USB Certification Guidelines

White Paper

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NORWEGIAN
ACCREDITATION
No. **S03**

NS-EN ISO 9001 CERTIFICATED FIRM

Revision History

Date	Version	Description
March 2008	1.0	

Contents

1   Introduction

This white paper is an introduction on how to acquire Universal Serial Bus (USB) logo certification for devices that use full speed USB (12 Mbps) certified Nordic Semiconductor products. For USB logo certification (and to post on the USB integrators list) your company must be a member of the USB Implementer's Forum (USB IF).

A device using a full speed USB certified Nordic Semiconductor product can acquire USB logo certification in the following two ways:

- **Certification by similarity** (see chapter 3): Certification is given when a device is very similar to an already existing certified device.
- **Peripheral device certification** (see chapter 4): This is a more elaborate procedure, used when criteria for certifying by similarity is not fulfilled. The peripheral device certification procedure includes running the USB IF compliance program (see chapter 4.2).

The Universal Serial Bus revision 2.0 specification, also called the USB standard, provides the technical details for understanding USB requirements and designing USB compatible devices. This document is available at: http://www.usb.org/developers/docs/.

More details about USB logo certification can be found here: http://www.usb.org/developers/compliance/.

2　　USB Implementer's Forum (USB IF) and the USB IF integrator's List

USB Implementers Forum, Inc. is a non-profit corporation founded by the group of companies that developed the USB specification.

The USB IF integrators list is a list of USB devices that have met the criteria established by the USB IF compliance program, making them eligible to bear the USB IF logo. In order for a company to use the trademarked USB logo in conjunction with a device, the following requirements must be met:

- The devices must pass USB IF compliance testing for product quality and be listed on the integrators list under their company name.
- The company must sign the USB IF trademark license agreement.

More information about the USB logo can be found here: http://www.usb.org/developers/compliance/logo/

3   Certification by similarity

Certification can be approved without testing when a device seeking USB certification is very similar to an existing certified device. Some differences are accepted between devices seeking certification by similarity and the similar device that is already certified. These differences are defined in the USB IF guidelines. If the device differences are within these guidelines, the second device can be certified by submitting the Qualification by Similarity form.

> **Note:** Only USB IF members are allowed to submit the Qualification by Similarity form. This means that you must be a USB IF member to certify a device similar to a Nordic Semiconductor reference design.

3.1   Guidelines for significant differences

A certification by similarity is not issued and a retest is required if the following changes have been made to your device:

- Microcontroller design change (new architecture or a new product family).
- Connector footprint on PCB.
- Any change to the silicon requires retest, even if no change is made to the USB controller or associated logic. This is because silicon changes can increase noise thresholds, cross-talk, power consumption, and so on. This can adversely impact USB performance.
- Any change to the PCB requires retest.

A retest is not required if the following changes have been made to your device:

- Product packaging changes (color, shape, and so on).
- Microcontroller vendor change (no board layout change, no firmware change). Only if the new microcontroller is on the integrators list is a retest not required.
- Microcontroller firmware change (changes in fully modular code not associated with USB functions).
- Connector color and aesthetics.
- Connector vendor or model number change (no board layout change). This is applicable only as long as the new connector is on the integrators list.

For more information about certification by similarity see: http://www.usb.org/developers/compliance

4 Peripheral device certification

When the criteria for certification by similarity is not fulfilled, the device can be certified by peripheral device certification. The peripheral device certification procedure includes running the USB IF compliance program.

4.1 Example of equipment needed for USB IF compliance program

The following is an example of the type of equipment needed for conducting compliance tests:

- Oscilloscope (with test application installed)
- Passive probes
- Current probe with power supply
- USB test fixture
- Average current draw test jig
- USB analyzer and traffic generator
- USB analyzer Ellisys 110b.
- USB HUB 5X, needed for Device framework (chapter 9 in the Universal Serial Bus revision 2.0 specification) test and Interoperability tests

4.2 USB IF compliance program

The compliance certification program requires that the following documentation is submitted:

- A completed USB compliance checklist to the USB IF.
- Wireless technology information sent to the test lab (see section 4.2.2).
- A compliance test report with a pass result to the USB IF.
- The USB IF trademark license agreement.

When this documentation is submitted and acceptance is received from the USB IF, the USB logo can be used according to the guidelines listed in the logo license document found at: http://www.usb.org/developers/compliance/logo/.

4.2.1 The USB compliance checklists

Compliance checklists are a simple set of questions, measuring device compliance in areas that are difficult to test.

> **Note:** Some answers cannot be based on measurements but instead, must be based on design information.

The USB compliance checklists must be completed by your company. Use the peripheral device checklist, available at: http://www.usb.org/developers/compliance/check_list/.

4.2.2   Wireless technology Information

When the USB device contains wireless technology, information about this technology must be submitted to the test lab.

The following wireless technology information is required:

- Vendor Name
- Vendor Contact
- Vendor Email
- Product Name
- Product Model
- Product Revision
- Wireless Technology
- Operating Frequencies
- Product Description

See chapter 5 for an example on how to fill out this information.

4.2.3   The USB compliance test

The USB compliance tests must be performed by the USB IF or by a USB IF certified test laboratory. The USB IF tests are performed at USB compliance workshops (or 'plug fests'), which are a quarterly event. This means that if you use a compliance workshop there is three months of waiting time before a retest in the case of a failure.

But, you can also choose to use an independent test laboratory. For a list of laboratories where you can test your device check: http://www.usb.org/developers/compliance/labs/

Even if the final test is performed outside your company, you should perform as many tests as possible within your company to reduce the risk of failure and to optimize the USB compliance performance. The compliance test procedure is described in the **USB IF compliance test procedures rev. 1.31**. This document describes the various test sessions and can be found towards the bottom of this page: http://www.usb.org/developers/docs

The main tests you need to perform are:

- Electrical tests
- Device framework test (chapter 9 in the Universal Serial Bus revision 2.0 specification)
- Interoperability tests

4.2.3.1   Electrical tests

The electrical tests are described in chapter B and H in the **USB IF compliance test procedures rev. 1.31**. The two applicable tests for the USB devices (full speed peripherals) are:

- Chapter B. Inrush current testing (B.4), and upstream signal quality testing (B.6). You can conduct these tests with the agilent test setup or a similar setup.
- Chapter H. Back voltage testing.

These tests are easy to run and should be performed by your company. The tests are PC programs and can be downloaded from: http://www.usb.org/developers/tools/.

4.2.3.2   Device framework test

This test is named after chapter 9 in the Universal Serial Bus revision 2.0 specification. The test is a collection of USB host traffic sent to the device, to ensure that the device is able to reply correctly to a wide set of requests from the host.

The device framework test is described in chapter C in the **USB IF compliance test procedures rev. 1.31**. This document explains the use of the USB Command Verifier (USBCV) version 1.2. In the tests, version 1.3 should be used.

Device framework test is a PC program, which contains USBCV version R1.3 and documentation. The PC program is called **USBCVR13Beta3.msi** and can be downloaded from Http://www.usb.org/developers/tools/.

When performing the device framework test, the Device Under Test (DUT) should be connected to a 2.0 self powered USB hub. Make sure that you know the Vendor ID (VID) and Product ID (PID) of the device before performing this test.

> **Note:** VID and PID are needed to choose the correct device to test.

4.2.3.3   Interoperability tests

The interoperability tests address real life scenarios of the Device Under Test (DUT) towards different host controllers, and the DUT toward a defined USB tree with USB HUBs and devices, called the Gold tree suite.

A complete interoperability test must be done at an independent laboratory. This is because experienced personnel must make the correct choice of hosts, operating systems, USB HUBs and other USB devices.

However, even though the test lab conduct the Gold Tree suite, it is also useful for you to reproduce a Gold Tree suite in order to reproduce interoperability issues for debugging.

4.2.4   Submitting the USB IF trademark license agreement

The USB IF trademark license agreement must be signed and submitted to USB IF. The license agreement covers all your products that are on the USB integrator's list.

The document **USB IF trademark license agreement** can be downloaded from: http://www.usb.org/developers/logo_license.

4.3 Peripheral Device Certification

Table 1. lists the steps required to receive peripheral device certification.

Step	Perform	Comments
1	Assemble your device with the full speed USB certified Nordic Semiconductor product and USB contact.	Use only products (for example, silicon) and USB contacts which are USB certified and that have a TID (Test ID) number. The TID is used in USB compliance checklist peripherals.
2	Conduct as many tests as possible from the compliance test list and also conduct the device framework test.	Device framework test is a PC program. Download the program and run the test in accordance to this document: USB IF compliance test procedures rev. 1.31 http://www.usb.org/developers/docs The device framework test is performed under point D24 in the peripheral device checklist.
3	Fill in the form for wireless technology information and send the form to the test laboratory. Send your USB device to the test laboratory for performing the USB compliance test.	See example of filling in form in chapter 5 The test laboratory runs the test according to the USB IF compliance test procedures rev. 1.31. Your company must use USB IF or a USB IF certified laboratory. Even if the final test is performed outside your company, as much as possible of the tests should be performed at your company to reduce the risk of failure, and to optimize the USB compliance performance. Check the following link to see which laboratories are available to test your device: http://www.usb.org/developers/compliance/labs/
4	Receive USB acceptance from the test laboratory.	When your USB device is approved by the test laboratory, you receive a USB certification report and Test ID number (TID).
5	Perform the USB compliance checklist for your USB device, and submit a completed checklist to USB IF.	The USB compliance checklists must be completed by your company. Remember to fill in the TID for the Nordic Semiconductor product and the USB connector. Use the peripheral device checklist, it is available at: http://www.usb.org/developers/compliance/check_list/

Table 1. Peripheral device certification list

5   Example of filling in wireless technology information

Here is an example of how to fill in the wireless technology information. In this example nRF24LU1 is used. The nRF24LU1 is a USB full speed chip, with a USB and radio interface.

5.1   USB Compliance information

5.1.1   USB Connector:

Field	Description
Manufacturer	Molex Inc
Model name	USB A type plug/48037
TID	6100 0887

Table 2. USB connector information example

5.1.2   USB silicon:

Field	Description
Manufacturer	Nordic Semiconductor
Model name	nRF24LU1
TID	Write the Test ID (TID)

Table 3. USB silicon information example

5.2   Wireless Technology information

Field	Description
Vendor name	Write your company name
Vendor contact	Write the name of the contact person at your company
Vendor email	Write the email address of the contact person
Product name	Write your product's name
Product model	Write the product model name
Product revision	Write the product's revision number
Wireless technology	Nordic Semiconductor Proprietary RF Technology
Operating Frequencies	2.4000GHz - 2.4835GHz
Product Description	Description of your product". The RF and USB interface is based on Nordic semiconductor nRF24LU1 2Mbit/s 2.4GHz proprietary transceiver.

Table 4. Wireless technology information example

6 References

- You will find all necessary information on every aspect of USB at their website: www.usb.org

- Here are some good books about USB:
  - ▸ **USB Complete** by Jan Axelson.
  - ▸ **USB Mass Storage: Designing and Programming Devices and Embedded Hosts** by Jan Axelson.
  - ▸ **USB design by example** by John Hyde.
  - ▸ **USB in a Nutshell** by John Hyde.