

Vaunix Technology Corporation
Lab Brick® Family of Signal Generators

Operation Manual
and
Programming Guide



Certification

Vaunix Technology Corporation certifies that this product met its published specifications at the time of shipment from the factory.

Warranty

Lab Brick Signal Generators are warranted against defects in material and workmanship for a period of one year from the date of shipment.

LIMITATION OF WARRANTY

The foregoing warranty does not apply to connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or inadequate maintenance by the Buyer, unauthorized modification or misuse, or operation outside of the environmental specifications of the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies. Vaunix Technology Corporation shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

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Declaration of Conformity

Manufacturer's Name: Vaunix Technology Corporation

Manufacturer's Address: 242 Neck Road
Haverhill, MA USA

Declares under sole responsibility that the product as originally delivered

Product Name: Lab Brick Signal Generator

Model Numbers: LSG-XXX, LSG-XXXX

Product Options: This declaration covers all options for the above products

to which this declaration relates is in conformity with the following standards or other normative documents:

EN 55011:1998/A1:1999 /A2:2002 Group 1 Class A ISM emissions requirements
EN 61326:1997/A1:1998/A2:2001 EMC requirements for Electrical equipment for measurement, General Use

Canada: ICES-001 Issue 3 Class A ISM emissions requirements

Australia: AS/NZS CISPR 11:2004 Class A ISM emissions requirements

This Declaration of Conformity applies to the above listed products placed on the EU market after:

10 October, 2007
Date



Scott Blanchard
President

This ISM apparatus meets all requirements of the Canadian Interference-Causing Equipment regulations.

Ce generateur de fequence radio ISM respecte toutes les exigences du Reglement sur le materiel brouilleur du Canada.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This instruction complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.



To return an unwanted instrument, contact Vaunix Technology Corporation.



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1.0 GENERAL INFORMATION

This guide contains information on the installation , operation and specifications of the Lab Brick® Family of Signal Generators.

1.1 General Safety Information

To prevent the risk of personal injury and loss related to equipment malfunction, Vaunix Technology Corporation provides the following safety information. For your own safety please read this section before operating the equipment.

Warning

Before connecting your Lab Brick Signal Generator to other instruments ensure that all instruments are connected to earth ground. Any interruption of the earth grounding may cause a potential shock hazard.

Caution

- The Lab Brick Signal Generator contains components which are sensitive to Electro Static Discharge (ESD). Proper ESD precautions must be maintained at all times while using this equipment.
- This equipment has no serviceable parts.
- To prevent the risk of electrical shock or damage to precision components, **do not** remove the equipment covers.
- Unauthorized entry into the unit voids all warranties.

2.0 GETTING STARTED

Prior to installing your Lab Brick Signal Generator, verify the contents of the package. The package should contain:

Quantity 1 Lab Brick Signal Generator

Quantity 1 Cable - USB Type A male/ Mini-B male

Quantity 1 Flash Drive containing the manual and the Graphical User Interface program

2.1 System Requirements

The Lab Brick Signal Generator runs from a standard PC or lap top computer with the following minimum requirements:

- Operating System - Windows® 2000, Windows® XP or Windows® Vista
- RAM - 256 MB
- Processor Speed - 512 MHz
- A minimum of one USB port

No other AC or DC supply is required as the power for this unit is delivered from a USB port on the computer or a self powered USB hub.

2.2 Installation of the Graphical User Interface (GUI)

The Lab Brick is controlled through the GUI program supplied on the provided USB flash drive. To install the GUI proceed with the following steps:

- Insert the supplied USB flash drive into an available USB port on the computer
- Run the program "Setup.exe"
- Follow the instructions on the screen
- After Installation is complete, remove the USB flash drive

2.3 Using the Lab Brick Signal Generator

Start the Lab Brick program by selecting the Lab Brick Icon or selecting the Lab Brick program from the Start Menu on the computer. Attach the supplied USB cable to the Lab Brick Signal Generator and the USB port on the computer. The green LED on the Lab Brick will illuminate as communication with the computer is automatically established. The GUI program will recognize the device and display the model number and serial number in the upper left and lower left corners respectively. The Lab Brick is now ready for operation.

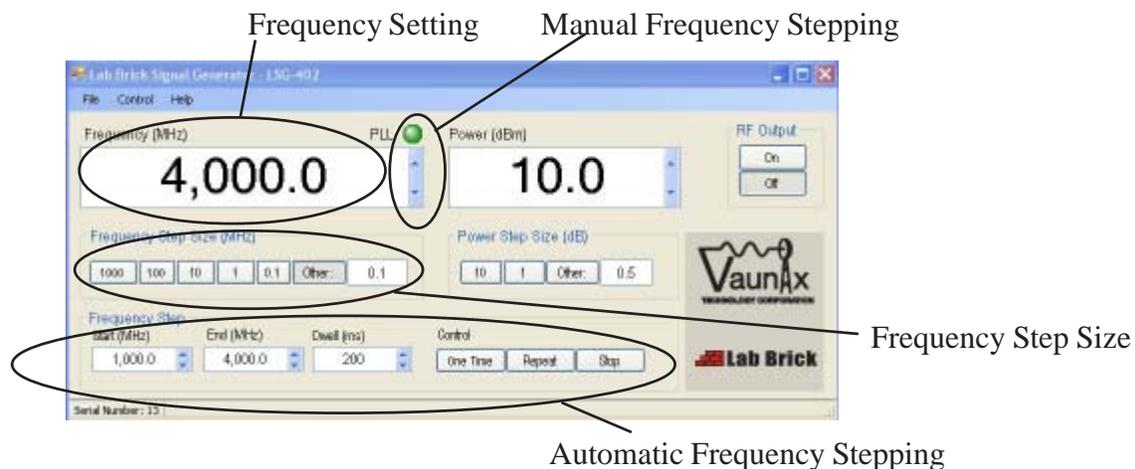
2.4 Using Multiple Lab Brick Signal Generators

Users may operate and control multiple Lab Bricks from a single computer. Start the Lab Brick GUI as described in section 2.3 for each Lab Brick Signal Generator that you will control from the computer. Connect each Lab Brick either directly to the USB port or through a self powered USB hub to the USB port of the computer. The green LED on each Lab Brick will illuminate as communication with the computer is automatically established. Each GUI application will automatically connect to one Lab Brick. The GUI will display the model number and serial number of the connected device in the upper left and lower left corners respectively.

3.0 OPERATING FEATURES AND CONTROLS

The general operation of the Lab Brick Signal Generator is designed by the Vaunix engineers to be intuitive and easy to use. This section describes the available features of the Lab Brick signal generator.

3.1 Frequency



3.1.1 Fixed Frequency Setting

The frequency is set using the Frequency field found on the left side of the GUI. Simply type the desired frequency into the window and hit the “Enter” key on your computer keyboard. The PLL indicator on the GUI will turn green to indicate that the desired frequency is established.

3.1.2 Configuring the Manual Frequency Step Size

The frequency may also be controlled by using the up and down arrows adjacent to the Frequency field. Use the controls directly below the frequency field to set the desired step size. Quick select buttons are available for fixed step sizes of 1000 MHz, 100 MHz, 10 MHz, 1 MHz and 100 kHz. Custom step sizes may also be used by selecting “Other” and entering the desired step size between 100 kHz and 1000 MHz.

3.1.3 Configuring the Automated Frequency Step Function

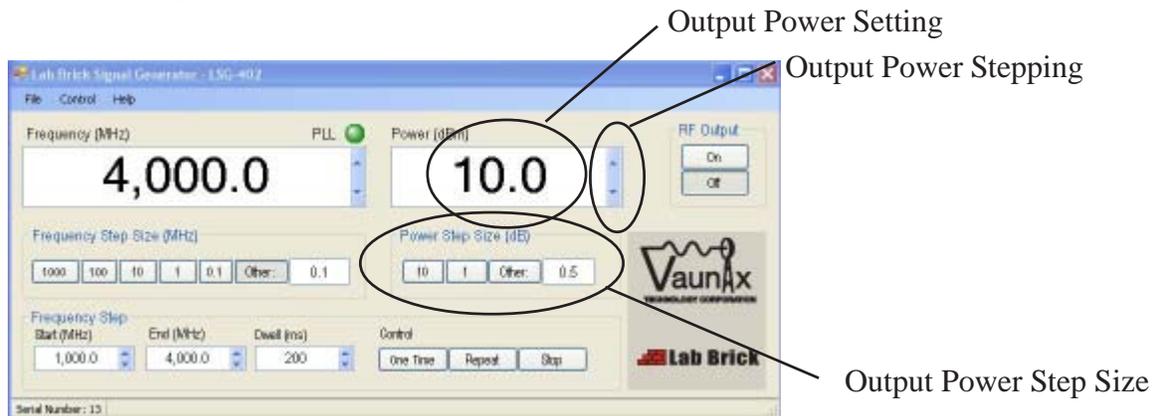
The Lab Brick can be configured to automatically step through a range of frequencies. The user must specify the start frequency, end frequency, step size and dwell time. The minimum start frequency and the maximum end frequency limits are predefined by the specific model number of the Lab Brick in use. The start and

end frequencies may be set anywhere in this range. The dwell time may be configured from 10 milliseconds to 5000 milliseconds per step. The step size is configured as described in section 3.1.2 .

By selecting the “One Time” control button, the Lab Brick frequency will sweep from the start to the end frequency. Upon completing the sweep, the Lab Brick output will stay at the end frequency. The user may stop the sweep at any time by selecting the “Stop” button.

By selecting the “Repeat” control button, the Lab Brick will repeatedly sweep from the start to the end frequency. The user may stop the sweep at any time by selecting the “Stop” button.

3.2 RF Power Output



3.2.1 Fixed Output Power Setting

The output power is set using the Power field found on the right side of the GUI. Simply type the desired output power into the window and hit the “Enter” key on your computer keyboard. The output will immediately go to the desired output power.

3.2.2 Configuring the Manual Output Power Step Size

The RF power may also be controlled by using the up and down arrows adjacent to the Power field. Use the controls directly below the Power field to set the desired step size. Quick select buttons are available for fixed step sizes of 10 dB and 1 dB. Custom step sizes may also be used by selecting “Other” and entering the desired step size between 0.5 dB and 40 dB in 0.5 dB increments.

3.2.3 RF On/Off

The output power is enabled and disabled by selecting the RF On or RF Off button as desired. The PLL indicator on the GUI changes from green to red to indicate that the RF output is disabled.

3.3 Setting the Initial Operating State

After configuring the frequency and power, the user may select to save the current settings. From the File menu select Save Current Settings as shown in the figure below.



These settings will be stored within the Lab Brick device. The Lab Brick will now power on in this predefined state when plugged into a USB port on any computer or USB self powered hub. The user may change the saved state at any time by repeating the process.

3.4 Autonomous Operation

The autonomous operation feature enables the Lab Brick to operate from a USB power source in the absence of a computer.

Configure the Lab Brick to the desired state and select the Save Current Settings command from the File menu. The power must now be removed from the Lab Brick by disconnecting the device from the computer or USB hub. When power is applied to the Lab Brick either from an unmanaged USB hub or USB battery pack the unit will begin operation at the saved setting. Please note that there is approximately 5 seconds of delay before the Lab Brick begins autonomous mode operation after power is applied.

3.5 External Reference (Option 001)

When option 001 is installed, the Lab Brick can operate from the internal reference or it can be phase locked to an external 10 MHz source. To use an external reference select External Reference from the Control menu. Once selected, the GUI will display a check mark adjacent to the External Reference command in the Control menu. Alternatively, the user may toggle the reference source using the F3 key on the keyboard.



4.0 SPECIFICATIONS

Model Number	LSG-251	LSG-152	LSG-222	LSG-402	LSG-602
Electrical					
Frequency Range (MHz)	50 to 250	250 to 1500	500 to 2200	1000 to 4000	1500 to 6000
Frequency Resolution	100 kHz	100 kHz	100 kHz	100 kHz	100 kHz
Frequency Accuracy ²	± 2 PPM	± 2 PPM	± 2 PPM	± 2 PPM	± 2 PPM
Guaranteed Output Power	+10 dBm	+10 dBm	+10 dBm	+10 dBm	+10 dBm
Output Power Setting Range	55 dB min	55 dB min	55 dB min	55 dB min	50 dB min
Output Power Setting Resolution	0.5 dB	0.5 dB	0.5 dB	0.5 dB	0.5 dB
Output Power Accuracy	+1.5/-0.5 dB	+1.5/-0.5 dB	+1.5/-0.5 dB	+1.5/-0.5 dB	+1.5/-0.5 dB
SSB Phase Noise @ 10kHz offset - typical	-105 dBc/Hz	-95 dBc/Hz	-90 dBc/Hz	-85 dBc/Hz	-75 dBc/Hz
SSB Phase Noise @ 100kHz offset - typical	-125 dBc/Hz	-115 dBc/Hz	-110 dBc/Hz	-105 dBc/Hz	-95 dBc/Hz
Harmonic Level	-10 dBc max	-10 dBc max	-10 dBc max	-10 dBc max	-10 dBc max
Non-harmonic Spurious Level	-70 dBc max -80 dBc typ	-70 dBc max -80 dBc typ	-70 dBc max -80 dBc typ	-70 dBc max -80 dBc typ	-70 dBc max -80 dBc typ
Output VSWR	1.5:1 max.	1.5:1 max.	1.5:1 max.	1.5:1 max.	1.5:1 max.
DC Power	via USB	via USB	via USB	via USB	via USB
GUI Compatibility	Windows™ 2000/XP/Vista	Windows™ 2000/XP/Vista	Windows™ 2000/XP/Vista	Windows™ 2000/XP/Vista	Windows™ 2000/XP/Vista
Mechanical					
Dimension - inches (mm)	4.90x3.14x1.59 (124x80x40)	4.90x3.14x1.59 (124x80x40)	4.90x3.14x1.59 (124x80x40)	4.90x3.14x1.59 (124x80x40)	4.90x3.14x1.59 (124x80x40)
Weight - lbs (Kgs)	<1.0 (<0.45)	<1.0 (<0.45)	<1.0 (<0.45)	<1.0 (<0.45)	<1.0 (<0.45)
RF Output	SMA - female	SMA - female	SMA - female	SMA - female	SMA - female
USB Port	Mini-B female	Mini-B female	Mini-B female	Mini-B female	Mini-B female
USB Cable - Type A male/Mini-B male	Included	Included	Included	Included	Included
Mounting Holes (clear) - 2 places Hardware not included	#6 Socket Head Cap Screw or equivalent	#6 Socket Head Cap Screw or equivalent	#6 Socket Head Cap Screw or equivalent	#6 Socket Head Cap Screw or equivalent	#6 Socket Head Cap Screw or equivalent
Operating Modes					
	Continuous Frequency Frequency Stepping Single Sweep Frequency Stepping Continuous Sweep				

Specifications are subject to change without notice

5.0 OPTIONAL ACCESSORIES

Vaunix offers the following optional accessories for the Lab Brick signal generator family. Please consult your sales representative or visit LabBrick.com for up to date pricing and availability.

4 Port USB Hub with external power adapter

USB Hub with LAN interface

Battery Pack with USB Interface

USB cable TypeA male/Mini-B male - 3 feet

USB cable TypeA male/Mini-B male - 6 feet

USB cable TypeA male/Mini-B male - 9 feet

USB cable TypeA male/Mini-B male - 15 feet

6.0 PROGRAMMING GUIDE

The Lab Brick Signal Generators are designed to be easily controlled from either their included control software or from applications programs that directly access the signal generators. The Lab Bricks use the USB HID class so that applications software can send commands and receive responses and status messages without the need to install any drivers or other special software components.

As with any USB HID device, there are two phases to working with the Lab Bricks. The first phase is the process of identifying the device you want to work with, and then opening the device to send and receive commands and status messages from it. The second phase is communicating with the device, using its commands to control it and reading its responses and status messages to determine the state of the Lab Brick.

This documentation includes examples from the Microsoft Windows™ environment. Similar strategies are used to communicate with USB HID devices under other operating systems, and this documentation will provide you with a general understanding of how to control the Lab Bricks under any operating system which supports USB HID class devices.

6.1 Identifying the Lab Brick Signal Generators

The Lab Brick Signal Generators are identified by their Vendor ID (“VID”) and Product ID (“PID”). Each Lab Brick also has a unique serial number, so that individual signal generators can be identified and selected in situations where multiple, otherwise identical Lab Bricks are connected to one computer.

Model Name	Frequency Range	VID	PID
LSG-251	50 to 250 MHz	0x041F	0x1203
LSG-152	250 to 1500 MHz	0x041F	0x1202
LSG-222	500 to 2200 MHz	0x041F	0x1205
LSG-402	1000 to 4000 MHz	0x041F	0x1201
LSG-602	1500 to 6000 MHz	0x041F	0x1204

Normally, in the Microsoft Windows environment, USB devices are identified by repeatedly calling the SetupDiEnumDeviceInterfaces function and then getting the symbolic link name for the HID device’s interface with the SetupDiGetDeviceInterfaceDetail function. There are a number of publications that

explain this technique, *Writing Windows WDM Device Drivers* by Chris Cant is a good starting point. Also, the Wiimote library by Brian Peek, (<http://www.codeplex.com/WiimoteLib>) is a good example of code for identifying and communicating with a USB HID device in a Microsoft Windows environment.

Use the `SetupDiGetDeviceInterfaceDetail` function to get the symbolic link name for the interface, which the operating system uses to encode its enumeration information describing the device. The string contains the VID and PID of the device found by the operating system. Test each string to find the one (or more if you have multiple Lab Bricks attached) that contains the VID and PID values in it. For the Microsoft Windows environment, the portion of the device strings containing the VID and PID are in the format:

```
sDevSubstring1 = "vid_041f&pid_1201";    // VID and PID for LSG-402
sDevSubstring2 = "vid_041f&pid_1202";    // VID and PID for LSG-152
sDevSubstring3 = "vid_041f&pid_1203";    // VID and PID for LSG-251
sDevSubstring4 = "vid_041f&pid_1204";    // VID and PID for LSG-602
sDevSubstring5 = "vid_041f&pid_1205";    // VID and PID for LSG-222
```

Once you have identified a Lab Brick, open it by using the `DevicePath` from the `Interface Device Detail Data` structure, using the normal `CreateFile` function. Once you have opened the device¹ you can read the Lab Brick's serial number using the `HidD_GetSerialNumberString` function.

```
WCHAR *pBuffer = new WCHAR [32]; // this buffer must be large enough to hold
                                // any serial number
HidD_GetSerialNumberString(hDevice, pBuffer, 32);
```

If you are using multiple Lab Bricks you will need to identify the Lab Bricks, open them all, and then use the serial numbers returned by each of the devices to map the device handles to the specific Lab Bricks.

¹ Actually, due to the architecture of USB HID devices, Interfaces on the device are opened and closed. A single HID device can have multiple Interfaces, and it is the Interfaces that are exposed by the HID Class driver for user level processes to interact with.

6.2 Controlling the Lab Brick Signal Generators

6.2.1 Commands

The Lab Brick Signal Generators use a simplified HID based set of commands. The commands, and the responses from the Lab Brick, are designed so that they can be easily created or parsed directly by your applications software. It is not necessary to use the normal HID API parsing functions.

Each Lab Brick command consists of an eight byte packet with the following format:

```
typedef struct
{
    BYTE command;
    BYTE count;
    BYTE byteblock[6];
} HID_REPORT_OUT;
```

(Note that in the Microsoft Windows environment, the HID driver stack requires a pre-pended 0 byte on packets written, and pre-pends a 0 byte to packets received, so your applications software needs to use a structure which has an additional BYTE before the command, and is therefore 9 bytes long.)

The command byte determines the meaning of the bytes within the byteblock. The count byte contains a count of the number of valid bytes in the byteblock. The values and the meaning of the bytes in the byteblock are set forth in the table below. For most commands the byteblock contains a 32bit DWORD quantity, several instances use a single byte quantity.

The most significant bit of the command byte determines whether the command gets or sets the parameter. To set the parameter, set the most significant bit. For example, to set the Lab Brick LSG-402 to 1.430GHz you would send the following command:

Command Byte	Count	Byteblock Contents
0x84	4	0xDC, 0x37, 00, 00, 00, 00

Frequency is set in 100KHz units, so 1.430GHz is 14,300 units, or 0x37DC.

The command to get the current frequency is:

Command Byte	Count	Byteblock Contents
0x04	0	xx, xx, xx, xx, xx, xx

The Lab Brick responds with a report that contains the command byte in its status field, along with a count of 4 bytes and a DWORD representing the current frequency in the byteblock of the response. The format of responses will be described in more detail in the next section.

Command Set

Command	Command Byte	Count	Byteblock Contents
Set/Get Frequency	0x84/0x04	4	DWORD = Frequency in 100KHz units
Set/Get Dwell Time	0x85/0x05	4	DWORD = Time to dwell at each frequency during a sweep in 1 millisecond intervals, with a 10msec. minimum
Set/Get Sweep Start Frequency	0x86/0x06	4	DWORD = Lower limit of the sweep in 100KHz units
Set/Get Sweep Stop Frequency	0x87/0x07	4	DWORD = Upper limit of the sweep in 100KHz units
Set/Get Frequency Step Size	0x88/0x08	4	DWORD = Frequency step size in 100KHz units.
Start/Stop Sweep	0x89/0x09	1	Byte = 01 for a single sweep, 00 to stop a sweep, and 02 for continuous sweeping
RF On/Off	0x8A/0x0A	1	Byte = 01 to enable RF output, 00 to disable RF output.
Power Level	0x8D/0x0D	1	Byte = power level relative to the maximum power of the Lab Brick Signal Generator, in .25db steps. 00 is maximum power, 02 is .5db less than full power. Note that the resolution of the power output setting is only .5db, the least significant bit of the value is ignored.
Restore Defaults	0x8F	1	Resets all of the parameters to their factory default settings.
Get Minimum Frequency	0x20	0	This is a read only value, only the "Get" command is supported.
Get Maximum Frequency	0x21	0	This is a read only value, only the "Get" command is supported.
Save User Parameters	0x8C	3	The first three bytes of the byteblock must be set to 0x42, 0x55, 0x31 as a key to enable the save operation. Save User Parameters records the frequency, power and sweep settings into non-volatile memory in the Lab Brick. The Lab Brick will reload these parameters when it is powered on.

As an example, this C code function sets the beginning frequency for a sweep to 3GHz:

```
static long FStart = 30000;           // start sweep at 3Ghz

void SetSweepStart(HANDLE hDevice)
{
    unsigned char *ptr = (unsigned char *) &FStart;
    if (SendReport(hDevice, VNX_FSTART | VNX_SET, ptr, 4)){
        printf(" sending the sweep start frequency\n");
    }
}

SetSweepStart(hDevice);
```

Applications programs should ensure that commands are sent with a minimum delay of 30ms between commands, in order that the Lab Brick can generate and send its responses.

6.2.2 Responses

The Lab Brick Signal Generators send status reports to the host computer periodically while they are operating, and in response to some commands. Applications programs should normally set up and maintain a read thread to capture responses and status reports from the device. The status reports are designed to be easily parsed directly by the applications program.

Each Lab Brick response consists of an eight byte packet with the following format:

```
typedef struct
{
    BYTE status;
    BYTE count;
    BYTE byteblock[6];
} HID_REPORT1;
```

The status byte contains a value indicating the type of status report, like the commands the contents of the byteblock varies depending on the value in the status byte. For command responses, the value of the status byte is equal to the command. So for example, the response to the Get Frequency command shown above would have a status byte of 0x04, a count of 4 corresponding to the 4 bytes used by the DWORD in the byteblock, and a value of 0x37DC, or 14,300.

Status Byte	Count	Byteblock
0x04	4	0xDC, 0x37, 00, 00, 00, 00

The Lab Bricks report their status periodically, at an interval equal to the dwell time set for frequency sweeps, whether or not a sweep is active. During a sweep, the status report occurs when the frequency changes². This allows an applications program to track the frequency output of the Lab Brick during the sweep. Note that the report of the new frequency may be received before the synthesizer stabilizes at the new frequency, so if the change in frequency is used to trigger a measurement process that process should be delayed until the synthesizer output is stable. The format for the periodic status report is:

```
typedef struct
{
    BYTE pkt_status;        // = 0x0E
    BYTE count;            // = 6
    DWORD frequency;
    BYTE dev_status;
    signed char power;
} VNX_STATUS_REPORT;
```

² The timing of the status reports will vary somewhat depending on the timing of the USB bus transactions, and software processes within the operating system, particularly for dwell times less than 100 milliseconds.

Status Byte	Count	Byteblock
0x0E	6	Frequency, dev_status, power

The dev_status byte contains a set of flags which describe the current state of the Lab Brick:

```
#define STATUS_PLL_LOCK 0x80 // MASK: PLL lock status bit, 1 = locked
#define STATUS_NEW_PARAM 0x40 // MASK: A parameter was set since the last
// "Save Settings" command
#define STATUS_OK 0x20 // MASK: A command completed
#define STATUS_RF_ON 0x08 // MASK: The RF HW is on
```

```
// Bit masks and equates for the Sweep command byte (stored in Sweep_mode,
and reported also in Status)
```

```
#define SWP_DIRECTION 0x04 // MASK: bit = 0 for sweep up, 1 for sweep down
#define SWP_CONTINUOUS 0x02 // MASK: bit = 1 for continuous sweeping
#define SWP_ONCE 0x01 // MASK: bit = 1 for single sweep
```

Note that the PLL lock status bit will typically be reported as 0 during sweeps since the status report is generated at the instant that the frequency is changed, before the synthesizer PLL has locked at the new frequency.

Power is the current value of the power level as set by the Power Level command. It is relative to the maximum output power of the Lab Brick, a value of 00 represents full power, a value of 04 represents an output power level 1db less than full power.

Since Lab Brick status reports occur asynchronously with respect to command responses, the applications code handling reports from the Lab Brick should be able to accept either a command response report or a status report.

Command Response Report Formats

Command Response	Status Byte	Count	<u>Byteblock</u> Contents
Frequency	0x04	4	DWORD = Frequency in 100KHz units
Dwell Time	0x05	4	DWORD = Time to dwell at each frequency during a sweep in 1 millisecond intervals, with a 10msec. minimum
Sweep Start Frequency	0x06	4	DWORD = Lower limit of the sweep in 100KHz units
Sweep Stop Frequency	0x07	4	DWORD = Upper limit of the sweep in 100KHz units
Frequency Step Size	0x08	4	DWORD = Frequency step size in 100KHz units.
Sweep Mode	0x09	1	Byte = 01 for a single sweep, and 02 for continuous sweeping
RF On/Off	0x0A	1	Byte = 01 if RF output enabled, 00 if RF output disabled.
Power Level	0x0D	1	Byte = power level relative to the maximum power of the Lab Brick Signal Generator, in .25db steps. 00 is maximum power, 02 is .5db less than full power. Note that the resolution of the power output setting is only <u>.5db</u> , the least significant bit of the value is ignored.
Minimum Frequency	0x20	0	DWORD = The minimum frequency which the Lab Brick can generate
Maximum Frequency	0x21	0	DWORD = The maximum frequency which the Lab Brick can generate.

6.3 Tips and Suggestions

Remember to handle the error cases for device removal, and close the device handles when you are done interacting with the device.

Remember that in the Microsoft Windows environment, the operating system pads the reports with a byte at the beginning of the report. Make sure to adjust your structures accordingly.

If you are programming in C or C++ you can create a set of unions to allow for convenient access to and conversion of the fields of the reports. For other languages, ensure that the byte order of a 32 bit unsigned integer is the same as the byte order used in the reports, which has the least significant byte stored in the lowest address.

7.0 MECHANICAL OUTLINE

