## MICRO LAMBDA WIRELESS, INC.



# MLVS Synthesizer User Manual

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## 1.0 Introduction

This manual describes the setup, operation and remote communication for the MLVS Synthesizer. The model and serial numbers are located on the label located on the top cover of the unit. Each unit has a separate, custom specification sheet for the particular model defining the synthesizer's frequency range, RF characteristics and options.

General operating/programming instructions are located herein.

The USB Flash Drive supplied with the package contains a **SetupMLVS.msi** file, when executed, will create a folder named "MLVS Support Files" on the desktop containing short cuts to the manual, documentation and programs for interfacing the product with a personal computer. This **SetupMLVS.msi** file is compatible with Windows 10. The most current versions of these files, new offerings and synthesizer specifications can be downloaded at our web site: http://www.microlambdawireless.com

### 2.0 Package Contents

Item	Quantity
MLVS Series Synthesizer	Purchased Qty.
DC Power mating connector	Purchased Qty.
USB A male to USB Mini-B cable	Purchased Qty.
USB Flash Drive (manual, quick start guide and PC software)	1 each
MLVS Quick Start Guide (Printed)	1 each

## 3.0 General Overview of Product Capabilities

The MLVS series of VCO-based synthesizers are ideal main local oscillators in Receiving Systems, Frequency Converters and Test & Measurement Equipment. MLVS-0520 provides 0.001 Hz frequency resolution over the 50 MHz to 21 GHz frequency range. Output power level of +15 dBm is provided throughout the full frequency range. Full band switching speed is 50 or 150 µsec maximum. The MLVS-0520 is 4" x 3.6" x 0.94" and fits a 2 slot PXI chassis. Standard frequency ranges are 500 MHz to 20 GHz, 500 MHz to 21 GHz, 50 MHz to 20 GHz and 50 MHz to 21 GHz. Two types of interface come standard: USB for trouble free connection to a personal computer and a 5-wire serial interface for use in the customers system. Outline drawing 99-0101-001 shown on the next page define the mechanical configurations. The drawing is displayed mainly for the mechanical and the connection information.

### 3.1 MLVS Outline drawing 99-0101-001



## 4.0 Setup and Operation

This product is designed for a 0 to 60 degrees C environment and should not be subjected to humidity >95%. Use proper ESD handling procedures. Allow for a proper heat-sink able to dissipate the total wattage/heat generated (15 Watts). Verify that all external RF/microwave cables and components connected to the unit are in good working condition.

## 4.1 Connections

Connect to the preferred interface port, Serial or USB. USB Mini-B to USB Male - A cable for connection to a host PC USB port, the USB interface is USB 1.1, 2.0 and 3.0 compatible. The serial port is a 0-5V and 0-3.3V, CMOS/TTL compatible port; it is very similar to an SPI communication port, SPI Mode 1. Clock, Data and Select/Enable operate in the typical serial communication format, except that the maximum clock speed is 10.0 MHz. The Busy line is for handshake to the controller, a High on this line tells the controller that the synthesizer is busy and should not be selected for communication at this time. The Data Out line is used to read data from the synthesizer if a command requested the synthesizer to read data. The data is read into the controller by the controller clocking out data of 0's to the MLVS and the controller reads during this time. The Busy line must be monitored. See section 6.0/6.1 serial communication for details. The RF Lock Alarm signal J1 pin 13 and the Ref. Lock Alarm signal J1 pin 6 are hardware logic signals that show the state of the internal phase locked loop circuits. The RF Lock line should be a TTL high for the majority of the time unless the unit is stepping frequency, then it will pulse low when switching between frequencies, typically it will be low for less than 50uS. The Ref. Lock line will be high when an external 10 MHz reference is connected J5. When no signal is applied to the J5, the line will be low (unlocked) and the unit will operate using the high stability internal oscillator. Connect an external reference frequency (if required) to J5. Connect a +10 to +16 VDC power supply with adequate current to operate the product (see spec sheet) to the J1 connector; +12 VDC on J1 pins 1 and 2 and a common ground for the supply on pins 3 and 4. Alternately, an AC to DC, +12V power supply can be connected to the J3 power jack. For reference, (Digi-Key part # 1647-1009-ND) or equivalent can be connected for this purpose..

## 4.2 MLVS Operation

Turn on the power supply voltage and verify that the current for the supply is below the maximum stated current in the specifications for your model. A 5-minute warm up is recommended before use. The unit should be operating at the last frequency it was set to before power down; this would typically be  $F_{min}$  when shipped from the factory. The Lock Alarm line (J1 pin 13) should be high.

## 5.0 Controlling the MLVS using a personal computer

The MLVS Synthesizer can be controlled by a personal computer for Demo purposes. The requirements for this are as follows: A USB ver. 1.1, 2.0 or 3.0 port on the PC, Windows 10, the programs included on the MLVS USB Flash Drive and a power supply capable of supplying the DC Voltage and Current required to operate the MLVS synthesizer. The communication syntax listed in Section 7.0 may be used to control the synthesizer via the USB or SPI interfaces.

## 5.1 Installing the documentation and control software

The USB Flash Drive supplied with the MLVS contains the file named **SetupMLVS.msi**. Execute this file to install the manual, documentation and control programs for PC interface. The setup file, when run, will create a folder named "MLVS Support Files" on the computer desktop with short cuts to the documentation and interface program.

## 5.2 USB Interface

The MLVS product, when connected using the USB interface, appears as a USB serial device (USB COM port) to the Windows 10 operating system (See Figure 3). The USB driver is supplied with the Windows 10 operating system and is installed automatically when the unit is connected to the PC's USB port. It may take > 1 minute for the PC to configure the unit the first time it is connected. Once the PC is familiar with the unit, it will remember it the next time it is connected and connect quickly. For MLVS USB driver installation on Windows 7 and/or 8, please see documentation files on the USB flash drive supplied with the MLVS or in the Desktop folder that was created during the software installation. The MLVS may be controlled remotely via a USB connection using the supplied Graphical User Interface (GUI), "MLVS.exe" program. A screen capture of this program is shown in Figure 1. Please note, it is not recommended to disconnect the USB cable when the synthesizer is in sweep mode.

## 5.3 MLVS User Interface screen (GUI)

	MLVS User Interf	face - C × ambda s, Inc. MLVS User Interface Model:MLVS-0520DS SN:0120	
1	Update Unit Info S.T. Min-Max Freq. Pass 50.0-21000.0 Memory Data A MLVS-0520DS	□ Enable Tool Tips       □ Help         PLL Ext. Ref.       □ Ext. Ref.         UnLocked       □ Int. Ref.         Addr.       □ Int. Ref.         00       □ Soft Reset         Erase Freq. Info       □ Ser Cfg. Defaults	
	Sweep Mode List Normal Fast Direction	Sweep-List     Freq. Recall     Point Dwell Time     Sweeps       to:     FLASH     RAM       RAM to FLASH     O     mS       ✓ Auto Copy Rash to RAM     Recall	3
2	Up Oown     Up/Down     Up/Down     Down/Up     Trigger Source     SW O HW     Trigger Type	Sweep-Normal (Step)       Frequency Start     Hz     Frequency Stop     Frequency Steps     Point Dwell Time     Sweeps       50.0     KHz     21000.0     KHz     50     KHz     500     S     Infinite       GHz     GHz     GHz     GHz     GHz     GHz     US     US	4
	Full O Point     Commands     Sweep Normal     Start 0001     Stop      Run	Sweep-Fast (Points)         Frequency Start       Hz       Max Frequency Points       Point Dwell Time       Sweeps         1       KHz       10       KHz       100       ms       100       ms       1         Image: Image	5
6	Send Clear Log SWE Full Trigger is selected Max Points are in OK	All Cmd Log       :NORM:FREQ:SETUP50.0MHz,21000.0MHz,50MHz,0,500mS, 0, 0, 0       G, next trigger is active when sweep is finished.	

Figure 1

## 5.4 MLVS User Interface screen (GUI) function reference table.

Section	Function / Button	Description
	COM Box Button	Press Red/Green button to Power down/up the unit.
	Update Unit Info	Updates current unit info. Flashing RED temp. = caution!
	Enable Tool Tips	Enables tool tips, hover mouse over item to display info.
	Help	Opens Command Descriptions (pdf).
	S.T.	Results of the last Self-Test.
	Min-Max Freq.	Displays the minimum and maximum frequency of unit, in MHz.
	PLL Ext. Ref.	Displays the state of the external reference PLL, Locked / Unlocked.
	Ext. Ref.	Select External reference source. Check = Currently Selected
	Int. Ref.	Select Internal reference source. Check = Currently Selected
	Memory Data	Displays MLVS internal nonvolatile memory information (Personality).
	Addr.	Select memory address # to view memory data, refer to Section 7.1.
	User Cfg. Defaults	Startup, output frequency and reference settings saved in 1 or 2.
1	Save	Save current output frequency and reference mode in FLASH memory 1 or 2.
	Recall	Recall output frequency and reference mode settings from FLASH memory 1 or 2.
	Factory Restore	Restore factory settings ("SP" command). Requires power off / on cycle.
	Soft Reset	Reboot/restart MLVS CPU
		Erase Frequency list from FLASH, RAM, and reset unit to default factory settings.
	Erase Freq. Info	This is a secure erase function that deletes all references to output frequency, in
		all memory locations. (Use with Caution!)
	Set Frequency	Set the output frequency in MHz, resolution 0.001 Hz. Current frequency and
	Corrioquonoy	temperature shown green, in the display above.
	Basic Commands	Send any ASCII command to MLVS, MLWI or SCPI formats.
	Receive	ASCII Query commands return information in this area as text. (Send "T" =
		+25.5C)
	Reset Synth.	Reset Freq to 10GHz, Internal reference mode, sweep trigger disabled.

Section	Function / Button	Description
	Mode	Sweep Mode section:
	List	List Sweep Mode – Sweep a user uploaded list of frequencies.
	Normal	Normal Sweep Mode – Sweep start to stop, at a given step, dwell as required.
	Fast	Fast Sweep Mode – Sweep start to stop, in a given number of points, dwell as
	1 431	required. (Faster because of pre-calculation of frequencies)
	Direction	Sweep Direction section:
	Up	Sweeps in ascending order.
	Down	Sweeps in descending order.
	Up/Down	Sweeps in ascending then descending order.
	Down/Up	Sweeps in descending then ascending order.
	Trigger Source	Sweep Trigger Source section:
	SW	Software Sweep Trigger activates sweep immediately after selecting the Sweep
		and Start / Stop buttons. Functions in all sweep modes.
•	HW	Hardware Sweep Trigger enables an external positive edge to start or step the
2		sweep. Pulse is applied to J1-7. Functions in all sweep modes.
	Trigger Type	Sweep Trigger Type section:
	Full	Full Sweep Trigger activates a full sweep (after selecting the Sweep and Start
	-	buttons), begins upon a trigger detected.
	Point	Start buttons), upon each trigger received
	Commands	Sween Commands section:
	Commanus	Start the current sweep mode as configured (if Run is checked) Button name
	Sweep XXXXX	changes based on mode selected.
	Start	Start the selected Sweep mode.
	Stop	Stop current Sweep.
	Dum	If selected, the selected Sweep will start immediately after clicking on the Sweep
	KUN	button.
	Number box	Number of times to run a sween
	(0001 default)	

Section	Function / Button	Description
	Sweep - List	Frequency List Sweep Mode Section:
	Edit File List Box	Select a CSV file to Edit or Upload to memory.
		Edit Frequency list file shown in box to the left. This is a comma separated value
	Edit	file (.CSV), it will open in M.S. Excel or a Text editor program. You can create
		more than one list file, just give each a different name. Default file = List.csv
	To: FLASH	Save file in FLASH (Also saves the file to RAM).
	To: RAM	Save file in RAM only, power cycle will clear / erase RAM.
	RAM to FLASH	Copy RAM to FLASH. Copies list in RAM to Flash for future use.
	Enable Power Up	Power-up list upload from FLASH to RAM. The unit remembers this setting, if
3	Auto List upload	checked, unit will upload FLASH to RAM, if unchecked, it will not.
	Freq. Recall	Frequency List Recall Section:
	Point	Frequency list point number to be recalled, if the recall button is pressed.
	Points:	Current number of frequency list points stored in FLASH / RAM.
	Recall	Recall list frequency shown in point box.
		A non-zero number here overrides the list frequency dwell time that was uploaded
	Point Dwell Time	to memory in the list file. Each list frequency will now use this number as its dwell
		time.
	Infinito	Sweep will continue until the Stop Sweep button is clicked. If Infinite is
		deselected, enter the number of times you would like the sweep to occur.

Section	Function / Button	Description
	Sweep – Normal (Step)	Normal Sweep Mode Section:
	Frequency Start	Start frequency (Hz to GHz)
	Frequency Stop	Stop frequency (Hz to GHz)
4	Frequency Steps	Step size frequency increment (mHz to GHz)
	Point Dwell Time	The Dwell Time is the time that each point in the sweep will remain static
	Foint Dweil Time	before moving to the next point
	Infinito	Sweep will continue until the Stop Sweep button is clicked. If Infinite is
	IIIIIIIte	deselected, enter the number of times you would like the sweep to occur.

Section	Function / Button	Description
	Sweep – Fast (Points)	Fast Sweep Mode Section:
	Frequency Start	Start frequency (Hz to GHz).
	Frequency Stop	Stop frequency (Hz to GHz).
5	Max Frequency Points	Maximum points, unit will calculate frequency increment.
	Point Dwall Time	The Dwell Time is the time that each point in the sweep will remain static
	Foline Dweil Tillie	before moving to the next point.
	Infinito	Sweep will continue until the Stop Sweep button is clicked. If Infinite is
	minnite	deselected, enter the number of times you would like the sweep to occur.

Section	Function / Button	Description
	Miscellaneous	Send commands, Receive Data, Convert Binary Command, and Info.
	Send	Send an ASCII command to the unit. The text box pull-down will show a list of the last commands sent during the current session.
	Clear Log	Clears the text box pull-downs of All Commands Log, and Sweep Commands Log, that have been sent to the unit.
6	All Commands Log	Keeps track of every command that the GUI sends to the unit for reference. Alternately, commands can be sent to the unit from this box by pressing the send button to the left.
	Sweep Commands Log	Keeps track of every sweep command that the GUI sends to the unit for reference. This can show you how to build SCPI commands for your communication program. Select sweep modes above, and press Sweep XXXXX button to show the command in the box. Copy and paste as needed.
	Information	Technical information and errors in settings for selected modes of operation.

## 5.5 USB PC Interface example C# source code

Included in the installed support files folder is an example of a simple USB Serial interface (Virtual Com Port) program written in C#. The project file and source code were written using Microsoft Visual Studio Community 2017, in C Sharp. The Visual Studio Community 2017 suite, can be downloaded for free at https://www.visualstudio.com/. After you download, and install this free version of the programming environment, you can create and edit C# programs. This source code will help you to get started integrating the MLVS USB communication into your own C programs. The example program is a simple interface in which you can send and receive ASCII characters (Commands / Returned info.). Once connected, you can send any of the ASCII commands, SCPI and native MLWI commands in the tables in section "7.0 – Communication Syntax", of this manual. When the MLVS unit is powered on and attached to a USB port on the PC, the PC will detect the unit and configure it after a few minutes. Once the PC is familiar with the unit, it will remember it the next time it is connected and connect quickly. Once the unit is connected, the Windows Device Manager will show the unit under the "Ports (Com & LPT)" section as a "USB Serial Device (COM?), on COM?, ? being the port number Windows decided to give the unit, see figure 3. The interface tests for a connection to the MLVS synthesizer by looking for a return string (Model number) identifying the MLVS when the correct communication port queried. An executable version of the program is located on the USB Flash Drive in the directory – \MLVS USB Serial Example\MLVS USB Serial Example/bin/Release. The file name is – MLVS USB Serial Example.exe. A screen shot of the interface is shown in figure 2.

🖳 MLVS USB Interface Example				$\times$
Model Number	Serial Number			
	Command Sent			
Send	Т			
	Data Received			
	+36.0C			
	Status			
Comm Port #	MLVS Unit Connected on COM5			
5				
Connect			Exit	

Figure 2

÷	Dev	ice Manager —	$\times$
File	e A	Action View Help	
<b>\</b>	-	🖬 📓 🛛 🖬 💻 💺 🗶 🖲	
<b>~</b> 1	븝 [	DESKTOP-BJPE449	
	> 1	Audio inputs and outputs	
	> 4	Computer	
	2.	Disk drives	
	> 4	Display adapters	
	Σį	PVD/CD-ROM drives	
	> [	GPIB Interfaces	
	> 🖗	Human Interface Devices	
	2	IDE ATA/ATAPI controllers	
	> =	Keyboards	
	> [	Mice and other pointing devices	
	> Ц	Monitors	
	2 4	P Network adapters	
	~ •		
		Communications Port (COMI)	
		Intel(K) Active Management Technology - SOL (COM3)	
		Dist succe	
	2.0	Drinters	
	2.1	Drocessor	
	1	Security devices	
	Ċŧ	Software devices	
	1	Sound video and game controllers	
	3	Storage controllers	
		System devices	
	57	Universal Serial Bus controllers	
	ς μ	WSD Print Provider	
	<i>г</i> к		

Figure 3

## 6.0 Serial interface (SPI)

The MLVS can be programmed using a 5-wire serial bus. The five control lines are described in the Table 1 below: Serial Hardware Interface Lines.

SELECT (SS) J1 – Pin 11	Input	Active Low. Enables the shifting of data into the internal command buffer. Also serves as a command terminator when it goes HIGH. The status of the BUSY line should be checked before activating this line. Note: All command + data, command strings must be sent using a single Select Line Cycle. When low, Busy is high.
CLOCK (CLK) J1 – Pin 9	Input	Data is clocked into the unit on the falling edge (SPI Mode 1) of the CLOCK and DATA OUT is valid at this time. The maximum clock rate of this line is 100 ns. For best performance the status of the BUSY line should be checked before sending the first Clock. This line should be maintained in a LOW state at the application of Select to prevent confusion.
DATA IN (MOSI) J1 – Pin 10	Input	Input data pin. Data is sent MSB first. Data must be stable 50 ns. Before the CLOCK line goes low and 50 ns. After the clock goes high. (Setup / Hold time)
BUSY J1 – Pin 12	Output	This line is used to indicate that the unit is busy processing other commands or doing its internal housekeeping. Before sending a Select = TRUE the status of this line should be checked to ensure that it is LOW (NOT Busy). Any command initiated by setting Select Low while BUSY is High may result in lost data and uncertain results. NOTE: The unit can be programmed without using this line if sufficient time is allowed between Clocks and between commands. The time required varies between commands. This mode is not recommended as there are some events that occupy the microcontroller other than the serial communications.
DATA OUT (MISO) J1 – Pin 14	Output	This line is used to pass internal information from the synthesizer to the user. Data is guaranteed to be valid on the falling edge of the clock signal. Data is sent out MSB first. DATA OUT will be returned to LOW after Select has been released.

Table 1: Serial Hardware Interface Lines

## 6.1 Serial interface

The timing diagram is shown in Figure 4: Serial Interface Timing Diagram





T <sub>sc</sub> > 1 us	select low before first clock
<b>T<sub>cs</sub> &gt; 50 ns</b>	clock low before chip select high
<b>T<sub>su</sub> &gt;</b> 50 ns	data stable before falling edge of clock
<b>T<sub>ch</sub> &gt; 50 ns</b>	minimum clock high time
<b>T<sub>cl</sub></b> > 50 ns	minimum clock low time
<b>T<sub>sb</sub> &gt; 1</b> us	(time to wait before sampling 'BUSY')

### Notes:

- 1. ≤ 10 MHz serial clock recommended
- 2. MLVS serial interface is compatible with SPI Mode 1

## 6.2 Arduino to MLVS Serial Interface Example

In this section we offer an example of serial interface using an Arduino UNO microcontroller, coded in C language. The Arduino series of educational prototype boards is a simple and effective way to communicate with the MLVS synthesizer. They are readily available for purchase on many web sites, including Amazon.com, for under \$15. A wire interconnection list is shown in Figure 5. You can copy and paste the Arduino code example below into a blank sketch or use the supplied MLXX Synthesizer ArduinoUNO Serial Interface.ino file.



## 6.3 The wiring interconnection between Arduino and the MLVS:

WIRE	COLOR	FROM	TO NOTES	A.W.G LENGTH
1	BLUE	14 PIN FEMALE - 1	BLUE BANANA MALE +15 VDC	22 36"
2	BLUE	14 PIN FEMALE - 2	BLUE BANANA MALE +15 VDC	22 36"
2				22 26"
3	BLACK	14 PIN FEMALE - 3	BLACK BANANA MALE GROUND	22 30
4	BLACK	14 PIN FEMALE - 4	Arduino UNO - 14 LOGIC GROUND	22 36"
5	ORANGE	14 PIN FEMALE - 9	Arduino UNO - 8 CLOCK	26 36"
6	BROWN	14 PIN FEMALE - 10	Arduino UNO - 11 DATA	26 36"
7	WHITE	14 PIN FEMALE - 11	Arduino UNO - 12 ENABLE (Select)	26 36"
8	GRAY	14 PIN FEMALE - 12	Arduino UNO - 13 BUSY	26 36"
9	YELLOW	14 PIN FEMALE - 14	Arduino UNO - 10 DATA OUT	26 36"
	Note	pin "1" mark on back face of conn	ector / Connector Lock Tab	
	Molex# 355	07-1400		
	Crimp pin =	050212-8100		
		PIN 1	Pin lock side PIN 1	4
			Back Side View	
		Pin 8	Pin 14	
			Malay Dart #	
			Arduino Header	
	Notoci			
	1	Crimp insulator and crimp wire an	d solder pin to wire	
	2.	Insert pin and wire with metal lock	tab face down so pins will lock into place.	
	3.	Do Not use Flux on connector or	ins.	
	4.	Heat shrink all pins on Adruino U	IO connector.	
	5.	Split power supply (w/ Banana plu	gs) and data wires into 2 bundles, cable tie each bundle every 6	6".
	6.	Add 1K res. To Anode of LED, he	stshrink wire and resistor, then heatshrink both wires.	

### 6.4 Arduino Code example:

```
/*
 Communicate with Micro Lambda Wireless, MLVS Synthesizer, using the Arduino serial monitor.
 For wire harness diagram see - MLVS synthesizer harness for Arduino interface 36 inch.xls
 D.S 6/12/16
*/
const int clockPin = 8://Serial Clock line
const int dataInPin = 10; //Serial Data (IN) line RX
const int dataOutPin = 11; //Serial Data (OUT)line TX
const int selectPin = 12;//Serial Select line
const int busyPin = 13; //Serial Busy line
//Pin 14 = Serial Logic Ground
String bitOrder = "MSBFIRST"; //serial stream bit order
int busy;
char sendArray[16];
char recvArray[16];
int counter:
int b = 0;
int i = 0:
int x = 0;
void setup() {
 //set pins to output/input serial data
 pinMode(clockPin, OUTPUT);
 pinMode(dataInPin, INPUT);
 pinMode(dataOutPin, OUTPUT);
 pinMode(selectPin, OUTPUT);
 pinMode(busyPin, INPUT);
 digitalWrite(selectPin, HIGH); //Init the selectPin high
 Serial.begin(9600):
 while (! Serial); // Wait untilSerial is ready - For Leonardo
 Serial.println("MLVS Arduino Synthesizer Interface - Enter a Command");
}
void loop() {
 while (Serial.available() > 0) {
  //read all char's to send from serial monitor
  delay(1); //wait for serial port
  sendArray[i] = Serial.read();
  i = i + 1;
  delay(1); //wait for serial port
  //when all char's received, call serial send frequency routine (sends ASCII #'s)
  if (Serial.available() == 0) {
    sendFreq();
  }
  //prints the command sent / received to the serial monitor window
  if (Serial.available() == 0) {
    printComm();
  }
}
}
//send / receive command routine
void sendFreq() {
 do {
  busy = digitalRead(busyPin); //read busy line, if low continue
 } while (busy == 1);
 //loop for array length of chars to send
 for (counter = 0; counter != i; counter++)
 {
```

```
digitalWrite(selectPin, LOW); //selectPin Low and hold low for as long as you are transmitting
 delayMicroseconds(10);
 //shift out 8 bits with xx uS delay (Bit Bang)
 for (b = 0; b < 8; b++) {
  if (bitOrder == LSBFIRST)
  { digitalWrite(dataOutPin, !!(sendArray[counter] & (1 << b)));
   delayMicroseconds(2);
  }
  else
  { digitalWrite(dataOutPin, !!(sendArray[counter] & (1 << (7 - b))));
   delayMicroseconds(2):
  //toggle clock line
  digitalWrite(clockPin, HIGH);
  delayMicroseconds(2);
  digitalWrite(clockPin, LOW);
  delayMicroseconds(2);
 delayMicroseconds(5); //delay between chars for byte visibility on Dig. scope
}
digitalWrite(selectPin, HIGH); //pull the selectPin to save the data
digitalWrite(dataOutPin, LOW); //set data out low when done
digitalWrite(clockPin, LOW); //set clock low when done
delayMicroseconds(10); //wait for a xuS between write/read
//read back data from unit if available
do {
 busy = digitalRead(busyPin); //read busy line, if low continue
} while (busy == 1);
digitalWrite(clockPin, HIGH); //clock line high to start for read
//read back data from unit if available, 16 bytes
for (counter = 0; counter < 16; counter++)
{
 digitalWrite(selectPin, LOW); //selectPin Low and hold low for as long as you are receiving
 delavMicroseconds(10):
 //shift in 8 bits with xx uS delay (Bit Bang)
 for (b = 0; b < 8; b++) {
  if (bitOrder == LSBFIRST)
  { recvArray[counter] |= digitalRead(dataInPin) << b; //shift in bits
   delayMicroseconds(2):
  }
  else
  { recvArray[counter] |= digitalRead(dataInPin) << (7 - b); //shift in bits MSB first
   delayMicroseconds(2);
  }
  //toggle clock line
  digitalWrite(clockPin, LOW);
  delayMicroseconds(2);
  digitalWrite(clockPin, HIGH);
  delayMicroseconds(2);
 }
 delayMicroseconds(5); //delay between chars for byte visibility on Dig. scope
}
digitalWrite(selectPin, HIGH); //pull the selectPin to save the data
digitalWrite(dataOutPin, LOW); //set data out low when done
digitalWrite(clockPin, LOW); //set clock low when done
```

delayMicroseconds(10); //wait for a 5uS between commands

```
}
//format and print command sent/received to serial monitor window
void printComm() {
 Serial.print("Command Sent = ");
 for (x = 0; x < 16; x++) {
  Serial.print(sendArray[x]);
 }
 Serial.println();
 Serial.print("Info Received = ");
 for (x = 0; x < 16; x++) {
  Serial.print(recvArray[x]);
 }
 Serial.println();
 //clear var.
 i = 0;
 x = 0;
 b = 0;
 memset(&sendArray[0], 0, sizeof(sendArray)); //clear array
 memset(&recvArray[0], 0, sizeof(recvArray)); //clear array
}
```

## 7.0 Communication Syntax

The following table describes the commands that the MLVS supports. This is a custom syntax created by Micro Lambda Wireless, Inc. All commands are sent and received in ASCII format. The commands are NOT case sensitive. These commands can be used with all forms of communication (USB and Serial).

For the following information, please reference Table 1: Serial Hardware Interface Lines, regarding Busy and Data out.

### MLWI ASCII Command Example:

Recommended read data sequence: The returned data is variable in length, however, it is recommended that the full 16 bytes of data be read to clear the buffer. Set select low, send the desired read command and set select high. The unit interprets the command and places the requested data in its buffer. Check Busy, then set select low and clock out 16 ASCII nulls while clocking in the data, then set select high. Example: To read the units internal temperature, set select low and send ASCII T (01010100), set select high. Set select low and send 16 0000000 while reading the data line and clocking in bits. Set select high. The information should be similar to +25.0C, in ASCII. All of the memory locations in the unit can be read in this manner, using the R command.

In addition to the lines above, there are two, unit status lines: RF LOCK status (J1- Pin 13), and REF LOCK status (J1-Pin 6) which are static lines. These TTL output lines (High = Locked) indicate the overall health of the unit – specifically, that all of the internal phase locked loops are locked. Please note: if there is no 10 MHz Ext. Reference signal applied to J5, the Ref. Lock line will be low indicating an unlock condition and the unit will automatically switch to Internal Ref. mode.

The MLVS serial interface lines operate on internal 3.3V logic of a microcontroller; this should allow the unit to communicate in systems operating with 2.5V, 3.3V and 5.0V serial control lines. Maximum voltage on the control lines is -0.5Vdc to +5.5Vdc.

## 7.1 Micro Lambda Wireless Native Commands and Memory Map.

?         Report Status (returns 1100011 in ASCII)         D0         Ref. Lock, D1 = RL Lock, D2 = self Lock, D2 = SU L	Command	Function	Comments
Final Action (Action (Action))         Action (MR26)         Action (MR26)           NR         Recall a used swaft requency sating of unit to memory location (MS76)         0-98, stored (8) NOVO location 200-289           POWERONT         Turns ON Internal acplates felated to +120 input         Turns ON supplies           NOVERONT         Turns ON Internal acplates felated to +120 input         Turns ON supplies           SP         Synthesizer preset to factory settings         Power cycle required after command           SP         Synthesizer preset to factory settings         Reset (DV) code true in the Cycle of the factory setting (S)           SP         Soli Tost         Read status byte O2: 1 = Pass; (oxample: T, +35.45C)           SP         Read MLVS internal 3: 80 power supply         Returns 6.3C (charm, reading in Deg. C; (example: T, +35.45C)           V2         Read MLVS internal 3: 00 power supply         Returns 2.0V           V3         Read MLVS internal 3: 00 power supply         Returns 2.0V           V4         Read MLVS internal 3: 00 power supply         Returns 2.0V           V5         Read MLVS internal 3: 00 power supply         Returns 2.0V           V6         Read MLVS internal 3: 00 power supply         Returns 2.0V           V6         Read MLVS internal 3: 00 power supply         Returns 2.0V           V6         Read MLVS internal 3: 00 po	?	Report Status (returns 11000011 in ASCII)	D0 = Ref. lock, D1 = RF Lock, D6 = self test, D7 = NOVO lock
MR         Recail a user saved frequency setting for memory location (MS7)         0-89, stored & NOVO location 200-299           MS         Save current frequency setting of unit to memory location (MS7)         0-99, stored & NOVO location 200-299           DVEREON         Tums OF Internal applies related to 1-2V input         Microcontroller Supply is always on           SP         Symbiastic relation 1-2V input         Microcontroller Supply is always on           SP         Symbiastic relation 1-2V input         Recontroller Supply is always on           SR         Soft Reset         Reset of Eul, clear var. nn CPU code from setting.           SR         Soft Reset         Reset databus by Do 2: 1 - Ress, locangle: SR, then ceed datal           T         Read internal temp.         Returns ASCI chars, neading in Deg. C. (swample: T, +354.45C)           V1         Road MLVS internal 3.2V power supply         Returns 5.0V           V3         Road MLVS internal 5.0V power supply         Returns 5.1V           V4         Road MLVS internal 5.0V power supply         Returns 1.0V           Road MLVS internal 5.0V power supply         Returns 1.00           Road MLVS internal 5.0V power supply         Returns 1.00           Road MLVS internal 5.0V power supply         Returns 1.0V           Road MLVS internal 5.0V power supply         Returuns 1.0V           Road MLVS internal	F	Frequency (ASCII) (Dec. #)	ASCII freq in MHz: xxxxx.xxxxx; (example: F12345.678901234)
MS         Save current fraquency setting of unit to memory location (MS7)         0.98, stored & NOVO location 200-298           POWERDN         Tums OFF internal supplies related to +12V input         Tums OFF internal supplies related to +12V input         Mccroontroller Supply is always on           Synthessare present to factory settings.         Fower cycle required after command           Synthessare present to factory settings.         Fower cycle required after command           Synthessare present to factory settings.         Fower cycle required after command           Synthessare present to factory settings.         Fower cycle required after command           Synthessare present to factory settings.         Fower cycle required after command           Synthessare present to factory settings.         Fower cycle required after command           Via         Read MLVS internal 1.50 power supply         Returns 5.0V           Via         Read MLVS internal 5.0V power supply         Returns 5.1V           Via         Read MLVS internal 5.0V power supply         Returns 5.10           Via         Read MLVS internal 5.0V power supply         Returns 1.0v           Rodd MLVS internal 5.0V power supply         Returns 1.0v         Returns 1.0v           Rodd MLVS internal 5.0V protein supply         Returns 1.0v         Returns 1.0v           Rodd MLVS internal 5.0V protensupply         Returns 1.0v <td< td=""><td>MR</td><td>Recall a user saved frequency setting from memory location (MR25)</td><td>0-99, stored @ NOVO location 200-299</td></td<>	MR	Recall a user saved frequency setting from memory location (MR25)	0-99, stored @ NOVO location 200-299
POWERDN         Tums ON internal supples related to +12V input         Tums ON supples.           POWERDF         Tums OF internal supples related to +12V input         Microscontrolled Supply is always on           PS         Synthesizer present to factory settings.         Power cycle required after command           SR         Soft Reset         Reset CPU, Geer var, run CPU code instant: (oxample: SR)           SR         Soft Reset         Reset alwas for b2:1 = Pask; (oxample: SR), then read data)           T         Reset MLS Internal 3:0/ pomer supply         Returns ACCI Pask; (oxample: T, +35:45C)           V1         Read MLS Internal 3:0/ pomer supply         Returns 5:0/           V3         Read MLS Internal :0/ pomer supply         Returns 5:0/           V4         Read MLS Internal :0/ pomer supply         Returns 5:0/           V6         Read MLS Internal :0/ pomer supply         Returns 10.0/           V7         Read MLS Internal :0/ pomer supply         Returns 10.0/           V8         Read MLS Internal :0/ pomer supply         Returns 10.0/           V7         Read MLS Internal :0/ pomer supply         Returns 10.0/           V8         Read MLS Internal :0/ pomer supply         Returns 10.0/           V7         Read MLS Internal :0/ pomer supply         Returns 10.0/           V8         Renal MLS Internal	MS	Save current frequency setting of unit to memory location (MS75)	0-99, stored @ NOVO location 200-299
POWERSPF         Tums OFF Internal supplies related to 112V input         Microcontroller Supply is always on           SP         Synthesizer preset to factory settings.         Power cycle required after command           SR         Soft Reset.         Reset Atsus Synthesizer preset to factory settings.         Reset Atsus Synthesizer preset to factory settings.           ST         Seft-Test.         Read atsus Synthesizer preset to factory settings.         Read Status Synthesizer CPU. Gent xr. nn. CPU. code from start. (example: T. +35.45C)           V1         Read MLVS internal 3.3V power supply         Returns 3.3V         Read MLVS internal 3.3V power supply           V3         Read MLVS internal 5.0V power supply         Returns 23.6V         Returns 23.6V           V4         Read MLVS internal 3.0V power supply         Returns 23.6V         Returns 23.6V           V6         Read MLVS internal 5.0V power supply         Returns 23.6V         Returns 23.6V           V6         Read MLVS internal 5.0V power supply         Returns 23.6V         Returns 23.6V           V6         Read MLVS internal 5.0V power supply         Returns 20.6V         Returns 20.6V           V6         Read MLVS internal 5.0V power supply         Returns 20.6V         Returns 20.6V           V6         Reset MLVS internal 10V reference voltage         Returns 10.0V         Returns 10.0V	POWERON	Turns ON internal supplies related to +12V input	Turns ON supplies.
SP         Synthesize preset to factory settings.         Power cycle required after command           SR         Soft Reset         Rest VCU (set var. nu CPU code from start (example: SR, then read data)           Start Start         Read MUS internal 3.5V power supply         Returns ASCII chars, reading in Deg. C. (asample: T, +35.45C)           V1         Read MUS internal 3.5V power supply         Returns 3.3V           V3         Read MUS internal 3.5V power supply         Returns 3.3V           V4         Read MUS internal 3.0V power supply         Returns 3.3V           V5         Read MUS internal 3.0V power supply         Returns 20.6V           V6         Read MUS internal 3.0V power supply         Returns 20.6V           V6         Read MUS internal 3.0V power supply         Returns 5.0V           V7         Read MUS internal 3.0V power supply         Returns 1.6V           V8         Read MUS internal 3.0V power supply         Returns 1.6V           V8         Read MUS internal 3.0V power supply         Returns 1.6V           V8         Read MUS internal 1.0V reference voltage         Returns 1.6V           V8         Read MUS internal 1.0V reference voltage         Returns 1.6V           V8         Read MUS internal 0.0V reference voltage         Returns 1.6V           V8         Read MUS internal 0.0V reference voltag	POWEROFF	Turns OFF internal supplies related to +12V input (Low power state)	Microcontroller Supply is always on
SR         Soft Reset         Reed FDPL (dear var. run CPU code from start; (example: SR)           T         Read internal temp.         Returns ASCII chars, reading in Dag. C; (example: T, +35.45C)           V1         Read MLVS internal 3.07 power supply         Returns 3.07           V3         Read MLVS internal 5.07 power supply         Returns 3.07           V4         Read MLVS internal 5.07 power supply         Returns 5.07           V4         Read MLVS internal 5.07 power supply         Returns 1.6V           V5         Read MLVS internal 5.07 power supply         Returns 1.6V           V6         Read MLVS internal 5.07 power supply         Returns 1.6V           V6         Read MLVS internal 5.07 power supply         Returns 1.6V           V7         Read MLVS internal 100 reference voltage         Returns 5.1 V           V7         Read MLVS internal 100 reference voltage         Returns 1.6V           R1         Serial Number         1224           R2         Xtal Serial Number         1234           R4         Finax, in MHz         50.0           R5         Temp max, in MBg. C         435.7C           R11         Height Temp reached, in Deg. C         60           R4         Finax, in MBg. C         435.7C           R11         He	SP	Synthesizer preset to factory settings.	Power cycle required after command
Str         Self Test         Read status byte D2, 1 = Pass; (xxxmple: SR; then read data)           T         Read Internal temp,         Returns ASCII chars; reading in Deg. C; (example: T, +35.45C)           V1         Read MLVS internal 3: XP power supply         Returns 3.19           V3         Read MLVS internal 3: XP power supply         Returns 5.0V           V4         Read MLVS internal 3: OV power supply         Returns 5.0V           V5         Read MLVS internal 3: OV power supply         Returns 5.0V           V6         Read MLVS internal 3: OV power supply         Returns 5.1V           V7         Read MLVS internal 3: OV power supply         Returns 5.1V           V8         Read MLVS internal 5.0V power supply         Returns 5.1V           V7         Read MLVS internal 5.0V power supply         Returns 5.1V           V8         Read MLVS internal 5.0V power supply         Returns 5.0V           V8         Read MLVS internal 5.0V power supply         Returns 5.0V           V8         Read MLVS internal 5.0V power supply         Returns 5.0V           V8         Frask, Ind MPa         2000           Returns 1.0V         Returns 1.0V         Returns 5.0V           V8         Frans, In MHz         2000           R1         ROYO State - LocodedUntocked         Lociz	SR	Soft Reset	Reset CPU, clear var. run CPU code from start; (example: SR)
T         Read Internal temp.         Returns ASCII chars, reading in Deg. C; (example: T, +35.45C)           V1         Read MLVS internal 3.37 power supply         Returns 3.37           V3         Read MLVS internal 3.07 power supply         Returns 5.07           V4         Read MLVS internal 5.07 power supply         Returns 5.07           V5         Read MLVS internal 5.07 power supply         Returns 4.16V           V6         Read MLVS internal 5.07 power supply         Returns 4.16V           V6         Read MLVS internal 5.07 power supply         Returns 4.16V           V6         Read MLVS internal 100 reference voltage         Returns 4.51V           R1         Serial Number         1224           R2         Xtall Serial Number         1500           R4         Franz, in dBm         1500           R4         Franz, in dBm         21000.0           R6         Ref max, in dBm         2100           R6         Temp nax. in Deg. C         600           R1         NoVO State - Locked/Unicoked         Locked           R11         NOVO State - Locked/Unicoked         Locked           R13         Unit Realitional Temp nax. in Deg. C         430.7C           R14         Unit Calitration Status - Yee No.         Yee S	ST	Self-Test	Read status byte D2; 1 = Pass; (example: SR, then read data)
V1         Read MLVS Internal 3.37 power supply         Returns 1.8V           V2         Read MLVS Internal 3.37 power supply         Returns 3.07           V3         Read MLVS Internal 5.07 power supply         Returns 3.07           V4         Read MLVS Internal 3.07 power supply         Returns 2.07           V5         Read MLVS Internal 3.07 power supply         Returns 5.17           V6         Read MLVS Internal 3.07 power supply         Returns 5.17           V7         Read MLVS Internal 3.07 power supply         Returns 5.10           V8         Read MLVS Internal 5.07 power supply         Returns 5.10           V8         Read MLVS Internal 5.07 power supply         Returns 5.10           V8         Read MLVS Internal 5.07 power supply         Returns 5.10           V8         Read MLVS Internal 5.07 power supply         Returns 5.07           R1         Sorial Serial Number         1234           R2         Xal Serial Number         2000           R3         Fermax, in MHz         200           R4         Fermax, in MHz         200           R5         Read MLVS Internal Xal Serial Number         600           R11         NOVO State - Locad-Unicoked         Locked           R12         Internal Xal Serial Number         600	Т	Read internal temp.	Returns ASCII chars, reading in Deg. C; (example: T, +35.45C)
V2         Read MLXS Internal 3.07 power supply         Returns 5.07           V3         Read MLXS Internal 5.07 power supply         Returns 5.07           V4         Read MLXS Internal 5.07 power supply         Returns 20.07           V6         Read MLXS Internal 5.07 power supply         Returns 20.07           V7         Read MLXS Internal 5.07 power supply         Returns 5.14           V7         Read MLXS Internal 5.07 power supply         Returns 5.14           V7         Read MLXS Internal 5.07 power supply         Returns 5.14           V8         Model Number         1234           R1         Minth         0940-002           R3         Fmin, In MBrz         150.0           R4         Fmax, In MBrz         200.0           R6         R7 mm, In Meg. C         60           R1         Highest Temp reached, In Deg. C         +35.7C           R11         NOVO State - Locked/Unicoked         Locked           R12         Firmware Version & data         Pass           R13         Unit Calibration Status - Yea/No         Yea           R14         Unit Calibration Status - Yea/No         Yea           R14         Unit Calibration Status - Yea/No         Yea           R14         Unit Calibration Status	V1	Read MLVS internal 1.8V power supply	Returns 1.8V
V3         Read MLVS internal 5.07 power supply         Returns 1.04           V4         Read MLVS internal 300 power supply         Returns 29.67           V5         Read MLVS internal 300 power supply         Returns 29.67           V6         Read MLVS internal 300 power supply         Returns 5.10           V7         Read MLVS internal 5.07 power supply         Returns 10.07           V8         Read MLVS internal 5.07 power supply         Returns 10.07           V7         Read MLVS internal 5.07 power supply         Returns 10.07           V8         Serial Number         1234           V8         Serial Number         600.02           R3         Frini, in MHz         500.00           R4         Frini, in dBm         15.0           R7         RF max, in dBm         20.0           R8         Temp mini, in Deg, C         00           R1         Firmp mini, In Deg, C         60           R11         NOVO State - Locked/Unicked         Locked           R11         NOVO State - Locked/Unicked         Good or Tail V5 78 sexample           R14         Unit Relatin Status - Yes/No         Yes           R15         Self-Test Results - Pass/Fail         Pass           R16         Current Output Freguency	V2	Read MLVS internal 3.3V power supply	Returns 3.3V
V4         Read MLVS internal 300 power supply         Returns 21.6V           V5         Read MLVS internal 300 power supply         Returns 2.6 V0           V6         Read MLVS internal 300 power supply         Returns 5.1V           V7         Read MLVS internal 300 power supply         Returns 5.1V           R1         Serial Number         MUSP-GS20DS           R1         Serial Number         1234           R2         Xtal Serial Number         0940 002           R3         Fmin, in Mtz         50.0           R4         Fmax, in Mtz         21000.0           R6         RF min, in Deg.         0           R7         RF max, in Mtz         20.0           R8         Temp min, in Deg. C         0           R11         MOVO State - LockedUhlocked         Locked           R14         Unit Calination Status - Yes/NO         Yes           R13         Unit Realth Status - Teos/No         Yes           R14         Unit Calination Status - Yes/NO         Yes           R15         Self-test Results - Stas/Fail         Pass           R14         Unit Calination Status - Yes/NO         Yes           R15         Gelf-test Results - Stas/Fail         Pass           R14	V3	Read MLVS internal 5.0V power supply	Returns 5.0V
V5         Read MLVS internal 50V power supply         Returns 2.9 GV           V6         Read MLVS internal 50V power supply         Returns 5.1V           V7         Read MLVS internal 10V reference voltage         Returns 5.1V           R1         Serial Number         1040           R0         Model Number         1234           R1         Serial Number         094-002           R3         Fmin, in MHz         500           R4         Fmax, in dBm         150           R6         RF max, in dBm         150           R6         Temp rmin, in Deg. C         0           R1         NOVO State - Locked/Unlocked         Locked           R11         NOVO State - Locked/Unlocked         Locked           R12         Filmware Version & date         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R14         Unit Health Status - "Good" or Self-test failure information         Good or Fail V5 as example           R15         Self-test Results - Pass/Fail         Pass           R16         Current Output Frequency setting - MHz         2500.12346789           R17         Internal Xtal         Cortox cail # (Hex, (SCP) DIASC CAL-REF-DAX XXX         0000 FFFF - QUW iii set COX CA DIA (Hex, SCP)           R15         Current Output Frequ	V4	Read MLVS internal 11V power supply	Returns 11.6V
V6         Read MLVS internal 1:00 power supply         Returns 1:0.0V           V7         Read MLVS internal 1:00 reference voltage         Returns 1:0.0V           R0         Model Number         MLVS-0520DS           R1         Serial Number         1234           R2         Xtal Serial Number         0940-002           R3         Fmin, in MHz         50.0           R4         Fmin, in MBr         21000.0           R6         R7 min, in dBm         15.0           R7         RF max, in dBm         20.0           R8         Temp max, in Deg. C         0           R11         NOVO State - Locked/Unlocked         Locked           R12         Filmware Version & date         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R13         Unit Calibration Status - YearNo         Yea           R14         Unit Calibration Status - YearNo         Yea           R15         Sciff-Test Resulting - Inf         currently, in difference setting - MHz         25000 Sciff Fer GPU will set OCXO DAC to this number on start-up           R15         OCX cal # (Hex), (SCPI) DIAS; CAL: REF:DAC XXXX         0000-FFFF - CPU will set OCXO DAC to this number on start-up           R14         Unit Calibration Spec., in dBc         -102           R34	V5	Read MLVS internal 30V power supply	Returns 29.6V
V7         Read MLVS internal 10V reference voltage         Returns 10.0V           R0         Model Number         MLVS-0520DS           R1         Serial Number         1234           R2         Xtal Serial Number         0940-002           R3         Fmin, in MHz         50.0           R4         Fmax, in MHz         21000.0           R6         R F min, in dBm         15.0           R7         R F max, in MBr         20.0           R8         Temp min, in Deg. C         0           R1         Temp max, in Deg. C         60           R1         NOVO State - Locked/Unlocked         Locked           R12         Firmware Version & date         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R13         Unit Health Status - "Good" or Self-test failure information         Good or Fail VS as example           R14         Unit Calibration Status - Yes/No         Yes           R15         Self-Test Results - Pass/Fail         Pass           R16         Current Output Frequency setting - IML         currently, it mode; internal Xtal           R14         Unit Calibration Status - Yes/No         Yes           R14         Unit Calibration Status - Yes/No         Yes           R15         Self-test Re	V6	Read MLVS internal -5.0V power supply	Returns -5.1V
R0         Model Number         ML VS-0520DS           R1         Serial Number         1234           R2         Xtal Serial Number         9940-002           R3         Fmin, in MHz         50.0           R4         Fmax, in dBm         15.0           R7         RF max, in dBm         20.0           R8         Temp min, in Deg. C         0           R9         Temp max, in Deg. C         0           R1         Highest Temp reached, in Deg. C         405           R1         NOVO State - Looked Unlocked         Locked           R11         NOVO State - Looked Unlocked         0004 Or Fail VS as example           R14         Unit Calibration Status - Yes/No         Yes           R15         Self-Test Results - Pass/Fail         Pass           R16         Current Output Frequency setting - MHz         25001 123466789           R17         Internal Xtal Setting - Int         currently, 1 mode; Internal Xtal           R18         OCXO Cail # (HA), (SCPI) DIAGCAL: REF: DAC XXXX         0000 FFFF - CPU will set OCXO DAC to this number on stat-up           R18         OCXO Cail # (HA), (SCPI) DIAGCAL: REF: DAC XXXX         0000 FFFF - CPU will set OCX DAC to this number on stat-up           R31         Dustomer pait number, if shown on P.O.	V7	Read MLVS internal 10V reference voltage	Returns 10.0V
R1         Serial Number         1234           R2         Xial Serial Number         0940-002           R3         Frmix, in MHz         50.0           R4         Frax, in MHz         2100.0           R6         RF min, in d8m         15.0           R7         RF max, in MHz         20.0           R8         Temp min, in Deg. C         0           R9         Temp max, in Deg. C         60           R1         NOVO State - Locked/Unlocked         Locked           R11         NOVO State - Locked/Unlocked         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R12         Firmware Version & date         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R13         Unit Realth Status - "Good" or Self-est failure information         Good or Fail V5 as example           R14         Unit Calibration Status - Yes/No         Yes         Yes           R15         Self-Test Resulfs - Pass/Fail         Pass         Ze00.123456739           R17         Internal Xial Setting - Int         Current(Ur, Imdee, Internal Xial Setting - Int         Current(Ur, Imdee, Internal Xial Setting - Int           R16         Current Output Frequency setting - No.         Yes         Yes           R17         Internal Xial Setting - Int         Current(U	R0	Model Number	MLVS-0520DS
R2         Xial Serial Number         0940-002           R3         Frmin, in MHz         50.0           R4         Frax, in MHz         21000.0           R6         RF max, in dBm         15.0           R7         R Fmax, in dBm         20.0           R8         Temp max, in Deg. C         0           R1         NOVO State - Looked/Unlocked         60           R10         Highest Temp reached, in Deg. C         455.7C           R11         NOVO State - Looked/Unlocked         Looked           R12         Firmware Version & date         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R13         Unit Health Status - "Good" or Self-test failure information         Good or Fail V5 as example           R14         Unit Calibration Status - Yes/No         Yes         Zeson 122456789           R15         Self-test Results - Pass/Fail         Pass         Zeson 122456789           R16         Current Output Frequency setting - IMHz         Zeson 122456789         Zeson 22456789           R16         Current Utput Frequency setting - IMHz         Zeson 22456789         Zeson 246789           R18         OcxXo atf # (Hex), (SCP) DIAG:CAL:REF:DAC XXXX         D000 Decimal = 1000 list frequencies in memory.           R28         Xtal Cal status, Yes /	R1	Serial Number	1234
R3         Frmis, in MHz         50.0           R4         Frmax, in MHz         21000.0           R6         RF min, in dBm         20.0           R7         RF max, in Deg. C         0           R8         Temp min, in Deg. C         0           R9         Temp max, in Deg. C         60           R1         NOVO State - Locked/Unlocked         Locked           R11         NOVO State - Locked/Unlocked         Dodt of 71 0 17 10 (Ver., Year, Mo., Day, Hour.)           R13         Unit Health Status - "Good" or Self-test failure information         Good or Fail V5 as example           R14         Unit Calibration Status - Yea/No         Yea           R15         Self-Test Results - Pask         Pasks           R16         Current Output Frequency setting - MHz         Z500.123456789           R17         Internal Xial Setting - Int         currently, in mode. Internal Xial           R18         OCXO call # (Hex), (SCPI) DIAC-CAL-REF:DAC XXXX         0000 Decimal = 1000 list frequencies in memory.           R13         List mode, last index # of current list of frequencies         1000 Decimal = 1000 list frequencies in memory.           R17         R14         Curstomer part number, if shown on P.O.         123-45-6789 (Shown on unit label as PN.)           R33         Spurious Spe	R2	Xtal Serial Number	0940-002
R4         Fmax, in MHz         21000.0           R6         RF min, in dBm         15.0           R7         RF max, in dBm         20.0           R8         Temp min, in Deg. C         0           R9         Temp max, in Deg. C         60           R10         Highest Temp reached, in Deg. C         45.7C           R11         NOVO State - Locked/Unlocked         Locked           R12         Firmware Version & date         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R13         Unit Health Status - "Good" or Self-test failure information         Good or Fail V5 as example           R14         Unit Calibration Status - Yes/No         Yes           R15         Self-Test Results - Pass/Fail         Pass           R16         Current Output Frequency setting - MHz         2500.123456789           R17         Internal Xtal Setting - Int         currently, 1 mode; Internal Xtal           R18         OCXO cali (#key, ISCPI) DIAS-CALLREF: DAC XXXX         0000 FFFF - CPU will set OCXO DAC to this number on start-up           R19         List mode, last index # of current list of frequencies         1000 Decimal = 1000 list frequencies in memory.           R17         Internal Xtal Setting - Int & Gord Chester, in dBC/Hz         -12           R33         Spurious Spec., in dBc <td>R3</td> <td>Fmin, in MHz</td> <td>50.0</td>	R3	Fmin, in MHz	50.0
R6         R F max, in dBm         15.0           R7         R F max, in Deg. C         0           R9         Temp max, in Deg. C         60           R10         Highest Temp reached, in Deg. C         +35.7C           R11         NOVO State - Locked Unlocked         Locked           R12         Firmware Version & date         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R13         Unit Health Status - "Good" or Self-test failure information         Good or Fail V5 as example           R14         Unit Calibration Status - VesNo         Yes           R15         Self-Test Results - Pass/Fail         Pass           R16         Current Output Frequency setting - Mtz         2000.123456789           R17         Internal Xtal Stitidex # of current list of frequencies         10000 Decimal = 1000 list frequencies in memory.           R18         OCXO cal # (Hex), (SCPI) DIAG:CAL.REF:DAC XXXX         0000-FFFF - CPU will set OCXO DAC to this number on start-up           R18         DCXNore part number, if shown on P.O.         123-45-6789 (Shown on unit label as PN;)           R28         Xtal Cal status; Yes / No         Yes           R33         Spurious Spec., in dBc         -10           R34         Harmonics Spec. (in dBc/Hz         -11           R35         Phase Noise Spe	R4	Fmax, in MHz	21000.0
R7         RF max, in dBm         20.0           R8         Temp max, in Deg, C         0           R10         Highest Temp reached, in Deg, C         435.7C           R11         NOVO State - Locked/Unlocked         Locked           R12         Firmware Version & date         0001 2017 10 71 0 (Ver., Year, Mo., Day, Hour.)           R13         Unit Health Status - "Good" or Self-test failure information         Good or Fail V5 as example           R14         Unit Calibration Status - Yes/No         Yes           R15         Self-Test Results - Pass/Fail         Pass           R16         Current Output Frequency setting - MHz         2000.123456789           R17         Internal Xtal Setting - Int         currently, 1 mode, internal Xtal           R18         OCXC Cal # (Hex), (SCPI) DIAG:CAL::REF: DAC XXXX         0000-FFFF - CPU will set OCXD DAC to this number on start-up           R19         List mode, last index # of current list of frequencies         1000 Decimal = 1000 list frequencies in memory.           R20         Xtal Cal status; Yes / No         Yes         Yes           R31         Customer part number, if shown on P.O.         123.45-6789 (Shown on unit label as PN:)           R33         Spurious Spec., in dBc         -60           R34         Harmonicis Spec. 0 to Mtz Offset, in dBc/Hz <t< td=""><td>R6</td><td>RF min, in dBm</td><td>15.0</td></t<>	R6	RF min, in dBm	15.0
R8         Temp min, in Deg. C         0           R9         Temp max, in Deg. C         60           R10         Highest Temp reached, in Deg. C         +35.7C           R11         NOVO State - Locked/Unlocked         Locked           R12         Firmware Version & date         0001 2017 10 17 10 (Yer., Year, Mo., Day, Hour.)           R13         Unit Health Status - "Good" or Self-test failure information         Good or Fail V5 as example           R14         Unit Calibration Status - Yes/No         Yes           R15         Self-Test Results - Pass/Fail         Pass           R16         Current Output Frequency setting - MHz         2500.123456789           R17         Internal Xtal Setting - Int         currently, 1 mode; Internal Xtal           R18         OCXO cal # (Hex), (SCPI) DIAG:CAL;REF:DAC XXXX         0000-FFFF - CPU will set OCXO DAC to this number on start-up           R19         List mode, last index # of current list of frequencies         1000 Decimal = 1000 list frequencies in memory.           R28         Xtal Cal status; Yes / No         Yees         1000 Decimal = 1000 list frequencies in memory.           R33         Spurious Spee, in dBc         -60         -12           R34         Harmonics Spee, 01 NHz Offset, in dBc/Hz         -113           R35         Phase Noise Spee, 01 0 KHz	R7	RF max, in dBm	20.0
R9     Temp max, in Deg, C     60       R10     Highest Temp reached, in Deg. C     +35.7C       R11     NCVO State - Locked/Unlocked     Locked       R12     Firmware Version & date     0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)       R13     Unit Health Status - "Good" or Self-test failure information     Good or Fail V5 as example       R14     Unit Calibration Status - Yeos/No     Yes       Self-Test Results - Pass/Fail     Pass       R16     Self-Test Results - Pass/Fail     Pass       R17     Internal Xtal Setting - Int     currently, 1 mode, Internal Xtal       R18     OCXX col # (Hex), (SCP) DIAG:CAL:REF:DAC XXXX     0000-FFFF - CPU will set OCXD DAC to this number on start-up       R19     List mode, last index # of current list of frequencies     1000 Decimal = 1000 list frequencies in memory.       R18     OLXX col # (Hex), (SCP) DIAG:CAL:REF:DAC XXXX     0000-FFFF - CPU will set OCXD DAC to this number on start-up       R19     List mode, last index # of current list of frequencies     1000 Decimal = 1000 list frequencies in memory.       R18     OLXX col # (Hex), (SCP) DIAG:CAL:REF:DAC XXXX     0000-FFFF - CPU will set OCXD DAC to this number on start-up       R19     List mode, last index # of current list of frequencies     1000 Decimal = 1000 list frequencies in memory.       R28     Xtal Cal status: Yes / No     Yes     -12       R30     <	R8	Temp min, in Deg. C	0
R10       Highest Temp reached, in Deg. C       +35.7C         R11       NOVO State - Locked/Uncked       Locked         R12       Firmware Version & date       0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)         R13       Unit Health Status - "Good" or Self-test failure information       Good or Fail V5 as example         R14       Unit Calibration Status - Yes/No       Yes         R15       Self-Test Results - Pass/Fail       Pass         R16       Current Output Frequency setting - MHz       2500.123456789         R17       Internal Xtal Setting - Int       currently, 1 mode: Internal Xtal         R18       OCXO cal # (Hex), (SCPI) DIAG:CAL:REF:DAC XXX       0000-FFFF - CPU will set OCXD DAC to this number on start-up         R19       List mode, Isat index # of ourrent list of frequencies       1000 Decimal = 1000 list frequencies in memory.         R28       Xtal Cal status; Yes / No       Yes       Yes         R31       Customer part number, if shown on P.O.       123-45-678 (Shown on unit label as PN:)         R33       Spurious Spec, in dBC       -60         R34       Harmonics Spec., in dBC       -12         R35       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -113         R36       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -119         R39	R9	Temp max, in Deg. C	60
R11         NOVO State - Locked/Unlocked         Locked           R12         Firmware Version & date         0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)           R13         Unit Health Status - "Good" or Self-test failure information         Good or Fail V5 as example           R14         Unit Calibration Status - Yes/No         Yes           R15         Self-Test Results - Pass/Fail         Pass           R16         Current Output Frequency setting - MHz         2500.123456789           R17         Internal Xtal Setting - Int         currently, Imode: Internal Xtal           R18         OCXO calf (Hex), (SCPI) DIAC:CAL:REF:DAC XXXX         0000-FFFF - CPU will set OCXO DAC to this number on start-up           R19         List mode, last index # of current list of frequencies         1000 Decimal = 1000 list frequencies in memory.           R28         Xtal Cal status; Yes / No         Yes         123-45-6789 (Shown on unit label as PN:)           R31         Customer part number, if shown on P.O.         123-45-6789 (Shown on unit label as PN:)           R34         Harmonics Spec., in dBc         -12           R35         Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz         -119           R36         Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz         -119           R38         Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz         -119     <	R10	Highest Temp reached, in Deg. C	+35.7C
R12       Firmware Version & date       0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)         R13       Unit Health Status - 'Good' or Self-test failure information       Good or Fail V5 as example         R14       Unit Calibration Status - Yes/No       Yes         R15       Self-Test Results - Pass/Fail       Pass         R16       Current Output Frequency setting - Int.       2500.123456789         R17       Internal Xtal Setting - Int.       currently. 1 mode; Internal Xtal         R18       OCXO cal # (Hex), (SCPI) DIAG:CAL:REF:DAC XXXX       0000-FFFF - CPU will set OCXO DAC to this number on start-up         R19       List mode, last index # of current list of frequencies       1000 Decimal = 1000 list frequencies in memory.         R28       Xtal Cal status; Yes / No       Yes       Yes         R31       Customer part number, if shown on P.O.       123-45-6789 (Shown on unit label as PN:)         R33       Spurious Spec., in dBc       -60         R34       Harmonics Spec., in dBc       -12         R35       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -113         R36       Phase Noise Spec. @ 10 NHz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 10 NHz Offset, in dBc/Hz       -119         R39       Phase Noise Spece. @ 10 NHz Offset, in dBc/Hz       -118	R11	NOVO State - Locked/Unlocked	Locked
R13       Unit Realth Status - "Good" or Self-test failure information       Good or Fail V5 as example         R14       Unit Calibration Status - Yes/No       Yes         R15       Self-Test Results - Pass/Fail       Pass         R16       Current Output Frequency setting - MHz       2500.123456789         R17       Internal Xtal Setting - Int       currently, 1 mode; Internal Xtal         R18       OCXO cal # (Hex), (SCPI) DIAG:CAL:REF:DAC XXXX       0000-FFFF - CPU will set OCXO DAC to this number on start-up         R19       List mode, last index # of current list of frequencies       1000 Decimal = 1000 list frequencies in memory.         R28       Xtal Cal status; Yes / No       Yes         R31       Customer part number, if shown on P.O.       123-45-6789 (Shown on unit label as PN:)         R33       Spurious Spec., in dBc       -10         R34       Harmonics Spec.       R10 Hz Offset, in dBc/Hz       -84         R36       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -113         R37       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -118         R40       Switching Speed Spec. Opt. S = 500 Sor Opt. R = 1500.S       50      <	R12	Firmware Version & date	0001 2017 10 17 10 (Ver., Year, Mo., Day, Hour.)
R14     Unit Calibration Status - Yes/No     Yes       R15     Self-Test Results - Pass/Fail     Pass       R16     Current Output Frequency setting - Int     Currently, 1 mode; Internal Xtal       R17     Internal Xtal Setting - Int     Currently, 1 mode; Internal Xtal       R18     OCX0 cal # (Hex), (SCPI) DIAG:CAL:REF:DAC XXXX     0000-FFFF - CPU will set OCX0 DAC to this number on start-up       R19     List mode, last index # of current list of frequencies     1000 Decimal = 1000 list frequencies in memory.       R28     Xtal Cal status; Yes / No     Yes       R31     Customer part number, if shown on P.O.     123:45-6789 (Shown on unit label as PN:)       R33     Spurious Spec., in dBc     -60       R34     Harmonics Spec., in dBc     -12       R35     Phase Noise Spec. @ 10 Hz Offset, in dBc/Hz     -113       R36     Phase Noise Spec. @ 10 Hz Offset, in dBc/Hz     -119       R38     Phase Noise Spec. @ 10 Hz Offset, in dBc/Hz     -119       R39     Phase Noise Spec. @ 10 Hz Offset, in dBc/Hz     -118       R40     Switching Speed Spec., Opt. S = 500 sor Opt. R = 1500S     50       R41     +12V Supply current Max, in mA     1250       R51     Installed Options:     A, B, C, D, R, and S       R52     Current Reference Source Setting (Int/Ext).     Ext       R53     MLWI Prod	R13	Unit Health Status – "Good" or Self-test failure information	Good or Fail V5 as example
R15     Steff-Test Results - Pass/Fail     Pass       R16     Current Output Frequency setting - MHz     2500.123456789       R17     Internal Xtal Setting - Int     currently, 1 mode; Internal Xtal       R18     OCX0 cal # (Hex), (SCPI) DIAS:CAL:REF:DAC XXXX     0000-FFFF - CPU will set OCX0 DAC to this number on start-up       R19     List mode, Iast index # of current list of frequencies     1000 Decimal = 1000 list frequencies in memory.       R28     Xtal Cal status; Yes / No     Yes       R31     Customer part number, if shown on P.O.     123-45-6789 (Shown on unit label as PN:)       R33     Spurious Spee., in dBc     -60       R34     Harmonics Spee., in dBc     -12       R35     Phase Noise Spee @ 100 Hz Offset, in dBc/Hz     -113       R37     Phase Noise Spee. @ 100 Hz Offset, in dBc/Hz     -119       R38     Phase Noise Spee @ 100 Hz Offset, in dBc/Hz     -119       R39     Phase Noise Spee @ 100 Hz Offset, in dBc/Hz     -119       R39     Phase Noise Spee @ 100 Hz Offset, in dBc/Hz     -119       R39     Phase Noise Spee @ 100 Hz Offset, in dBc/Hz     -118       R40     Switching Speed Spee., Opt. S = 500 to rol. R = 150uS     50       R41     +12V Supply current Max, in mA     1250       R52     Current Reference Source Setting (Int/Ext).     Ext       R53	R14	Unit Calibration Status - Yes/No	Yes
R16       Current Output Frequency setting - MHz       22500/123456789         R17       Internal Xtal Setting - Int       currently, I mode; Internal Xtal         R18       OCXO cal # (Hex), (SCPI) DIAG:CAL:REF:DAC XXXX       0000-FFFF - CPU will set OCXO DAC to this number on start-up         R19       List mode, last index # of current list of frequencies       1000 Decimal = 1000 list frequencies in memory.         R28       Xtal Cal status; Yes / No       Yes         R31       Customer part number, if shown on P.O.       123-45-6789 (Shown on unit label as PN:)         R33       Spurious Spec., in dBc       -60         R34       Harmonics Spec. @ 100 Hz Offset, in dBc/Hz       -84         R36       Phase Noise Spec. @ 10 Hz Offset, in dBc/Hz       -113         R37       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 10 NHz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 1 MHz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 1 MHz Offset, in dBc/Hz       -118         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed	R15	Self-Test Results - Pass/Fail	Pass
R17       Internal Xtal Setting – Int       currently, 1 mode; Internal Xtal         R18       OCXO cal # (Hex), (SCPI) DIAG:CAL:REF:DAC XXXX       0000-FFFF - CPU will set OCXO DAC to this number on start-up         R19       List mode, last index # of current list of frequencies       1000 Decimal = 1000 list frequencies in memory.         R28       Xtal Cal status; Yes / No       Yes         R31       Customer part number, if shown on P.O.       122-45-6789 (Shown on unit label as PN:)         R33       Spurious Spec., in dBC       -60         R34       Harmonics Spec., in dBC       -12         R35       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -84         R36       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -119         R37       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -118         R40       Switching Speed Spec. @ 10 Hz Offset, in dBc/Hz       -118         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF       OFF         (unit returms C with Query)       Forequency status o	R16	Current Output Frequency setting - MHz	2500.123456789
R18       OCXO call # (Hex), (SCPI) DIAG: CAL:RE::DAC XXXX       0000-FFF - CPU will set OCXO DAC to this number on start-up         R19       List mode, last index # of current list of frequencies       1000 Decimal = 1000 list frequencies in memory.         R28       Xtal Cal status; Yes / No       Yes         R31       Customer part number, if shown on P.O.       123-45-6789 (Shown on unit label as PN:)         R33       Spurious Spec., in dBc       -60         R34       Harmonics Spec., in dBc       -12         R35       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -13         R37       Phase Noise Spec. @ 100 kHz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 100 kHz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 100 kHz Offset, in dBc/Hz       -118         R40       Switching Speed Spec. Qpt. S = 500S or Opt. R = 1500S       50         R41       +12V Supply current Max, in mA       1250         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF       OFF         (unit returns CR with Query)       10°0024       Poweroff* commands         R58       MLWI Sales (Job) number       10°0024	R17	Internal Xtal Setting – Int	currently, 1 mode; Internal Xtal
H19       List mode, last index # of current list of frequencies       1000 Decimal = 1000 list frequencies in memory.         R28       Xtal Cal status; Yes / No       Yes         R31       Customer part number, if shown on P.O.       123-45-6789 (Shown on unit label as PN:)         R33       Spurious Spec., in dBc       -60         R34       Harmonics Spec. @ 100 Hz Offset, in dBc/Hz       -84         R35       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -113         R37       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -118         R40       Switching Speed Spec., Opt. S = 50uS or Opt. R = 150uS       50         R41       +12V Supply current Max, in mA       1250         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF       OFF         (unit returns CR with Query)       OFF       0FF         R58       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R50       Power State (Power supplies on or off) On power-up will default to 'ON' or "OFF" (Low power) - Show sta	R18	OCXO cal # (Hex), (SCPI) DIAG:CAL:REF:DAC XXXX	0000-FFFF - CPU will set OCXO DAC to this number on start-up
H28       Xtal Cal status; Yes / No       Yes         R31       Customer part number, if shown on P.O.       123-45-6789 (Shown on unit label as PN:)         R33       Spurious Spec., in dBc       -60         R34       Harmonics Spec., in dBc       -12         R35       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -84         R36       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -113         R37       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -119         R40       Switching Speed Spec., Opt. S = 50uS or Opt. R = 150uS       50         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF       OFF         (unit returns CR with Query)       10*0024         R58       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to	R19	List mode, last index # of current list of frequencies	1000 Decimal = 1000 list frequencies in memory.
R31       Customer part number, if shown on P.O.       123-45-6789 (Shown on unit label as PN:)         R33       Spurious Spec., in dBc       -60         R34       Harmonics Spec., in dBc       -12         R35       Phase Noise Spec. @ 10 Hz Offset, in dBc/Hz       -84         R36       Phase Noise Spec. @ 10 Hz Offset, in dBc/Hz       -113         R37       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 100 kHz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 100 kHz Offset, in dBc/Hz       -118         R40       Switching Speed Spec., Opt. S = 500S or Opt. R = 1500S       50         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF       OFF         (unit returns CR with Query)       10*0024         R58       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to 'ON' or 'OFF' (Low power) - Show status of "poweron" and "powerof" commands <t< td=""><td>R28</td><td>Xtal Cal status; Yes / No</td><td></td></t<>	R28	Xtal Cal status; Yes / No	
H33       SpUrious Spec., in dBc       -60         R34       Harmonics Spec., in dBc       -12         R35       Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz       -84         R36       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -113         R37       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -118         R39       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -118         R40       Switching Speed Spec., Opt. S = 50uS or Opt. R = 150uS       50         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       0FF         R58       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Adfined default 1 - Frequency setting       Frequency stored in MHz (ASCII), save and recall using MS & MR commands	R31	Customer part number, it snown on P.O.	123-45-6789 (Snown on unit label as PN:)
R34       Harmonics Spec., in dBc       -12         R35       Phase Noise Spec. @ 10 Hz Offset, in dBc/Hz       -84         R36       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -113         R37       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz       -118         R40       Switching Speed Spec., 0pt. S = 50uS or Opt. R = 150uS       50         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands	R33	Spurious Spec., in dBc	-60
R35       Phase Noise Spec. @ 100 H2 Offset, in dBc/H2       -64         R36       Phase Noise Spec. @ 100 HZ Offset, in dBc/Hz       -113         R37       Phase Noise Spec. @ 100 HZ Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 100 HZ Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 1 MHZ Offset, in dBc/Hz       -118         R40       Switching Speed Spec., Opt. S = 50uS or Opt. R = 150uS       50         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "OFF" (Low power) - Show status of "poweron" and "poweroff" commands         R300       User defined default 1 - Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R301       User defined default 1 - Mode Settings	R34	Harmonics Spec., in dBc	-12
R36Priase Noise Spec. @ 1 KH2 Offset, in dBC/H2-113R37Phase Noise Spec. @ 10 kHz Offset, in dBc/Hz-119R38Phase Noise Spec. @ 1 MHz Offset, in dBc/Hz-119R39Phase Noise Spec. @ 1 MHz Offset, in dBc/Hz-118R40Switching Speed Spec., Opt. S = 50uS or Opt. R = 150uS50R41+12V Supply current Max, in mA1250R51Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)2.5R52Current Reference Source Setting (Int/Ext).ExtR55Installed Options:A, B, C, D, R, and SR57USB Com port carriage return send ON/OFF (unit returns CR with Query)OFFR58MLWI Sales (Job) number10*0024R59MLWI Product Outline Drawing # and Revision99-0101-001 A "poweroff" commandsR60Power State (Power supplies on or off) On power-up will default to ON!"ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commandsR300User defined default 1 - Frequency settingFrequency stored in MHz (ASCII), save and recall using MS & MR commandsR301User defined default 1 - Frequency settingR301R303User defined default 2 - Mode SettingsR303	R35	Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz	-84
R37       Phase Noise Opt @ 100 kHz Offset, in dBc/Hz       -119         R38       Phase Noise Spec. @ 100 kHz Offset, in dBc/Hz       -119         R39       Phase Noise Spec. @ 1 MHz Offset, in dBc/Hz       -118         R40       Switching Speed Spec., Opt. S = 50uS or Opt. R = 150uS       50         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R300       User defined default 1 - Frequency setting       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R301       User defined default 1 - Strequency setting       R303       User defined default 2 - Frequency setting	R30 P27	Phase Noise Spec. @ 1 kHz Offset, in dBc/Hz	-113
R30       Finase Roise Spec. (e) 10K RL Offset, in dBC/Hz       -118         R40       Switching Speed Spec., Opt. S = 500S or Opt. R = 1500S       50         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R300       User defined default 1 - Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R301       User defined default 1 - Frequency setting       R302       User defined default 2 - Frequency setting         R303       User defined default 2 - Mode Settings       R303       User defined default 2 - Mode Settings	R38	Phase Noise Spec. @ 10 KHZ Offect in dBa/HZ	-110
R40       Switching Speed Spec., Opt. S = 50uS or Opt. R = 150uS       50         R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R300       User defined default 1 - Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R301       User defined default 1 - Mode Settings       Image Node Settings         R303       User defined default 2 - Frequency setting       Image Node Settings	R30	Phase Noise Spec. @ 100 KHZ Olisel, 111 UBC/HZ	-118
R41       +12V Supply current Max, in mA       1250         R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R301       User defined default 1 - Frequency setting       Image: commands         R302       User defined default 2 - Frequency setting       Image: commands         R303       User defined default 2 - Mode Settings       Image: commands	R40	Switching Speed Spec. Ont $S = 50 \mu S \text{ or } Ont R = 150 \mu S$	50
R51       Level flatness spec. in +/- dB (+/- 2.5 = 5.0 total)       2.5         R52       Current Reference Source Setting (Int/Ext).       Ext         R55       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Actine default 1 - Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R300       User defined default 1 - Frequency setting       R301       User defined default 1 - Mode Settings         R302       User defined default 2 - Frequency setting       R303       User defined default 2 - Mode Settings	R41	+12V Supply current Max in mA	1250
Rotations spool in the drift 2.5 - or or order       2.5         Rotations spool in the drift 2.5 - or order       2.5         Rotations spool in the drift 2.5 - or order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Ext         Rotations Spool in the drift 2.5 - order       Figure 1.5         Rotations Spool in the drift 2.5 - order       Figure 1.5         Rotations Spool in the drift 2.5 - order       Figure 1.5         Rotations Compared in the drift 2.5 - order       Figure 1.5         Rotations Compared in the drift 2.5 - order       Figure 1.5         Rotations Compared in the drift 2.5 - order       Figure 1.5         Rotations Compared in the drift 2.5 - order       Figure 1.5         Rotations Compared in the drift 2.5 - order       Figure 1.5         Rotatin the drift 2.5 - order       Figure	R51	Level flatness spec in $\pm/-$ dB ( $\pm/-25 - 5.0$ total)	25
R32       Current Reference Source Setting (INEX).       Ext         R53       Installed Options:       A, B, C, D, R, and S         R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R300       User defined default 1 - Frequency setting       commands         R301       User defined default 2 - Frequency setting         R302       User defined default 2 - Frequency setting         R303       User defined default 2 - Mode Settings	R51	Current Reference Source Setting (Int/Ext)	Evt
R57       USB Com port carriage return send ON/OFF (unit returns CR with Query)       OFF         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R300       User defined default 1 - Frequency setting       Image: Commands         R301       User defined default 1 - Mode Settings       R302         R303       User defined default 2 - Frequency setting       Image: Commands	R52 R55	Installed Ontions:	
R57       Out returns CR with Query)       Of Y         R58       MLWI Sales (Job) number       10*0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R300       User defined default 1 - Frequency setting       Commands         R301       User defined default 1 - Mode Settings         R302       User defined default 2 - Frequency setting         R303       User defined default 2 - Mode Settings	R57	USB Com port carriage return send ON/OEF	
R58       MLWI Sales (Job) humber       10'0024         R59       MLWI Product Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R300       User defined default 1 - Frequency setting       R301         R302       User defined default 2 - Frequency setting         R303       User defined default 2 - Mode Settings		(unit returns CR with Query)	4010004
R59       MLWI Froduct Outline Drawing # and Revision       99-0101-001 A         R60       Power State (Power supplies on or off) On power-up will default to ON!       "ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands         R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R300       User defined default 1 - Frequency setting       MLWI Frequency setting         R301       User defined default 1 - Mode Settings       MLWI Frequency setting         R302       User defined default 2 - Frequency setting       MLWI Frequency setting         R303       User defined default 2 - Mode Settings       MLWI Frequency setting	R00	IVILVVI Sales (JOD) NUMDer	
Root       Power State (Power supplies on or off) On power-up will default to ON!       "ON" of "OFF"(Low power) - Snow status of "poweron" and "poweroff" commands         R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R300       User defined default 1 - Frequency setting       Image: Commands         R301       User defined default 1 - Mode Settings       Image: Commands         R302       User defined default 2 - Frequency setting       Image: Commands         R303       User defined default 2 - Mode Settings       Image: Commands	R09	IVIL VVI PTODUCI OUTITIE Drawing # and Kevision	99-0101-001 A   "ON!" or "OFF"/( ou nower) - Show status of "nowerser" or it
R200-299       User Save / Recall Frequency setting locations (100 Total)       Frequency stored in MHz (ASCII), save and recall using MS & MR commands         R300       User defined default 1 - Frequency setting       Image: Commands         R301       User defined default 1 - Mode Settings       Image: Commands         R302       User defined default 2 - Frequency setting       Image: Commands         R303       User defined default 2 - Mode Settings       Image: Commands	R60	Power State (Power supplies on or off) On power-up will default to ON!	"ON" or "OFF"(Low power) - Show status of "poweron" and "poweroff" commands
R300       User defined default 1 - Frequency setting         R301       User defined default 1 - Mode Settings         R302       User defined default 2 - Frequency setting         R303       User defined default 2 - Mode Settings	R200-299	User Save / Recall Frequency setting locations (100 Total)	Frequency stored in MHz (ASCII), save and recall using MS & MR commands
R301       User defined default 1 - Mode Settings         R302       User defined default 2 - Frequency setting         R303       User defined default 2 - Mode Settings	R300	User defined default 1 - Frequency setting	
R302       User defined default 2 - Frequency setting         R303       User defined default 2 - Mode Settings	R301	User defined default 1 - Mode Settings	
R303 User defined default 2 - Mode Settings	R302	User defined default 2 - Frequency setting	
	R303	User defined default 2 - Mode Settings	

## 7.2 SCPI Commands

### Power

Description	SCPI Cmd.	SCPI Param.	Command / Results Examples	
RF Module power control (*)	OUTP:STAT	OFF/ON	OUTP:STAT ON	
Get RF Module power state	OUTP:STAT?	0/1	OUTP:STAT? / OUTP:STAT 1	

(\*) This command takes about 1500mS

#### Reset

Description	SCPI Cmd.	Result
Reset Frequency	*RST (*)	10GHz , Int. Ref. Source , triggering disabled

(\*) SPI Interface delay – 300uS, USB Comport delay – 100mS

#### Frequency

Description	SCPI Cmd.	SCPI Param.		Command / Results Examples
Set Frequency (*)	FREQ	GHz, MHz, kHz, Hz, mlHz		FREQ 1.2GHz

(\*) Each frequency command has a delay according to the specification of the system which can be 50uS (0520DS) to 150uS (0520DR).

1.

### Configuration

Description	SCPI Cmd.	SCF Para	n.	Command / Results Examples
Set Ref. Source	ROSC:SOUR	INT/E	XT	ROSC:SOUR EXT
Get Ref. Source	ROSC:SOUR?	INT/E	XT	EXT
Set Internal Ref DAC Value	DIAG:CAL:REF:DAC	0 T 0	)	DIAG:CAL:REF:DAC 3000
		6553	5	
Get Internal Ref DAC Value	DIAG:CAL:REF:DAC?	non	9	3000

(\*) Response to each command is dependent of the process time and can take 10uS to 1000uS

### Diagnostic

- SPI diagnostic commands need to be sent twice, the 1<sup>st</sup> SPI return byte is always Don't Care
- If commands format is ASCII, the return is in ASCII, if commands format is HEX, the return is in Hex
- Return value of frequency in mIHz

Description	SCPI Cmd.	SCPI Return Example
Get ID- 1.Module# 2.Options 3.Soft. Ver. 4. Serial#	IDN?	0520 DS 0001 0002
Get Status BIT0-not used BIT1-RF Locked BIT2-REF Locked BIT3-RF Output BIT4-Voltage status BIT5-not used BIT6-Sweep status BIT7-Comport Status	STAT?	BIT0 -not used BIT1 -0 Locked, 1 unlocked BIT2 -0 Locked, 1 unlocked BIT3 -0 OFF, 1 ON BIT4 -0 OK, 1 Err BIT5 - not used BIT6 -0 OFF, 1 Run BIT7 -0 Ready, 1 Busy
Get Frequency	FREQ?	12123456789123
Get Ref. Source	ROSC:SOUR?	INT or EXT
Get Temp. (C)	DIAG:MEAS?	38.9
List Points get Size	LIST:PVEC:SIZE?	LIST:PVEC:SIZE?
List Point get Freq.	LIST:PVEC: GET?	LIST:PVEC:GET? 15

### Save / Erase

Description	SCPI Cmd.	SCPI Param.			Command Example
Save current state in Flash	*SAV	User Se	etting 1,2		*SAV 2
Restore current state from Flash	*RCL	(*	"*)		*RCL 2 or *RCL 0 (***)
Save List Table to Flash (*4)	LIST:SAV (*5)				none
Copy List from Flash to RAM on Request	LIST:COPY:REQ				none
Automatically Copy List from Flash to	LIST:COPY:AUTO				LIST:COPY:AUTO:YES/NO
RAM upon power up			none		
Erase the entire List Table in RAM (*6)	LIST:ERAS				LIST:ERAS
Erase the entire List Table in FLASH,	LIST:ERAS:FLASH				LIST:ERAS:FLASH
RAM and NOVO (*)					

(\*) "Secure Erase" command (takes about 3 sec and before sending the next command):

- Stops any Sweep
- Resets to 10GHz ٠

Erase ongoing setting data from NOVO such as last frequency and list point length •

Erase ongoing setting data from NOVO such as last frequency and list point length
 (\*\*) User Setting includes: Frequency and current Ref. Source selected
 (\*\*\*) \*RCL 0 is factory default
 (\*4) A delay of at least 100uS per list point is required before sending the next command
 (\*5) The LIST:SAV command allows the list in RAM to be save in FLASH and it will be automatically copied to the RAM upon powerup
 (\*6) The LIST:ERAS command deletes the list points stored in RAM only and is very fast

### Sweep/List Run

Description	Command	Parameters	Command Examples
Description	SCPI	SCPI	SCPI
Run selected List Point	LIST:PVEC:RUN	1 to 32767 (Points)	LIST:PVEC:RUN 1
Start List Start Fast Sweep Start Normal Sweep	LIST:STAR(T) SWE:FAST:FREQ:STAR(T) SWE:NORM:FREQ:STAR(T)	1 - 32767 times 0 – infinite times	LIST:STAR 5 SWE:FAST:FREQ:STAR 15 SWE:NORM:FREQ:STAR 0
Stop List / Sweep	LIST:STOP or SWE:STOP		LIST:STOP or SWE:STOP
Send Sweep state request	SWE:BUSY?	none	SWE:BUSY?
Get Sweep state	SWE:BUSY:YES/NO		SWE:BUSY:YES

### Sweep/List Setup

Description	SCPI Cmd.	SCPI	_	Config.		Command Example
Decemption	00110111	Param.		SCPI		
List point	LIST:PVEC (*11) (*12)	1. List po	pint #			LIST:PVEC 1,3GHz,0,1s
setup		( <b>1</b> to 327	67)			4A0001
RAM		2. Freq (	*)			0B06B655DA83
FLASH(*4)		3. 0 (Res	erved)			0000
		4. List D	well			1A000000
		Time (*3	)		None	
		5. Pulse	Mod-			
		N/A (*7)				
		6. RF OL	itput-			
		N/A (*8)				
		7. Save t	0			
		Flash-N/	A (*9)			
List setup	LIST:SETUP	1. Config	-	1. Point	Dwell time(*3)	LIST:SETUP 2s,0,2,2,R
and Run	(List Setup & run)	Paramet	ers	(*10)		
Fast Sweep	SWE:FAST:FREQ:SETUP	1. Start F	req (*)	2. Times	to run:	SWE:FAST:FREQ:SETUP
and run (*5)	(Fast Sweep Setup)	2. Stop F	req (*)	1 to 327	<b>767</b>	2GHz,10GHz,100,0,1s,10,0,0,
		3. Numb	er of	0 – infin	ite	R
		Points (1	to	2.	Irigger:	
		32767)		3.		
		4.0 (Res	erved)	0-SVV F	-ull,	
		5. Config		1-HVV F	-ull,	
		Param.		2-HVV F	Point,	
Normal	SWE:NORM:FREQ:SETUP	1. Start F	req (*)	3-SW P	oint	SWE:NORM:FREQ:SETUP
Sweep and	(Normal Sweep Setup)	2. Stop F	req (*)	4.	Direction	2GHz,8GHz,1G Hz,0,5ms,
Run (*6)		3. Step F	req (*)	5.		200,2,2,R
		4.0 (Res	served)	0–0p, 1	–Down,	
		5. Config		2-Up &		
		Param.		3- Dowr	1 & Up	
				5. Kun U		
				R – run		
1						

(\*) GHz, MHz, KHz, Hz, mIHz,

(\*3) us, ms, s (default us).

The shortest **Dwell time** is according to the specification of the system (50uS to 150uS).

- (\*4) Upon completing List point setup (0x13 or 4A), send LIST:SAV (4B) to save in FLASH, more info in in (\*9)
- (\*5) In Fast Sweep (either HW Point or SW Point) mode, to reach the Stop frequency, you must send one extra trigger. In Fast Sweep (either HW Full or SW Full) mode, the firmware will automatically add the extra step. Formula = FSTOP – FSTART / POINTS = Frequency Step Size
  - Example: 10000MHz 1000MHz / 10 = 900MHz step x10 steps + 1 step to reach 10000MHz
- (\*6) In Normal Sweep mode, to reach the Stop frequency, make sure for evenly division by Step frequency

Trigger Types description:

- 0-SW Full each frequency point is triggered by a software timer (Dwell time)
- 1-HW Full starts a SW Full Trigger Types by an external trigger
- 2–**HW Point** each frequency point is triggered by an external trigger
- 3-**SW Point** each frequency point is triggered by the start button (new command)
- (\*7) Pulse Mod not supported
- (\*8) RF Output not supported since Switching response On/OFF takes about 1500mS
- (\*9) Save to Flash not supported since writing time to Flash is too long and not efficient for one list mode.
  - The list is saved in RAM automatically, when ready send a LIST:SAV command (or 13) to save all the lists in Flash.
    - Make sure the list pointer points on the last list to be save in Flash.
- (\*10) If **Point Dwell time** > 0, it overwrites the **List Dwell Time** of each Frequency in the CSV file
- (\*11) Set Ext. or Int. Ref. before sending the 'LIST: PVEC' parameters , the reference is kept in the memory for each list point
- (\*12) The MLVS updates the list and number of frequencies in RAM (only) after each LIST:PVEC command.
  - As long as you make the list sequentially, the old list will be erased automatically and the erase command is not needed. Example:
    - If you have saved 20 frequencies using the LIST:PVEC 1..., to LIST:PVEC 20... commands, the unit knows that you have 20 frequencies in the list, start from 1 to 20
    - If you then, without turning off the power, save 5 frequencies in RAM using LIST:PVEC 1..., to LIST:PVEC 5... your list is now 5 frequencies long, and list points 6-20 are no longer accessible (virtually erased).

#### Example: Fast Frequency Sweep Setup and Run command:

Start Frequency: 5 GHz, Stop Frequency: 8 GHz Number of Points Between Frequencies (inclusive): 30 Dwell Time: 3 sec, Number of times to run sweep: 2 Enable Sweep Trigger: Yes, Enable Sweep Point Triggers: No, Direction: Up

Field	Start Freq.	Stop Freq.	No. Points	Reserved	Dwell Time	No. Runs	Trigger	Direction
Units	milliHertz	milliHertz			μs		Bool	
Decimal	500000000000	800000000000	30	0	3000000	2	Yes	Up

17 04 8C 27 39 50 00 07 46 A5 28 80 00 00 1E 00 00 00 2D C6 C0 00 02 04 After this command is executed, ONE Sweep trigger signal should be applied.

Example: Normal Frequency Sweep Setup with Software-Point trigger: Send Normal Sweep setup: 1C 00448CE31B30 13196AE931C2 000025AA0760 0000 00000064 0000 0C Send Start Normal Sweep to set the 1<sup>st</sup> Frequency: 21 Continue sending 21 commands for each next Frequency Point

## 8.0 Hardware Installation Information

The unit may be installed into a system using four #4-40 screws, through the mounting surface, on the sides, two on each side. Alternately, four #4-40 screws can be attached from the bottom side through the mounting surface, in the four mounting holes. The mounting hole dimensions and Molex connector (J1), and mating connector information and are shown in the drawing number 99-0101-001 in this document. The USB connector (J2) is a standard Mini-B. The DC power supply connector (J3) is a barrel plug with a center pin diameter of 1.3mm and outer connection point diameter of 3.6mm. The center pin is the positive contact. Recommended AC/DC (12Vdc, 46W) wall mount adapter is Digi-Key part number 1647-1009-ND

## 9.0 Technical Support

For Technical support please contact:

Micro Lambda Wireless, Inc. 46515 Landing Pkwy. Fremont, CA 94538 Ph: (510) 770-9221 Fax: (510) 770-9213

Email: sales@microlambdawireless.com

You can visit our website at <u>http://www.microlambdawireless.com</u> for updated information, specifications and downloads.

## 10.0 Warranty

Seller warrants for a period of twelve (12) months from the date of original shipment that the products will be free from defects in material and workmanship and design (if of Micro Lambda Wireless, Inc. design) and will be in conformity with applicable specifications and drawings and all other contractual requirements. However, this warranty shall not apply to any product which that has been subjected to misuse, misapplication, accident, improper installation, neglect, unauthorized repair, alteration, adjustment, inundation or fire. See the complete warranty and return policy document number 96-0200-005 Rev A at our website at <a href="http://www.microlambdawireless.com">http://www.microlambdawireless.com</a>.