WL1271 Production Line Testing (PLT) Recommendations

Literature Number: SPRAB94
January 2010

Contents

List of Tables

Revision History

Version	Date	Description
1.0	January 2010	Release

Reference Documents

The documents listed below provide complementary specifications and information for the device:

- NONE

About This Document

This document describes the recommendations for the Bluetooth® and WLAN production line tests (PLTs) that are performed by customers.

The document contains the following chapters:

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Introduction

This document describes Texas Instrument's recommendations for the Bluetooth and WLAN production line tests (PLTs) that are to be performed by customers. This document is not intended to provide a comprehensive testing suite for the customer, but only the basic set of tests needed to verify that all modules are mounted correctly.

The purpose of this document is to describe test scenarios and their expected limits. It does not provide the full test setup and test procedures. The customer may choose a subset of the recommended test set or conduct all the tests, based on time constraints, human resources constraints and accessibility to testing equipment.

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RF Performance Assumptions

Unless otherwise noted, parameters are referenced to the single-ended RFANT port

The optimal RF performance of the WL1271 WiLink6.x based LSR module system makes the following assumptions:

- The correct electrical connections are made between the devices.
- The circuit layout follows guidelines.
- Relevant interference from other radiating elements in the system is within identified limits.
- The location and isolation between the WLAN and other antennas is within identified limits.
- Host software driver integration adheres to TI and Mistral recommendations.
- All WLAN measurements were performed at VBAT=3.6V, at the RF output port unless otherwise noted.
- All BT measurements were performed at VBAT=3.6V, at the RF output port unless otherwise noted.

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Bluetooth

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3.1 Overview

Before performing any Bluetooth PLT testing, it is necessary to calibrate the device. The calibration is applied when the Bluetooth core is initialized (by uploading the init script to the device).

3.2 Tx Testing

3.2.1 Overview

It is important to note that all measurements are referenced to the LSR module's single-ended RFANT port (without the band-pass filter at the FEM output). This means that you should take into account all additional components that may be added between the module RF output port and the antenna port (for example, switches and filters).

3.2.2 Max RMS Output Power

Table 1: Max RMS Output Power - BT

Condition		Min.	Typ.	Unit
8DPSK	VDD_LDO_IN_CLASS1P5 = VBAT	7	9	dBm

It is possible to integrate modulation accuracy tests together with output power tests. However, additional testing equipment is required and the test setup is more complicated. You may refer to *Section A1, BT*, for reference.

3.3 Rx Testing

3.3.1 Sensitivity

Table 2: Sensitivity - BT

Condition	Min.	Typ.	Spec.	Unit
Pi/4-DQPSK modulation; BER=0.1%	-87	-92	-70	dBm

TI recommends the use of only one Bluetooth channel for the test, because there is no difference RF chain-wise across channels. In addition, EDR2 is sufficient, and there is no real benefit in running all modulation types. Test scenario reduction is crucial, especially because time duration is significant in terms of PLT.

In order to obtain sufficient statistics, the time duration for each scenario is estimated, as follows:

- According to the Bluetooth SIG RF test suite, the sensitivity limit is established when at least 1,600,000 bits are transmitted.
- According to each modulation, the duration is calculated as:
  - **Pi/4-DPSK:** The largest packet is 679 bytes, meaning 5,432 bits. 295 packets are required. The total time duration for each packet is 2,716 [seconds], resulting in approximately 0.8 seconds.

WLAN

Topic Page

4.1 Overview

Before performing any WLAN PLT testing, it is necessary to calibrate the device. Calibration is referred to as Built-in PLT (BiP), whose main purpose is to remove the use of external testing equipment at the customer production line.

4.2 BiP Calibration

Before performing any test, it is very important to run the Tx BiP calibration based on the reference points provided in the ini file. The RF port should be terminated with a 50 ohm load when the Tx BiP is run. Make sure to store the calibration in the NVS file.

For example if you are using the TI's CLI tool following commands with perform the BiP Calibration and store the NVS file.

/ w p 1 l 2 f 2 (Sets the power mode to always „ON" instead of automode)

/ t r h 0 7 (Tunes to channel 7)

/ t b b 375 128 0 (uses the BiP reference point 375, 128 (16dbm*8) for calibration)

/ t b t 1 0 0 0 0 0 0 0 (Executes the calibration and saves the NVS file)

Details of the commands parameters for these and other commands needed to run the below tests can be found in the PLT user guide (SWAU060_WL6.1_BIP_PLT_ATE_SyLinWIN.pdf).

4.3 Tx Testing

4.3.1 Overview

It is important to note that all measurements are referenced to the LSR module's single-ended RFANT port. This means that the customer should take into account all additional components that may be added between the RF output port and the antenna port (for example, switches and filters).

4.3.2 Max RMS Output Power

Table 3: Max RMS Output Power - WLAN

Condition	Min.	Min. 25˚C	Unit
11 Mbps (CCK modulation)	18	20.5	dBm
54 Mbps (OFDM modulation)	13	14.5	dBm

It is recommended to run these tests over three channels: channels 1, 7 and 14.

The time duration is negligible.

It is possible to integrate modulation accuracy tests together with output power tests. However, additional testing equipment is required and the test setup is more complicated. You may refer to *Section A.2, WLAN*, for reference.

4.4 Rx Testing

4.4.1 Sensitivity

Table 4: Sensitivity - WLAN

Condition	Min.	Min. 25˚C	Typ.	Unit
1 Mbps (DSSS modulation)	-92.5	-95	-96	dBm
54 Mbps (OFDM modulation)	-70.5	-73	-73.5	dBm

It is recommended to run these tests over three channels: channels 1, 7 and 14.

Note: For channel 14, sensitivity is degraded up to 2 dB.

The power levels in Table 4 refer to a PER value of 8% for 11b (DSSS and CCK modulations) and a PER value of 10% for 11g/n (OFDM modulation).

In order to obtain sufficient statistics, the time duration for each scenario is estimated, as follows:

- 200 packets for 11b results in approximately 3.3 seconds.
- 500 packets for 11g/n results in approximately 1.6 seconds.

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Modulation Accuracy

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A.1 BT

Modulation accuracy is tested differently for GFSK and PSK modulations. For GFSK, frequency deviations are measured, whereas for PSK modulations, DEVM is measured.

Note: It is possible to integrate this test with the output-power test in order to save time. However, the modulation test may require additional testing equipment.

Table 5: GFSK Modulation Accuracy - BT

Condition	Min.	Typ.	Max.	Spec.	Unit
Average deviation	150	165	170	140-175	KHz
Instantaneous deviation	120	130		> 115	KHz
dFavg/dFins	85	88		> 80	%

The modulated data for average deviation is 1111000011110000…

The modulated data for instantaneous deviation is 10101010…

Table 6: 8DPSK Modulation Accuracy – BT

Condition	Typ.	Max.	Spec.	Unit
RMS DEVM	6	12	13	%
99% DEVM		20	20	%
Peak DEVM	16	25	25	%

According to the Bluetooth SIG RF, DEVM measurement is made over a total of 200 non-overlapping blocks, where each block contains 50 symbols. Thus, the total time duration is 10 [mSec].

A.2 WLAN

Table 7: EVM - WLAN

Condition	Min.	Min. 25˚C	Unit
54 Mbps (OFDM modulation) at +13.5 dBm	-28	-30	dB

It is recommended to run these tests over three channels: channels 1, 7 and 14.

The time duration is negligible.