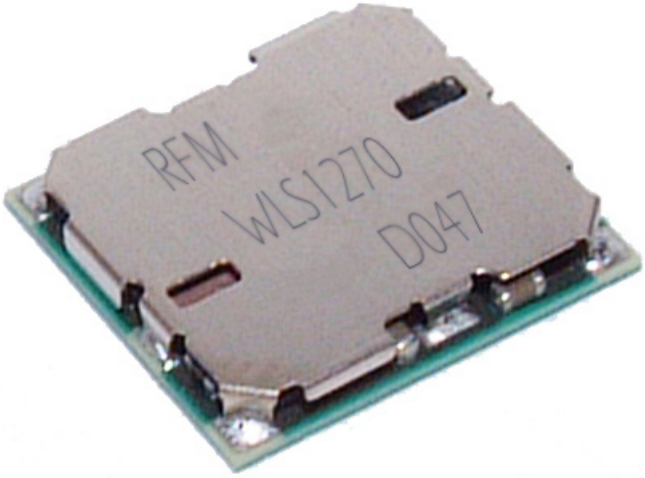
Preliminary

INNOVATOR IN ELECTRONICS

Designing WLS1270 WLAN Modules into an Application



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1.0 Designing WLS1270 Modules into an Application

WLS1270 modules are highly versatile radio modules that provide IEEE 802.11 WLAN connectivity on 2.4 GHz. WLS1270 modules are available in two versions - a small footprint OEM module for cost sensitive, high volumes applications, and as a pre-certified module that facilitates fast time-to-market for medium volume applications. WLS1270 modules can achieve WLAN air data rates up to 65 Mbps. This application note discusses the steps and related considerations to design a WLS1270 module into an embedded application.

1.1 Design Steps

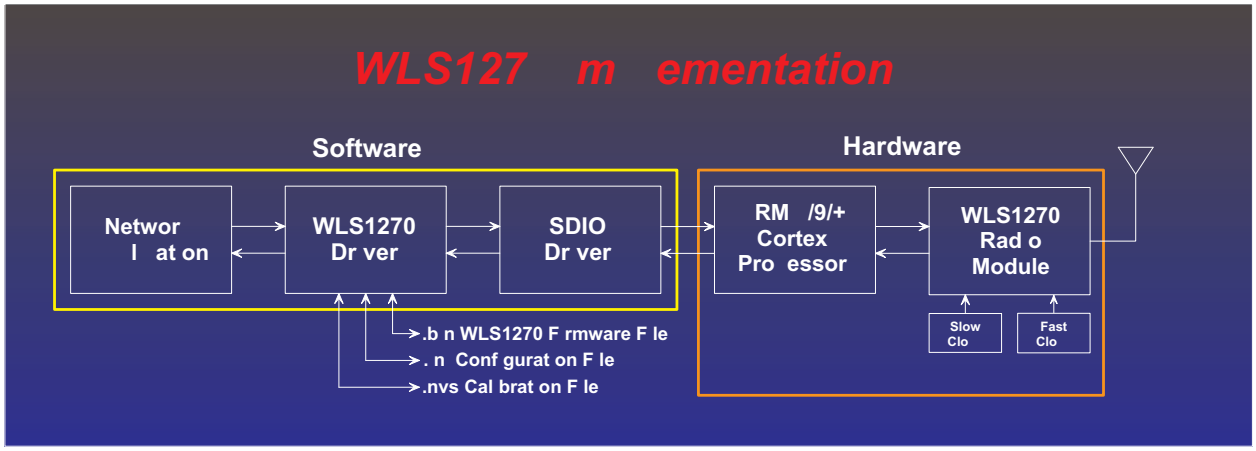


Figure 1.1

A block diagram of a typical WLS1270 implementation is shown in Figure 1.1. The hardware aspects of the implementation are shown on the right, and the software aspects of the implementation are shown on the left. The design steps in a WLS1270 implementation include:

- Select either the OEM or pre-certified WLS1270 module for the application
- Pair the WLS1270 with a supported host processor
- Determine the WLS1270 interconnections with the host processor for WLAN operation
- Determine the WLS1270 interconnections with the host processor for Bluetooth operation
- Determine the WLS1270 interconnections with an audio codec for Bluetooth audio (if needed)
- Choose the WLS1270 frequency references
- Support the WLS1270 power supply requirements
- Incorporate the WLS1270 land pattern in the application PCB
- Add the RF stripline trace and/or RF connector to the application PCB
- Select a suitable 2.4 GHz antenna for the application
- Choose an RF test lab & TCB to conduct certification testing (OEM module)
- Prepare the required certification notices and labels
- Acquire the WLS1270 driver and related files for the host processor and operating system
- Compile/link the driver and related files into the operating system kernel
- Create the .nvs calibration file

Each of these steps is discussed in the sections below.

2.0 Hardware Integration

Both the OEM and pre-certified versions of the WLS1270 include the WL1270 IC, plus an RF front end module, RF filters and single input power supply. The pre-certified module also includes a TCXO frequency reference and an RF connector. The assembled and pretested WLS1270 modules are much simpler and faster to integrate into an application compared to starting with discrete components.

2.1 OEM or Pre-certified Module Selection

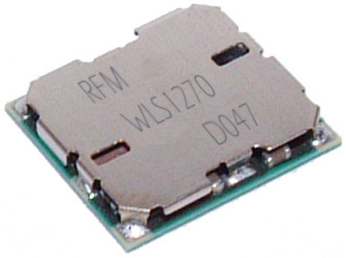


Figure 2.1.1

Figure 2.1.2

The WLS1270 OEM module is shown in Figure 2.1.1, and the DR-WLS1270-101 pre-certified module is shown in Figure 2.1.2. The steps to incorporate either module into an application are almost identical, with the exception that the pre-certified module eliminates the need to incorporate a fast clock frequency reference or do RF certification testing. The WLS1270 is a very compact 9.2 x 8.4 x 1.35 mm module that is generally chosen for applications were small size and/or low cost in volume production are primary considerations. The DR-WLS1270-101 is a compact 14.1 x 20.8 x 2.0 mm module which includes the WLS1270 module plus a TCXO frequency reference and a U.FL RF connector for the 2.4 GHz RF port. The pre-certified DR-WLS1270-101 is generally chosen for applications where fast time-to-market is a primary consideration.

2.2 Host Processor Selection

Table 2.2.1 lists the processors for which Linux, Android and/or WinCE drivers for the WLS1270 modules are currently available. The WLS1270 modules can be paired with any of the listed processors in an application.

Processor	Technology	Manufacturer
OMAP 3	ARM Cortex™-A8	Texas Instruments
OMAP 4	Dual ARM Cortex™-A9	Texas Instruments
AM18xx	ARM-9	Texas Instruments
AM37xx	ARM Cortex™-A8	Texas Instruments
i.MX53	ARM Cortex™-A8	Freescale

Table 2.2

2.2.1 WLAN-Processor Interconnections

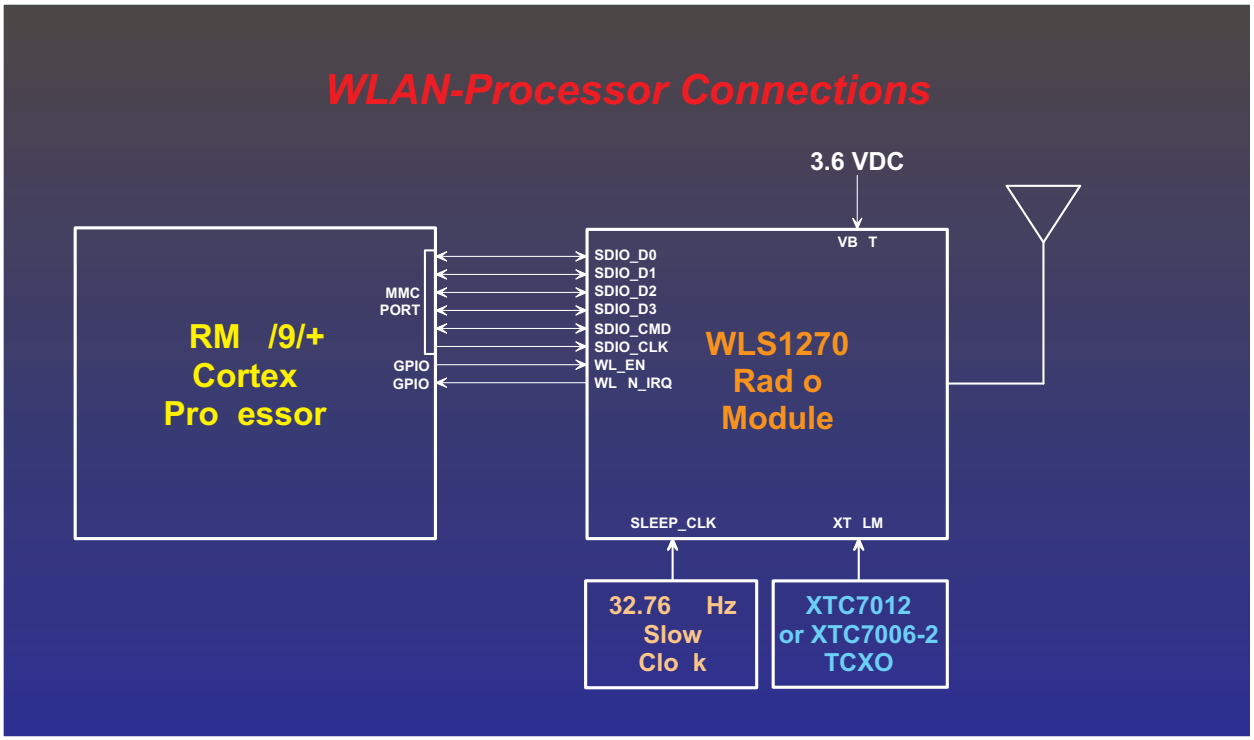


Figure 2.2.1

As shown in Figure 2.2.1, the WLAN interconnection with the host processor consists of four SDIO data lines, SDIO_D0 through SDIO_D3, the SDIO_CLK and SDIO_CMD lines, plus two GPIO lines on the host processor. The six SDIO lines will be organized on the host processor as one of its MMC ports. The WLAN interconnection is also used to download the WLAN firmware from the host processor.

2.3 Frequency References

Murata offers two TCXO's for use with the WLS1270 OEM module (fast clock). The XCT7012 is a 38.4 MHz TCXO and the XTC7006-2 is a 26 MHz TCXO. Murata recommends the use of a TCXO frequency refer-ence in industrial applications which are expected to have a long operating life and which may be ex-posed to temperature extremes during operation. It is possible to use a 38.4 or 26 MHz crystal frequency reference rather than a TCXO in less demanding consumer applications. The overall crystal accuracy including initial tolerance, temperature drift and aging must not exceed ±20 ppm. The DR-WLS1270-101 contains an XTC7012 and requires no external fast clock frequency reference.

A 32.768 kHz frequency reference is required for the slow clock input on the WLS1270 and DR-WLS1270-101 modules, such as an ECS International ECS-327KE or equivalent.

2.4. Power Supply Requirements

The WLS1270 modules require a single supply voltage in the range of 3.0 to 4.2 Vdc. The peak operating current requirement is 500 mA. A DC-to-DC convertor is included in the WLS1270 modules to generate 1.8 VDC, as required by one of the WL1270L power buses. Note the WLS1270 I/O is 1.8 V logic.

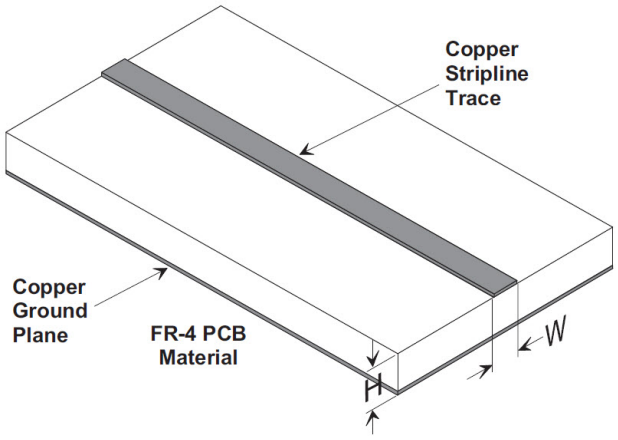
2.5. PCB Layout

The recommended PCB land patterns for the WLS1270 and the DR-WLS1270-101 modules are detailed in their respective data sheets. The number of layers in the PCB is dictated by the host processor. A minimum of 4 layers will be required, with 6 or 8 layer PCB layouts common. Special attention is needed for the RF trace, as discussed in the next section. Contact Murata technical support if you have any questions about adapting the recommend land pattern to your application specifics or before using non-standard land dimensions.

2.6. RF Connector and Antenna

The connection between the WLS1270 OEM module and the antenna or antenna connector on the host circuit board should be implemented as a 50 ohm stripline. Referring to Figure 2.6.1, the width of this stripline depends on the thickness of the circuit board between the stripline and the groundplane. For FR-4 type circuit board materials (dielectric constant of 4.7), the width of the stripline is equal to 1.75 times the thickness of the circuit board. Note that other circuit board traces should be spaced away from the stripline to prevent signal coupling, as shown in Table 2.6.2. The stripline trace should be kept short to minimize its insertion loss.

Circuit Board Stripline Trace Detail



For 50 ohm impedance W = 1.75 * H

Trace Separation from 50 ohm Microstrip	Length of Trace Run Parallel to Microstrip
100 mil	125 mill
150 mil	200 mil
200 mil	290 mil
250 mil	450 mil
300 mil	650 mil

Table 2.6.2

The WLS1270-101 module includes a U.FL RF connector on the antenna port. A variety of 2.4 GHz antennas are available with attached U.FL cables.

2.7. Certification Testing

An application incorporating the WLS1270 OEM module must be certified to comply with the low power radio regulations in each region it is to be marketed. The certification process includes conducting RF tests to demonstrate technical compliance, plus the submission of draft product manuals, product photos, schematics and certain related technical data. In most cases, product developers will contract with a test lab that has a direct association with a TCB/Notified Body (regulatory contractor) that is authorized to issue the certifications. The test lab and TCB will provide guidance on the items needed to conduct the test and issue the certifications.

The DR-WLS1270-101 module is pre-certified to FCC Part 15, Canadian IC RSS-210 and European ETSI low power radio regulations.

2.8. Notices and Labeling

The DR-WLS1270-101 certifications require certain product manual notices and product labeling in connection with the certification, as given below:

DR-WLS1270-101 FCC Certification - The DR-WLS1270-101 hardware has been certified for operation under FCC Part 15 Rules, Section 15.247. *The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.*

DR-WLS1270-101 FCC Notices and Labels - *This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.*

A clearly visible label is required on the outside of the user's (OEM) enclosure stating the following text:

Contains FCC ID: HSW-DR-WLS1270-101
Contains IC: 4492A-DR-WLS1270-101

WARNING: This device operates under Part 15 of the FCC rules. Any modification to this device, not expressly authorized by Murata Manufacturing Co., Ltd., may void the user's authority to operate this device.

This apparatus complies with Health Canada's Safety Code 6 / IC RSS 210.

IC RSS-210 Notice - *Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.*

ICES-003

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of Industry Canada.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de Classe B prescrites dans le reglement sur le brouillage radioelectrique edicte par Industrie Canada.

Following the certification of an application using the WLS1270 OEM module, manual notices and labeling similar to the DR-WLS1270-101 will be required. The certification agent will provide specific information on the required notices and labeling.

3.0 Software Integration

For the processors listed in Table 2.2, WLS1270/DR-WLS1270-101 open source software drivers are available for the Linux 2.6.35, Android GingerBread 2.3 and WinCE6 operating systems. A WLS1270 driver provides several functions, and references several related files. Referring to the left side of Figure 1.1, the driver downloads a .bin firmware file into the WLS1270 module during initialization, as guided by the .ini initialization/configuration file, and then provides an interface to the WLS1270 network application programs. The driver will also create an .nvs calibration file during production testing. The driver and related files must be compiled into the operating system kernel. This step requires a programmer with experience in installing drivers into the operating system kernel being used in the application.

3.1 Acquiring Open Source WLS1270 Drivers and Related Files

For the Texas Instruments processors listed in Table 2.2, the drivers and related WLS1270 firmware and initialization files can be downloaded from the following links:

Linux:

http://linuxwireless.org/en/users/Drivers/wl12xx

or

http://linuxwireless.org/en/users/Download

or

git://git.kernel.org/pub/scm/linux/kernel/git/luca/wl12xx.git

Android:

http://software-dl.ti.com/dsps/dsps_public_sw/sdo_tii/TI_Android_DevKit/TI_Android_GingerBread_2_3_4_DevKit_2_1/index_FDS.html

or

http://processors.wiki.ti.com/index.php/TI-Android-GingerBread-2.3.4-DevKit-2.1.1_PortingGuides

WinCE6:

http://www.adeneo-embedded.com/en/Products/Application-Middleware

For the i.MX53 series Freescale processors, Linux and Android drivers and related WLS1270L firmware and initialization files can be downloaded from the following link:

ftp1.rfm.com

Contact Murata for the software licensing agreement (SLA) to access this site. Once the SLA is completed, Murata will issue a user name and password for access.

3.2 Creating the WLS1270 Calibration File

During initialization, the driver will search for an .nvs calibration file in its directory. If the calibration file is not found, the driver will run a built-in production test (BIP) calibration and create the .nvs file. To facilitate this initial calibration, the product incorporating the WLS1270/DR-WLS1270-101 module should be placed in an RF environment similar to its typical operating environment. For example, the product should be initialized on a non-metallic table to avoid skewing the BIP calibration values.

4.0 Application Support Resources

For WLS1270/DR-WLS1270-101 technical support, call RFM at (972) 789-3854 between the hours of 8:00 AM and 5:00 PM Central US Time, or E-mail tech_supsrr@rfm.com.

4.1 Design Documentation and Evaluation Kits

The following documents can be obtained through the RFM web site at www.rfm.com:

WLS1270 Product Brief
WLS1270 Data Sheet*
DR-WLS1270-101 Data Sheet
AN1200 Application Note (this document)

A WLS1270 evaluation kit is available through RFM's distributors:

DR-WLS1270 Evaluation Kit*

* A non-disclosure agreement (NDA) is required to download or purchase these items. RFM has an automated NDA process to streamline this step.