

A Standard for Host-Side Certified Wireless USB Connection Context Storage on Windows Operating Systems

January 16, 2009
Revision 1.0

Certified Wireless USB Connection Context Storage

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1 Document Properties

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2 Revision History

Revision	Date	Who	Tracking Level and Description
0.1	03/28/08	DS	Initial draft
0.3	03/28/08		Formatting changes
0.4	03/28/08	DS	Minor edits
0.5	05/07/08	SS	Updated to reflect USB-IF consortium accepted format for CC storage, added samples in Appendix
0.6	05/18/08	SS	Added BandGroups to Host key
0.7	05/21/08	SS	Added Appendix D to explain Registry access contention Added note about un-install not removing common keys
0.8	08/01/08	SS	Modifications as per review with MSFT: (1) New "Keys" and "Properties" sub-keys under CDID key (2) New "HostVendorID" and "AssocMethod" properties under "Properties" key (3) Wording change in the
0.9	08/06/08	SS	Language/wording modifications based on review
0.91	08/12/08	BD	Minor language tweaks based on further review
1.0	08/15/08	BD	Move version to 1.0.

Revision Checklist

- Microsoft Word Menu Bar: File – Properties – Comments: update field with document release date
- Change revision number on title page and in Document Properties table
- Update document fields with Edit – Select All, then right click on any field and select "update field"

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3 Purpose and Overview

3.1 Purpose

The Wireless USB Specification defines a set of values that must be retained on both the host and device at the time of association in order to establish a secure connection at a later time. The information required to establish a secure connection between a single host-device pair is referred to as a Connection Context. Although the specification defines what information is required for a Connection Context, it does not provide any guidelines or recommendations regarding storage of that information on the host side. The purpose of this document is to provide a standard for the host-side Connection Context Repository so that device associations may be shared by the software of all vendors on Microsoft Windows™ platforms. Appendices A and B provide examples of this specification.

4 Required Registry Keys and Values

The information for a single host-device pair Connection Context consists of a connection host ID (CHID), a connection device ID (CDID) and a connection key (CK). In addition to these, the host friendly name (HostFriendlyName), device friendly name (DeviceFriendlyName), language identifier (LangID) and supported Band Groups (BandGroups) are required fields under the host and device keys. The registry keys and values in this section encode this minimal data that must be stored on the host during device association in order to allow the establishment of a secure connection at a later time.

4.1 Registry Hive Root:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB

This key is the root of the host-side Connection Context. This key contains one or more sub-keys named “0”, “1” ... “<N>”. For the sake of interoperability across vendors, all vendors must support and use the host numbered “0”. The Connection Context information, CHID and other information stored under “0” are guaranteed to interoperate between hosts of different vendors. Any new Host driver stack that starts up within the System must recognize the presence of a preexisting Registry sub-key “0” and reuse the CHID, Connection Context information stored underneath it. This will enable an end-user to replace a WUSB Host product within the System and retain previous associations with devices. Vendors, who want to use different CHIDs and Device Associations for different hosts, may use sub-keys named “1” ... “<N>”, though it is not guaranteed that such associations will interoperate with other vendors’ hosts.

4.2 Host Key(s):

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB<N>

This key holds all the information for the unique Wireless USB host numbered “<N>”. At a minimum, there will be one Wireless USB Host registered in the system with number “0” whose information will be stored under the key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB\0. This key contains non-device-specific values. Each subkey (see 4.3) corresponds to a device association.

This key must contain the following values:

Value Name	Description	Type	Example
BandGroups	A 32-bit value containing bit flags indicating the UWB Band Groups supported by this Host	REG_DWORD	0x00000005
CHID	Host Identifier formatted as a GUID string (refer to Appendix C on rules of encoding a GUID)	REG_SZ	{953E13DC-BD1B-4D71-96D5-6D13F311FE91}
HostFriendlyName	Friendly name of Wireless USB Host	REG_SZ	TEST-HOST-01

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LangID	Language identifier	REG_DWORD	0x00000409
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4.3 Device Key(s) associated with Wireless USB Host <N>: **HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB\<N>\<CDID-GUID>**

The name of this key is the 16-byte connection device ID (CDID) for the device association being stored, formatted into a standard GUID string. For example, the CDID 0x0123456789ABCDEF02468ACE13579BDF is stored as the key name "{67452301-AB89-EFCD-0246-8ACE13579BDF}". Note the Endianness that drives the formatting of the 128-bit CDID into a string representation of a GUID – Appendix C contains GUID encoding method. This key does not contain any values, it has the following sub-keys:

- A sub-key named “Keys” which contains the CK to be used to establish a connection to this device
- A sub-key named “Properties” that contains other device-specific properties

There is a possible contention (race condition) between CBAF and Host drivers in accessing the CDID sub-section of the Registry when the association process completes and the device attempts to connect to the host. Please see Appendix D for more information on this subject.

4.3.1 HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB\<N>\<CDID-GUID>\Keys

This key contains the secure connection context key for establishing a connection with the specified device whose CDID is part of the key path. This key is accessible (for read/write) only by users belonging to the Administrators group of the System. Non-Admin users cannot read or write values within this key. In addition, on Vista (and later versions) of the Operating System, explicit read / write access may be provided to an association service running as a Local Service.

This key must contain the following values:

Value Name	Description	Type	Example
CK	Connection Key formatted as a GUID string (refer to Appendix C)	REG_SZ	{DC500FB8-A19D-41B7-96DB-DBA2A6421072}

4.3.2 HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB\<N>\<CDID-GUID>\Properties

This key contains device-specific properties other than the CK. This separation of device context into two sub-keys is required to allow for a more secure area for storing the CK. The values in the “Properties” key can be read or written by users belonging to the Administrators group and can be only be read by non-Admin users.

This key must contain the following values:

Value Name	Description	Type	Example
BandGroups	A 32-bit value containing bit flags indicating the UWB Band Groups supported by this Device	REG_DWORD	0x00000005
DeviceFriendlyName	Friendly name of Wireless USB Device	REG_SZ	TEST-Device0
LangID	Language identifier	REG_DWORD	0x00000409
HostVendorID	Vendor Identifier (VID) of the creator of the WUSB software	REG_DWORD	0x0000162F

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	that created this association		
AssocMethod	Association method used to create this association (0x01 indicates CBAF and 0x02 indicates NA). Any other values are treated as vendor-specific values.	REG_DWORD	0x00000001

5 Optional vendor-specific parameters

To allow for vendor-specific information storage at global, per-Host and per-Device levels, the following subkeys are to be used:

Vendor Subkey	Description
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB\Vendor\<Vendor Name>	Optional area in Registry to store global vendor-specific information
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB\<N>\Vendor\<Vendor Name>	Optional area in Registry to store host-specific information per vendor for the host numbered <N>
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Wireless USB\<N>\<CDID-GUID>\Vendor\<Vendor Name>	Optional area in Registry to store device-specific information per vendor for device <CDID-GUID> associated with host <N>

The use of vendor-specific subkeys is required to prevent the collision of values with the same name but different meanings in the vendor-shared Connection Context registry space. Care should be taken that if vendors use vendor-specific areas as proposed here, the software uninstall program from the vendor must clean all vendor-specific locations in the Registry.

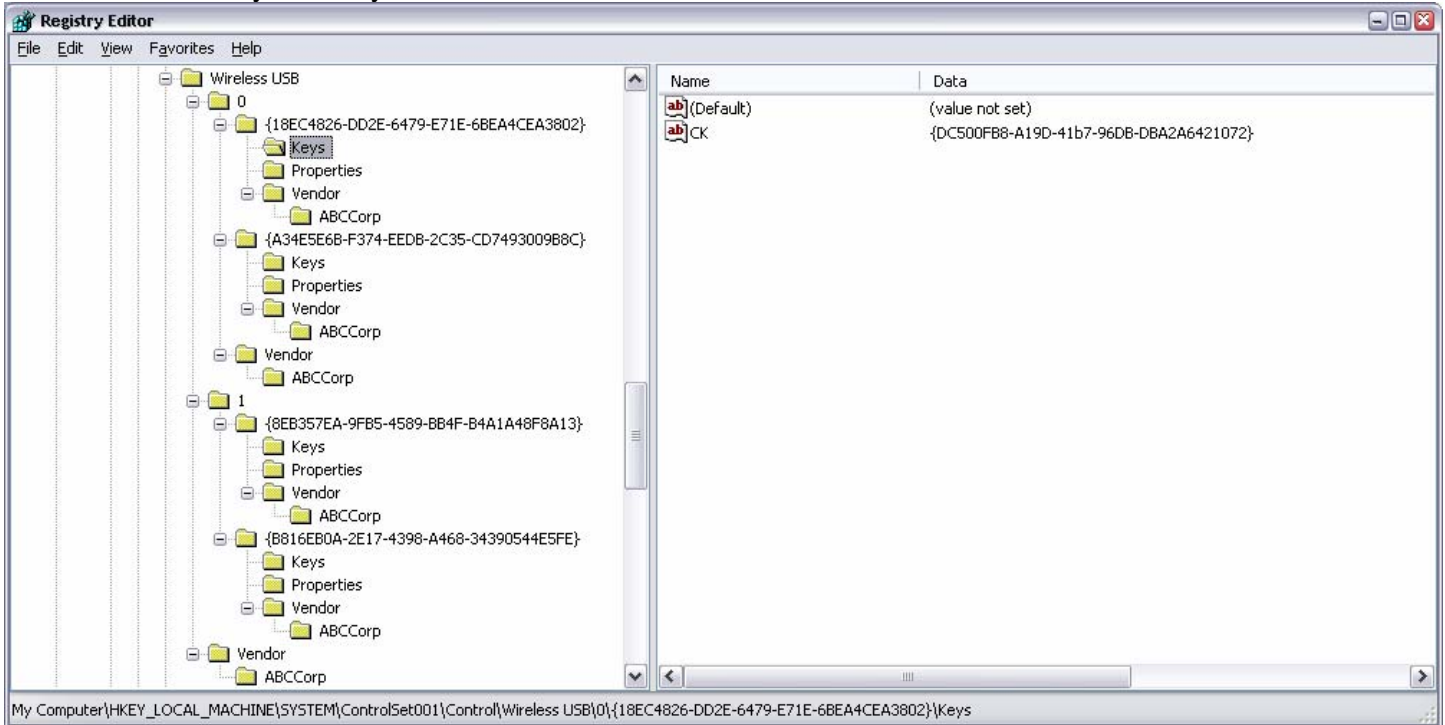
Care should also be taken to ensure that the software uninstall program from a vendor allows a user to retain the common Registry sections as specified in this document for reuse with another Host.

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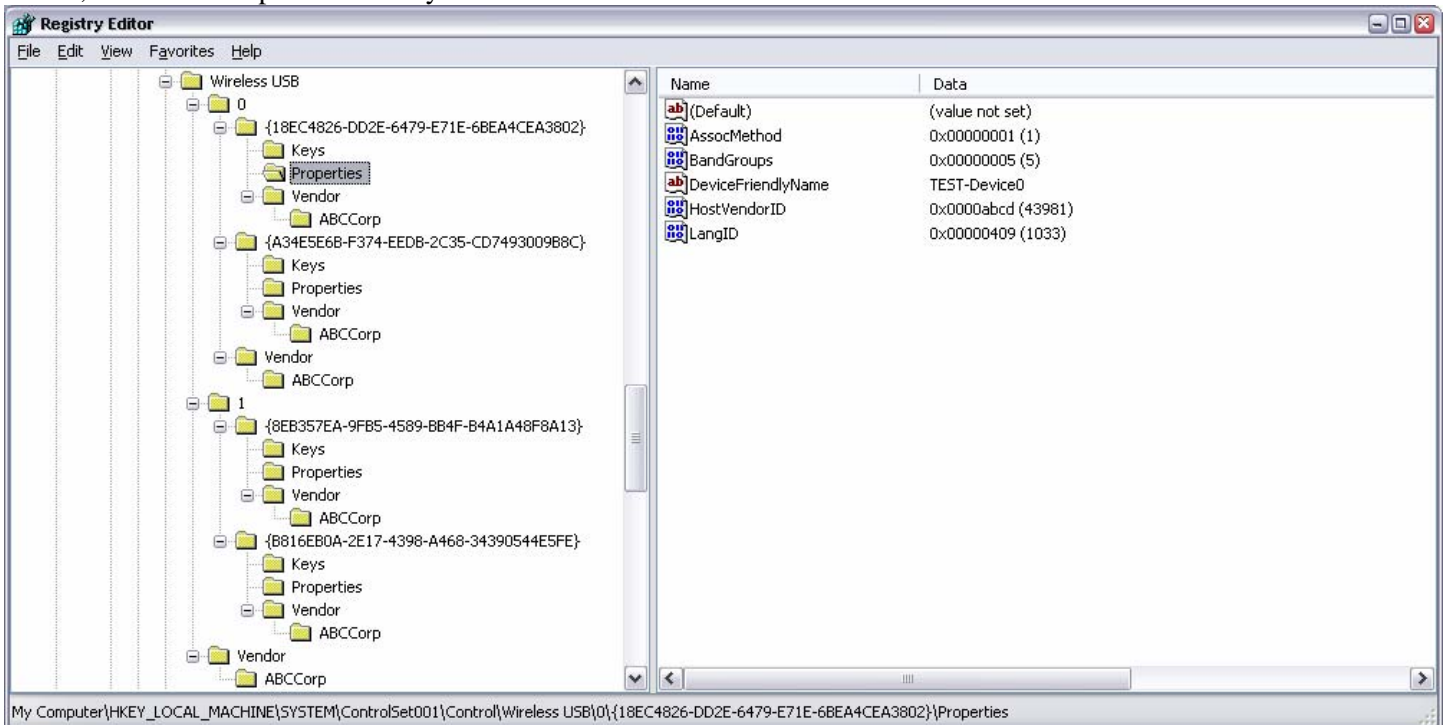
Appendix A

Sample Registry screenshots showing proposed Wireless USB hive:

Host-0, a CDID's "Keys" sub-key:



Host-0, a CDID's "Properties" sub-key:



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Appendix B

Sample .reg file contents using this specification:

Windows Registry Editor Version 5.00

```
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0]
"CHID"="{953E13DC-BD1B-4d71-96D5-6D13F311FE91}"
"HostFriendlyName"="WQ-HWA01"
"LangID"=dword:00000409

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\Vendor]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\Vendor\ABCCorp]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{18EC4826-DD2E-6479-E71E-6BEA4CEA3802}]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{18EC4826-DD2E-6479-E71E-6BEA4CEA3802}\Keys]
"CK"="{DC500FB8-A19D-41b7-96DB-DBA2A6421072}"

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{18EC4826-DD2E-6479-E71E-6BEA4CEA3802}\Properties]
"DeviceFriendlyName"="TEST-Device0"
"LangID"=dword:00000409
"BandGroups"=dword:00000005
"HostVendorID"=dword:0000ABCD
"AssocMethod"=dword:00000001

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{18EC4826-DD2E-6479-E71E-6BEA4CEA3802}\Vendor]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{18EC4826-DD2E-6479-E71E-6BEA4CEA3802}\Vendor\ABCCorp]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{A34E5E6B-F374-EEDB-2C35-CD7493009B8C}]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{A34E5E6B-F374-EEDB-2C35-CD7493009B8C}\Keys]
"CK"="{1BB66573-5EB5-476e-937F-C736421833E6}"

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{A34E5E6B-F374-EEDB-2C35-CD7493009B8C}\Properties]
"DeviceFriendlyName"="TEST-Device1"
"LangID"=dword:00000409
"BandGroups"=dword:00000005
"HostVendorID"=dword:0000ABCD
"AssocMethod"=dword:00000002

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{A34E5E6B-F374-EEDB-2C35-CD7493009B8C}\Vendor]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\0\{A34E5E6B-F374-EEDB-2C35-CD7493009B8C}\Vendor\ABCCorp]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1]
"CHID"="{020952D0-2E50-4f9b-83E6-89B7D27DD472}"
"HostFriendlyName"="OTHER-HOST"
"LangID"=dword:00000409

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{8EB357EA-9FB5-4589-BB4F-B4A1A48F8A13}]

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{8EB357EA-9FB5-4589-BB4F-B4A1A48F8A13}\Keys]
"CK"="{90C94F6F-321F-407e-959D-4F9E557BDEE3}"

[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{8EB357EA-9FB5-4589-BB4F-B4A1A48F8A13}\Properties]
"DeviceFriendlyName"="TestDev2"
"LangID"=dword:00000409
"BandGroups"=dword:00000005
"HostVendorID"=dword:0000ABCD
"AssocMethod"=dword:00000001
```


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```
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{8EB357EA-9FB5-4589-BB4F-B4A1A48F8A13}\Vendor]
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{8EB357EA-9FB5-4589-BB4F-B4A1A48F8A13}\Vendor\ABCCorp]
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{B816EB0A-2E17-4398-A468-34390544E5FE}]
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{B816EB0A-2E17-4398-A468-34390544E5FE}\Keys]
"CK"="{348FF732-A6C0-4328-A0F8-4F7FC7A428AD}"
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{B816EB0A-2E17-4398-A468-34390544E5FE}\Properties]
"DeviceFriendlyName"="TestDev3"
"LangID"=dword:00000409
"BandGroups"=dword:00000005
"HostVendorID"=dword:0000ABCD
"AssocMethod"=dword:00000002
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{B816EB0A-2E17-4398-A468-34390544E5FE}\Vendor]
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\1\{B816EB0A-2E17-4398-A468-34390544E5FE}\Vendor\ABCCorp]
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\Vendor]
[HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Wireless USB\Vendor\ABCCorp]
```

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Appendix C

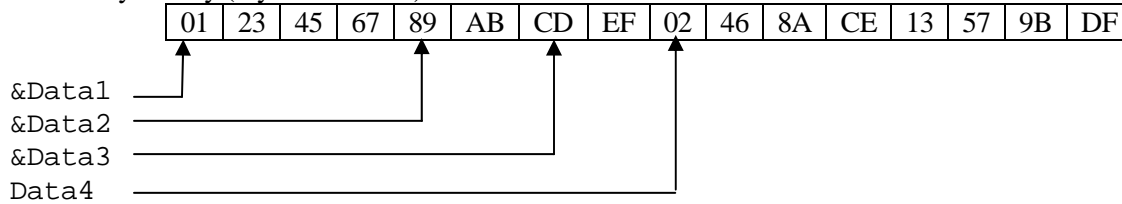
Method of encoding a 128-bit number into a GUID:

Encoding of 128-bit numbers (like CHID, CDID and CK) must follow the rules of formatting a GUID in Windows, assuming that the binary data was cast to a GUID structure.

In Windows, a GUID is defined as:

```
typedef struct _GUID {  
    unsigned long  Data1;  
    unsigned short Data2;  
    unsigned short Data3;  
    unsigned char  Data4[ 8 ];  
} GUID;
```

A raw 128-bit byte-array (say CDID value) of “0123456789ABCDEF02468ACE13579BDF” would be cast into a GUID as:



Using a little-Endian memory model, the fields of a GUID will be interpreted as:

Data1 == 0x67452301

Data2 == 0xAB89

Data3 == 0xEFCD

Data4 == { 0x02, 0x46, 0x8A, 0xCE, 0x13, 0x57, 0x9B, 0xDF }

so the result is formatted into a string as:

“{67452301-AB89-EFCD-0246-8ACE13579BDF}”

where Data4 (8 bytes) is split by the Windows GUID-to-String representation into 2 sections – a 2 byte and a 6-byte section (“0246-8ACE13579BDF”).

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Appendix D

Registry Access Contention

There is a possible contention (race condition) between a CBAF driver and a Host driver in accessing the CDID sub-key for a particular Connection Context. This could occur immediately after the association process completes and the device attempts to connect to the host. The problem is that the CBAF driver could be in the process of completing its storage of CK value in the Registry during which time the device attempts to connect to the host. This causes the Host driver to read incomplete information from the Registry (or the Registry Read API fails). The Host driver can retry reading the CK value or fail the connection attempts from the device as long as it does not have valid Connection Context information.