 16.

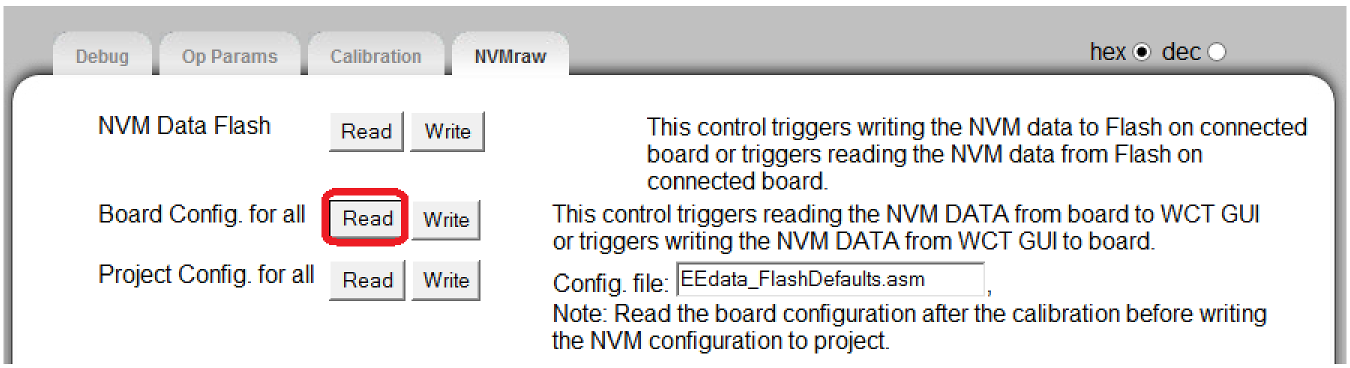


Figure 16. Copy updated NVM data

Write the NVM data to *EEdata_FlashDefaults.asm*. This feature is supported by the FreeMASTER tool version 1.4 (or later). After you click "Write" (as shown in Figure 17), CodeWarrior prompts that the *EEdata_FlashDefaults.asm* file is going to be replaced. Click "Yes" and rebuild the project for the next flashing.

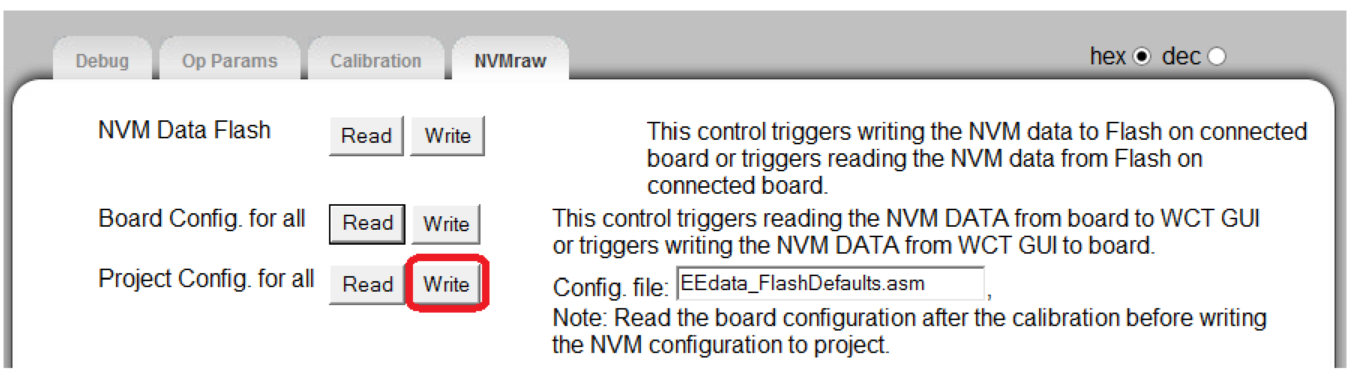


Figure 17. Write NVM data

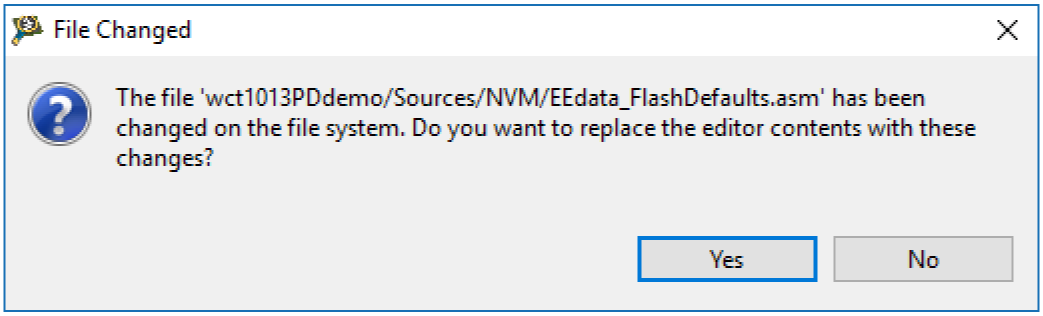


Figure 18. Replace EEdata_FlashDefaults.asm file

2.4 Q factor temperature calibration

The Q factor detection is affected by temperature. The following calibration steps are used to get accurate Q factor values at different temperatures.

Before performing the calibration, ensure that there is no object on the TX surface. The TX should perform auto-calibration during the first power-on after the firmware download. Check the following variable for automatic calibration. If its value is 1, skip step 1 and step 2, and go to step 3.

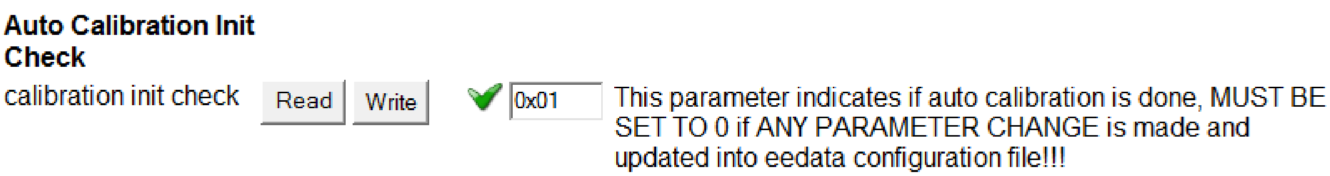


Figure 19. Check automatic calibration

1. Make the board at temperature T1 and enter “1” to the “gCMD_eCommand” line in the FreeMASTER variable watch window. This step stops the WCT library.

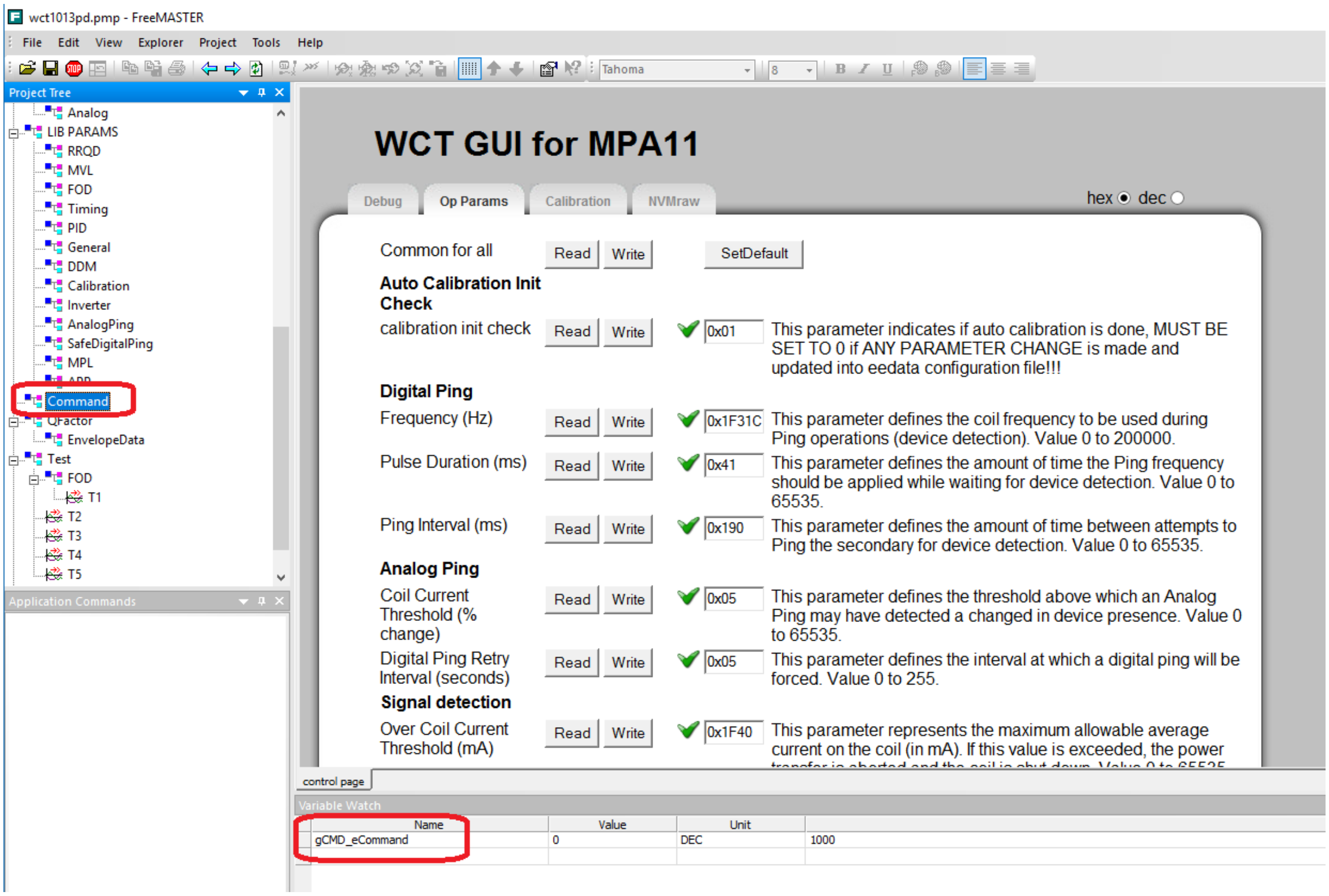


Figure 20. Set gCMD_eCommand

2. Enter “3” to the gCMD_eCommand in the FreeMASTER variable watch window, which redoes the automatic calibration.
3. Make the board at temperature T2 and make sure that the difference between T1 and T2 is more than 20 °C. Otherwise, the calibration coefficient accuracy cannot be guaranteed.
4. Enter “1” to the gCMD_eCommand in the FreeMASTER variable watch window, which stops the WCT library.
5. Enter “4” to the gCMD_eCommand in the FreeMASTER variable watch window, which generates the calibration coefficient and writes the coefficient to the flash.
6. Enter “2” to the gCMD_eCommand in the FreeMASTER variable watch window, which re-starts the WCT library.

3 NVM structure reference

3.1 Operation parameters

Auto-calibration check

Details:
This parameter indicates if the initial Q factor calibration and quick removal calibration have been done. Initially it is 0 and becomes 1 after the initial Q factor calibration and quick removal calibration are done and written to the NVM parameters online.
Default Value: `0`
Min Value: `0`
Max Value: `1`
Member: `NvmParams.OpParams.OpStateParams.dwAutoCalibrated`

Ping frequency (Hz)

Details:
This parameter defines the coil frequency to be used during the digital ping operations.
Default Value: `127772`
Min Value: `120000`
Max Value: `130000`
Member: `NvmParams.OpParams.OpStateParams.dwPingFrequency`

Ping pulse duration (ms)

Details:
This parameter defines the amount of time that the ping frequency should be applied for while waiting for a device detection.
Default Value: `65`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.wPingPulseDurationTimeMs`

Ping interval (ms)

Details:
This parameter defines the amount of time between the secondary ping attempts for device detection.
Default Value: `400`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.wPingIntervalMs`

Coil current threshold (% change)

Details:
This parameter defines the threshold above which an analog ping may have detected a change in device presence.
Default Value: `5`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.wAnalogPingCoilCurrentThreshold`

Digital ping retry interval (seconds)

Details:
This parameter defines the interval at which a digital ping is forced.
Default Value: `5`
Min Value: `0`
Max Value: `65`
Member: `NvmParams.OpParams.OpStateParams.byDigitalPingRetryIntervalSeconds`

Over coil current threshold (mA)

Details:
This parameter defines the maximum allowable current on the coil (in mA). If the coil current exceeds this threshold, the power transfer is aborted.
Default Value: `8000`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.wOverCoilCurrentThreshold`

Over rail voltage threshold (mV)

Details:
This parameter defines the maximum allowable rail voltage (in mV). If the rail voltage exceeds this threshold, the operational state machine is shut down.
Default Value: `17000`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.wOverRailVoltageThreshold`

Over input voltage threshold (mV)

Details:
This parameter defines the maximum allowable input voltage (in mV). If the input voltage exceeds this threshold, the operational state machine is shut down.
Default Value: `22000`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.wOverInputVoltageThreshold`

Under input voltage threshold (mV)

Details:
This parameter defines the minimum allowable input voltage (in mV). If the input voltage is lower than this threshold, the operational state machine is shut down.
Default Value: `8000`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.wUnderInputVoltageThreshold`

Over input current threshold (mA)

Details:
This parameter defines the maximum allowable input current (in mA). If the input current exceed this threshold, the power transfer is aborted.
Default Value: `5000`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.wOverInputCurrentThreshold`

Over temperature threshold (°C)

Details:
This parameter defines the maximum temperature. If the temperature exceeds this threshold, the operational state machine is shut down.
Default Value: `60`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.OpStateParams.swOverTemperatureThreshold`

Minimum frequency (Hz)

Details:
This parameter defines the absolute minimum allowable frequency used during the power transfer. If the power transfer algorithm attempts to set the “Active Frequency” below this value, the coil is turned off.
Default Value: `127772`
Min Value: `120000`
Max Value: `130000`
Member: `NvmParams.OpParams.OpStateParams.dwMinFreq`

Maximum frequency (Hz)

Details:
This parameter defines the maximum allowable frequency used during the power transfer. If the power transfer algorithm attempts to set the “Active Frequency” above this value, the coil is turned off.
Default Value: `127772`
Min Value: `120000`
Max Value: `130000`
Member: `NvmParams.OpParams.OpStateParams.dwMaxFreq`

Minimum rail voltage (mV)

Details:
This parameter defines the minimum operating rail voltage for the output drive (in mV). A value of 10000 corresponds to 10 V.
Default Value: `1000`
Min Value: `0`
Max Value: `25000`
Member: `NvmParams.OpParams.OpStateParams.wMinRailVoltageMv`

Maximum rail voltage (mV)

Details:
This parameter defines the maximum operating rail voltage for the output drive (in mV). A value of 10000 corresponds to 10 V.
Default Value: `25000`
Min Value: `0`
Max Value: `25000`
Member: `NvmParams.OpParams.OpStateParams.wMaxRailVoltageMv`

Coil 0 default rail voltage (mV)

Details:
This parameter defines the operating rail voltage for the Coil0 output drive (in mV). When in rail control, this value corresponds to the rail voltage used at ping. A value of 1000 corresponds to 1 V.
Default Value: `5000`
Min Value: `1000`
Max Value: `25000`
Member: `NvmParams.OpParams.OpStateParams.wDefaultRailVoltageMv[0]`

Power loss indication to power cessation (ms)

Details:
This parameter defines for how long the FOD indication is permitted to be active before the power is removed.
Default Value: `4500`
Min Value: `0`
Max Value: `4294967295`
Member: `NvmParams.OpParams.PowerLossParams.dwPowerLossIndicationToPwrCessationMs`

Power loss threshold for BPP low power RX (mW)

Details:
This parameter defines the power loss FOD threshold for BPP RX (in mW).
Default Value: `450`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.PowerLossParams.wPowerLossLPThreshold`

Power loss threshold for EPP middle power RX (mW)

Details:
This parameter defines the power loss FOD threshold for the EPP middle power RX (in mW).
Default Value: `600`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.PowerLossParams.wPowerLossEPPMPThreshold`

Power loss threshold for EPP low power RX (mW)

Details:
This parameter defines the power loss FOD threshold for the EPP low power RX (in mW).
Default Value: `450`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.OpParams.PowerLossParams.wPowerLossEPPLPThreshold`

Number of trips to indication

Details:
This parameter defines how many consecutive threshold breaches are required to trigger an FOD indication.
Default Value: `1`
Min Value: `0`
Max Value: `255`
Member: `NvmParams.OpParams.PowerLossParams.byNumFodTripsToIndication`

3.2 Calibration parameters

Minimum rail voltage (mV)

Details:
Indicates the minimum rail voltage the hardware can produce.
Default Value: `3828`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.CalParams.AnalogParams[0].wMinRailVoltageMv`

Maximum rail voltage (mV)

Details:
Indicates the maximum rail voltage the hardware can produce.
Default Value: `10828`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.CalParams.AnalogParams[0].wMaxRailVoltageMv`

Rail voltage cal slope

Details:
This field defines the rail voltage normalized calibration slope.
Default Value: `-4797`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.AnalogParams[0].sdwRailVoltageSlope`

Rail voltage cal offset

Details:
This field defines the rail voltage normalized calibration offset.
Default Value: `15819891`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.AnalogParams[0].sdwRailVoltageOffset`

Input current cal slope

Details:
This field defines the input current normalized calibration slope, which provides for the portion of input current that is dependent on the rail voltage.
Default Value: `-4280`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.AnalogParams[0].sdwInputCurrentSlope`

Input current cal offset

Details:
This field defines the input current normalized calibration offset, which provides for the portion of input current that is dependent on the rail voltage.
Default Value: `3401744`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.AnalogParams[0].sdwInputCurrentOffset`

Rail voltage cal normalization

Details:
This parameter defines the normalization factor used in the rail voltage normalized calibration.
Default Value: `10`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.CalParams.AnalogParams[0].wRailVoltageNorm`

Input current cal normalization

Details:
This parameter defines the normalization factor used in the input current normalized calibration.
Default Value: `28`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.CalParams.AnalogParams[0].wInputCurrentNorm`

Input voltage calibration constant (100 % = 32768)

Details:
Indicates the calibration error for the ADC reading of input voltage. A value of /77 %/ (translated to a parameter value of 25231) indicates that the actual value of the input voltage is 77 % of the reported ADC value for the system.
Default Value: `32001`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.CalParams.AnalogParams[0].wInputVoltageCalibration`

Input current calibration constant (100 % = 32768)

Details:
Indicates the calibration error for the ADC reading of input current. A value of /77 %/ (translated to a parameter value of 25231) indicates that the actual value of the input current is 77 % of the reported ADC value for the system.
Default Value: `32289`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.CalParams.AnalogParams[0].wInputCurrentCalibration`

C5 – quadratic coefficient (mW/mA^2 x 2^N5)

Details:
This parameter defines the quadratic coefficient of the equation used to calculate the transmission (TX) losses, represented in units of mW/mA^2 multiplied by the value of 2^N5, where N5 is the exponent defined by the next parameter.
Default Value: `0x4DB0`
Min Value: `-32768`
Max Value: `32767`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodCharacterizationParams.swQuadCoefficient`

C5 exponent (N5)

Details:
This parameter is the value of the exponent used to scale the C5 coefficient to obtain an integer value in units of mW/mA^2.
Default Value: `0x1B`
Min Value: `0`
Max Value: `65535`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodCharacterizationParams.wQuadExponent`

C6 – linear coefficient (mW/mA x 2^N6)

Details:
This parameter defines the linear coefficient of the equation used to calculate the TX losses, represented in units of mW/mA multiplied by the value of 2^N6, where N6 is the exponent defined by the next parameter.
Default Value: `0xBEB1`
Min Value: `-32768`
Max Value: `32767`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodCharacterizationParams.swLinearCoefficient`

C6 exponent (N6)

Details:
This parameter is the value of the exponent used to scale the C6 coefficient to obtain an integer value in units of mW/mA.
Default Value: `0x12`
Min Value: `0`
Max Value: `65535`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodCharacterizationParams.wLinearExponent`

C7 – constant term (mW)

Details:
This parameter represents the constant term of the equation used to calculate the TX losses (represented in mW). This value equates to the static losses of the FET drive circuitry.
Default Value: `0x4E`
Min Value: `-32768`
Max Value: `32767`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodCharacterizationParams.swConstantCoefficient`

Power loss calibration offset (mW)

Details:
This parameter represents the offset to be used with the calculation of the system power loss to prevent negative results due to the resolution on the reported RX power received, curve-fit, and other calibration errors.
Default Value: `0`
Min Value: `-30000`
Max Value: `30000`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodCharacterizationParams.swPowerLossCalibrationOffset`

CA1 – quadratic coefficient for region A (mW/mW^2 x 2^NA1)

Details:
This parameter defines the quadratic coefficient of the equation used to calculate the normalization for system power losses, represented in units of mW/mW^2 multiplied by the value of 2^NA1, where NA1 is the exponent defined by the next parameter.
Default Value: `18223`
Min Value: `-32768`
Max Value: `32767`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodNormalizationParams.swQuadCoefficient`

CA1 exponent (NA1)

Details:
This parameter is the value of the exponent used to scale the CA1 coefficient to obtain an integer value in units of mW/mW^2.
Default Value: `33`
Min Value: `0`
Max Value: `65535`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodNormalizationParams.wQuadExponent`

CA2 – linear coefficient for region A(mW/mW x 2^NA2)

Details:
This parameter defines the linear coefficient of the equation used to calculate the normalization for system power losses, represented in units of mW/mW multiplied by the value of 2^NA2, where NA2 is the exponent defined by the next parameter.
Default Value: `20577`
Min Value: `-32768`
Max Value: `32767`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodNormalizationParams.swLinearCoefficient`

CA2 exponent (NA2)

Details:
This parameter is the value of the exponent used to scale the CA2 coefficient to obtain an integer value in units of mW/mW.
Default Value: `20`
Min Value: `0`
Max Value: `65535`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodNormalizationParams.wLinearExponent`

CA3 – constant term for region A (mW)

Details:
This parameter represents the constant term of the equation used to calculate the normalization for system power losses (in mW).
Default Value: `-2`
Min Value: `-32768`
Max Value: `32767`
Member:
`NvmParams.CalParams.PowerLossParams[0][CoilId][0].FodNormalizationParams.swConstantCoefficient`

Ca – linear coefficient of input current calibration for quick removal

Details:
This parameter represents the linear coefficient of the equation used to calculate the input current value based on the rail voltage value for quick removal.
Default Value: `2876`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.QuickRemovalParams[0][CoilId].InCurFrmRailVol.sdwSlope`

Cb – constant coefficient of input current calibration for quick removal

Details:
This parameter represents the constant coefficient of the equation used to calculate the input current value based on the rail voltage value for quick removal.
Default Value: `64616`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.QuickRemovalParams[0][CoilId].InCurFrmRailVol.sdwOffset`

Exponent of input current calibration for quick removal

Details:
This parameter is the value of the exponent used to scale the Ca and Cb to obtain an integer value.
Default Value: `14`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.CalParams.QuickRemovalParams[0][CoilId].InCurFrmRailVol.wNorm`

Ca – linear coefficient of coil current calibration for quick removal

Details:
This parameter represents the linear coefficient of the equation used to calculate the coil current value based on the rail voltage value for quick removal.
Default Value: `4294962290`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.QuickRemovalParams[0][CoilId].CoilCurFrmRailVol.sdwSlope`

Cb – constant coefficient of coil current calibration for quick removal

Details:
This parameter represents the constant coefficient of the equation used to calculate the coil current value based on the rail voltage value for quick removal.
Default Value: `6487391`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.QuickRemovalParams[0][CoilId].CoilCurFrmRailVol.sdwOffset`

Exponent of coil current calibration for quick removal

Details:
This parameter is the value of the exponent used to scale the Ca and Cb to obtain an integer value.
Default Value: `14`
Min Value: `0`
Max Value: `65535`
Member: `NvmParams.CalParams.QuickRemovalParams[0][CoilId].CoilCurFrmRailVol.wNorm`

Init resonance freq

Details:
This parameter represents the resonance frequency of the initial Q factor calibration (represented in Hz).
Default Value: `90826`
Min Value: `0`
Max Value: `4294967295`
Member: `NvmParams.CalParams.QfCalibParams[0][CoilId].dwInitResonanceFreq`

Init resonance Q factor

Details:
This parameter represents the Q factor of the initial Q factor calibration.
Default Value: `3767`
Min Value: `0`
Max Value: `4294967295`
Member: `NvmParams.CalParams.QfCalibParams[0][CoilId].dwInitQlc`

Calibration temperature coil 0

Details:
This parameter represents the Q factor calibration temperature.
Default Value: `26`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.QfCalibParams[0][CoilId].swCalibrationTemperature`

Impedance change per Celsius degree coil 0

Details:
This parameter represents the impedance change per a Celsius degree of the Q factor calibration.
Default Value: `0`
Min Value: `-2147483647`
Max Value: `2147483647`
Member: `NvmParams.CalParams.QfCalibParams[0][CoilId].swImpedanceChangePerCelsius`

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Document Number: WCT101XV10RTDUG
Rev. 0
04/2019