AM9012 Evaluation PCB User's Guide Rev 1.2
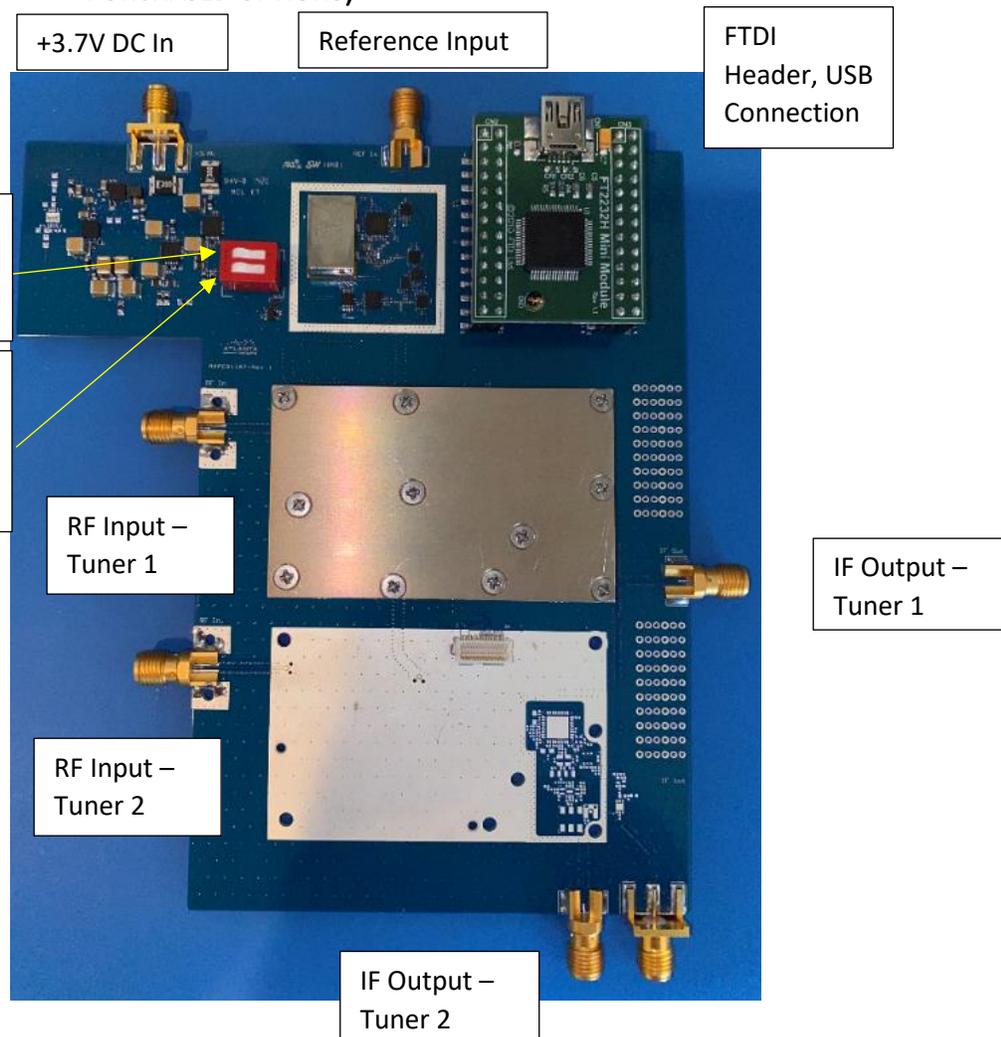
1 HARDWARE

1.1 AM9012 EVAL DESCRIPTION

The AM9012 is a 2 MHz – 6 GHz Receiver with a 80 MHz IF BW. The evaluation board provides a software controlled interface and test platform for customer evaluation of the AM9012 module. The evaluation board supports either 1 or 2 AM9012 modules.

1.2 EVAL BOARD CONNECTIONS (NOT ALL CONNECTIONS AND MODULES INSTALLED, BASED ON PURCHASED OPTIONS)

+3.7V DC In

Reference Input

FTDI Header, USB Connection

500MHz Ref Power Switch

Internal 10 MHz DIP Switch

RF Input – Tuner 1

IF Output – Tuner 1

RF Input – Tuner 2

IF Output – Tuner 2

2   INITIAL CONNECTION PROCEDURE

2.1   CONNECT POWER AND USB CABLE

a. Set current limit of power supply to 1.8 A (single module) or 3.6 A (two modules) and voltage to ensure 3.7V minimum is present at the board with ~ 3.2 A of current.
b. Connect power supply to the board via the +3.7V SMA connector.
c. Connect mini-B USB cable to the USB connector on the FTDI communication board. If the PC is connected to the Internet, the drivers for the FTDI board should automatically install. Wait for the automatic install to complete before proceeding. If the drivers do not install automatically, manual installation of the FTDI driver is covered in the following section.

2.2   MANUAL FTDI DRIVER INSTALLATION

If the FTDI driver installed automatically, skip to the next section.

Verify Installation of FTDI Driver on PC

To determine if the FTDI drivers have already be installed, check that the following files are located in C:\Windows\System32\

- ftbusui.dll
- ftcserco.dll
- ftd2xx.dll
- ftLang.dll
- ftserui2.dll

Verify the following files are in C:\Windows\System32\Drivers

- ftdibus.sys
- ftser2k.sys

If the files are missing, the FTDI driver has not been installed. The drivers should be automatically installed when the FTDI Mini-module is first connected to the computer. If this does not occur, manual installation can be performed.

FTDI instructions for Windows installation is here:

http://www.ftdichip.com/Support/Documents/InstallGuides.htm

The drivers can be manually downloaded here:

http://www.ftdichip.com/Drivers/D2XX.htm

2.3 INSTALL/UPDATE AM9012 CONTROL SOFTWARE

a. Copy the "AM9012 Control Installer" to a folder with admin privileges.
b. Open the copied folder, and run "setup.exe".
c. Complete the installer prompts to install the control software. If you do not install the AM9012 controls to the default directory, note the specified directory so you can browse to the executables. It will also install National Instruments Labview Run-Time engine if it is not already on the PC. Once the installer is finished, the AM9012 Controls will be installed.

2.4 MAKE RF CONNECTIONS

a. 10 MHz Reference – Connect the 10 MHz Reference signal to the 10 MHz Input. Set power level to +0 dBm. There is an onboard 100 MHz PLL that will generate the reference signal for the tuner. Ensure both DIP switches are in the ON position.
b. Connect the signal source to RF In.
c. Connect the measurement device to IF Out

2.5 EXTERNAL REFERENCE DIP OPERATION

The AM9012 eval board defaults to using a 10 MHz input on its Reference Input connector to generate a 100 MHz clock for the AM9012. A 100 MHz external reference (+0 dBm) can also be used to drive the AM9012 directly. There is a software control for this function (discussed in section 3.1) but to get the best performance the on board DIP switches need to be configured.

- 10 MHz Reference (default)
    - o Both DIP switches set to ON
    - o To switch from 100 MHz external Reference to 10 MHz:
        - Set both DIP Switches to ON (turns on the onboard PLL and VCO)
        - Click "External 100 MHz Reference" GUI button so the light isn't lit
        - Click "Reinitialize" button to lock the onboard VCO to the 10 MHz signal
- 100 MHz Reference – always has to be manually selected
    - o To switch from 10 MHz to 100 MHz external reference:
        - Make sure that 100 MHz signal is on and at +0 dBm in
        - Click "External 100 MHz Reference" GUI button so light is lit
        - Set DIP switches to OFF
        - The tuner may need to be reset due to clock disruption, if this is the case click the "Reinitialize" button

3 STARTUP

To start the control software, open the "AM9012_Control.exe" with the eval board powered and connected via USB to the PC. When opened, the GUI will connect to the eval board and set the tuner to 350 MHz center frequency (CF).

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3.1 CONTROL FIELD DESCRIPTIONS

The tuner can be controlled solely with the CF (MHz) field. Entering a frequency into that field will set all the attenuation, tunable filter/band, and amplifier settings to calibrated values. The Attenuation field also uses the calibrated settings to apply additional attenuation according to a distribution plan (gain is calibrated to ~ 3dB, if Attenuation is 1 gain will be 6dB, etc.). These settings can be overridden using the other GUI fields as described below.

- Tuner Selection – Pull down indicating which tuner is being controlled by the GUI. The AM9012_StatusOut fields will reflect the current status of the tuner indicated by this field.
- CF (MHz) – Primary control for the tuner. Entering a value in this field between 0 and 5960 MHz in increments of 5 will configure the tuner for that center frequency. All switches, attenuators, amplifiers, and tunable filter values will be set automatically depending on the value entered. The gain of the module has been leveled to provide 3dB of gain and the calibration settings for each frequency are stored in the FPGA flash and will be applied when this field is used to change frequency. Frequencies between 0 and 60 MHz are invalid and will revert to an entry of 0 MHz.
- Attenuation Controls
    - o Attenuation – Sets a tuner attenuation that is added to the gain calibrated values. Distribution of the attenuation between the RF and IF attenuators is determined by the tuner flash.
    - o RF Attenuation – Overrides the FPGA setting for the RF attenuator. When the CF field value is changed this value will reset to -1 which is the Auto setting.
    - o IF Attenuation – Overrides the FPGA setting for the IF attenuator. When the CF field value is changed this value will reset to -1 which is the Auto setting.
- Configuration Controls
    - o Band – Overrides the default band chosen for the Center Frequency. Setting returns to Auto when CF field value is changed.
    - o Gain Control Amp – Configures the bypassable amplifier
    - o IF Amp – Configures the bypassable amplifier in the second IF
- Tunable Preselector Controls
    - o Man. HPF 1 – Sets the digital tune word for the tunable HPF. When the CF field value is changed these will reset to -1 which is the Auto setting (values set by the FPGA from Flash)
    - o Man. LPF 1– Sets the digital tune word for the tunable LPF. When the CF field value is changed these will reset to -1 which is the Auto setting (values set by the FPGA from Flash)
    - o HPF Bypass – Selects whether the HPF is bypassed. Necessary to receive frequencies < 100 MHz.
- Power On Pin – Resets the FPGA to initial values. If this is off then the FPGA will ignore all commands. Once it is turned back on the FPGA will be ready to receive commands again.
- Connection Status (above Reconnect) – Indicates if the GUI is connected to the FTDI board. A green CONNECT means the connection is established.
- Reconnect – Re-initializes the connection to the FTDI board and resets the state of the AM9012 to its initial defaults.

- Close – Use this button to close the GUI. It closes the connection to the FTDI board so it can be safely removed or a new connection can be made.
- Status Poll? – Setting this toggle switch will have the GUI read status from the FPGA once a second
- Status Fields
    - Read Register – Sets which type of output is read from the FPGA. Default is status.
    - Last Read Data Out – Raw data read from FPGA during last status poll
    - Serial Number – AM9012 Module SN
    - Major HW Rev – AM9012 Module Major HW Revision
    - Minor HW Rev – AM9012 Module Minor HW Revision
    - FPGA Major Rev – Major revision of the FPGA firmware
    - FPGA Minor Rev – Minor revision of the FPGA firmware
    - PLL1 Lock – Indicates if the tuning LO is locked
    - PLL2 Lock – Indicates if the fixed LO is locked
    - Busy – Indicates the FPGA's busy bit is set
    - ADF4110 Lock – Indicates if the 500 MHz oscillator on the eval board is locked to the 10 MHz reference input
    - RF Overload – Indicates if the internal overload detector has tripped
    - Temperature – Indicates AM9012 module temperature in degrees C
- Manual Message (hex) – When the Send button is pressed the hex values in the Manual Message field are sent to the FPGA.
- Manual Readback – the data read back from the FPGA when the Manual Message was sent
- FPGA Controls – utilizes the low level control interface for the FPGA
    - Send Refresh – Reboots the FPGA
    - Get FPGA status – returns the FPGA status
    - Get Device ID – returns FPGA device ID
- SYNC Controls
    - Tune Together – toggles whether both tuners will tune to the frequency entered in the CF (MHz) field. If this toggle is true, when a new CF is entered, Tuner 1 will be sent the tune message first and then tuner 2 will be sent the same message.
    - Send SYNC – sends the SYNC pulse to both tuners
    - REF Distribution – selects between distributing the reference to both tuners (for eval boards with 2 tuners) and distributing to tuner 1 only. Choosing tuner 1 only will save about 100 mW of power consumption from the eval board. Tuner power consumption will not be affected.
- External 100 MHz – Toggle selects between using the Reference Input as 10 MHz used to create a phase locked 100 MHz reference for the tuner or supplying that 100 MHz reference directly to the tuner. Default is OFF – 10 MHz is required on the Reference Input. Correct operation of this functionality requires configuring the manual DIP switches on the eval board as discussed in section 2.5.
- Reinitialize – Resets the FPGA and retunes the frequency to the last tuned frequency for all installed tuners. Primary use is to re-lock the tuner if the reference input changes.