Micro Lambda Wireless Native Commands and Memory Map.

Command	Function	Comments
?	Report Status (returns 11000011 in ASCII)	D0 = Ref. lock, D1 = RF Lock, D6 = self-test, D7 = NOVO lock
F	Frequency (ASCII) (Dec. #)	ASCII freq in MHz: xxxxx.xxxxxx; (example: F12345.678901234)
MR	Recall a user saved frequency setting from memory location (MR25)	0-99, stored @ NOVO location 200-299
MS	Save current frequency setting of unit to memory location (MS75)	0-99, stored @ NOVO location 200-299
POWERON	Turns ON internal supplies related to +12V input	Turns ON supplies.
POWEROFF	Turns OFF internal supplies related to +12V input (Low power state)	Microcontroller Supply is always on
SP	Synthesizer preset to factory settings.	Power cycle required after command
SR	Soft Reset	Reset CPU, clear var. run CPU code from start; (example: SR)
ST	Self-Test	Read status byte D2; 1 = Pass; (example: SR, then read data)
T	Read internal temp.	Returns ASCII chars, reading in Deg. C; (example: T, +35.45C)
V1	Read MLVS internal 1.8V power supply	Returns 1.8V
V2	Read MLVS internal 3.3V power supply	Returns 3.3V
V3	Read MLVS internal 5.0V power supply	Returns 5.0V
V4	Read MLVS internal 11V power supply	Returns 11.6V
V5	Read MLVS internal 30V power supply	Returns 29.6V
V6	Read MLVS internal -5.0V power supply	Returns -5.1V
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	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	+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 - 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	-60
R34	Harmonics Spec., in dBc	-12
R35	Phase Noise Spec. @ 100 Hz Offset, in dBc/Hz	-84
R36	Phase Noise Spec. @ 1 kHz 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. @ 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
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	User defined default 1 - Mode Settings	
R302	User defined default 2 - Frequency setting	
R303	User defined default 2 - Mode Settings	

SCPI and Binary Commands

Power

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

(*) This command takes about 1500mS

Reset

Description	SCPI Cmd.	Binary Cmd.	Result
Reset Frequency	*RST (*)	0E	10GHz , Int. Ref. Source , triggering disabled

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

Frequency

Description	SCPI Cmd.	Binary Cmd.	SCPI Param.	Binary param.	Binary data bytes	Command / Results Examples
Set Frequency (*)	FREQ	0C	GHz, MHz, kHz, Hz, mlHz	mlHz	6	FREQ 1.2GHz

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

Binary Example: Set Output Frequency to 12.123456789123GHz

1. Convert to mlHz 12123456789123
2. Convert to 6 bytes Hex format 0B06B655DA83
3. Append & Send Command 0C0B06B655DA83

Binary Example: Get Output Frequency 12123456789123mlHz

1. Send command: 04
2. Use the received last 6 bytes: 0B06B655DA83
3. Convert from hex to decimal 12123456789123mlHz

Configuration

Description	SCPI Cmd.	Binary Cmd.	SCPI Param.	Binary Param.	Binary data bytes	Command / Results Examples
Set Ref. Source	ROSC:SOUR	06	INT/EXT	0/1	1	ROSC:SOUR EXT
Get Ref. Source	ROSC:SOUR?	07	INT/EXT	0/1	1	EXT
Set Internal Ref DAC Value	DIAG:CAL:REF:DAC	1B	0 TO 65535	0 TO FFFF	2	DIAG:CAL:REF:DAC 3000
Get Internal Ref DAC Value	DIAG:CAL:REF:DAC?	none	none	none	none	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 1st SPI return byte is always Don't Care
- Binary ASCII return always twice bytes of the HEX return
- 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 mlHz

Description	SCPI Cmd.	Binary Cmd.	Binary Return Data bytes	SCPI Return Example	Binary Return Example (*)
Get ID- 1.Module# 2.Options 3.Soft. Ver. 4. Serial#	*IDN?	01	11	 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?	02	01	 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?	04	06	12123456789123	0B06B655DA83
Get Ref. Source	ROSC:SOUR?	07	01	INT or EXT	00 or 01
Get Temp. (C)	DIAG:MEAS?	10	01	38.9	2E
List Points get Size	LIST:PVEC:SIZE?	N/A	N/A	LIST:PVEC:SIZE?	N/A
List Point get Freq.	LIST:PVEC: GET?	N/A	N/A	LIST:PVEC:GET? 15	N/A

(*) In binary mode, first receive byte is always Don't Care

Save / Erase

Description	SCPI Cmd.	Binary Cmd.	SCPI Param.	Binary Param.	Binary data bytes	Command Example
Save current state in Flash	*SAV	26	User Setting 1,2 (**)		1	*SAV 2
Restore current state from Flash	*RCL	27				*RCL 2 or *RCL 0 (***)
Save List Table to Flash (*4)	LIST:SAV (*5)	4B	none			none
Copy List from Flash to RAM on Request	LIST:COPY:REQ	4C				none
Automatically Copy List from Flash to RAM upon power up	LIST:COPY:AUTO	none				LIST:COPY:AUTO:YES/NO
Erase the entire List Table in RAM (*6)	LIST:ERAS	22				LIST:ERAS
Erase the entire List Table in FLASH, RAM and NOVO (*)	LIST:ERAS FLASH	23				LIST:ERAS FLASH

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

- Stops any Sweep
- Resets to 10GHz
- 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		Binary data bytes	Command Examples	
	SCPI	Binary	SCPI	Binary		SCPI	Binary
Run selected List Point	LIST:PVEC:RUN	14	1 to 32767 (Points)		2	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)	21	1 - 32767 times 0 – infinite times		2	LIST:STAR 5 SWE:FAST:FREQ:STAR 15 SWE:NORM:FREQ:STAR 0	210005 210015 210000
Stop List / Sweep	LIST:STOP or SWE:STOP	20	none			LIST:STOP or SWE:STOP	20
Send Sweep state request	SWE:BUSY?	none				SWE:BUSY?	none
Get Sweep state	SWE:BUSY:YES/NO	none				SWE:BUSY:YES	none

Sweep/List Setup

Description	SCPI Cmd.	Binary Cmd.	SCPI Param.	Binary Param.	Binary data bytes	Config. SCPI	Config. Binary	Command Example
List point setup RAM FLASH(*4)	LIST:PVEC (*11) (*12)	 4A 13	1. List point # (**1** to 32767) 2. Freq (*) 3. 0 (Reserved) 4. **List Dwell Time** (*3) 5. Pulse Mod-N/A (*7) 6. RF Output-N/A (*8) 7. Save to Flash-N/A (*9)		2 6 2 4	None		LIST:PVEC 1,3GHz,0,1s 4A0001 0B06B655DA83 0000 1A000000
List setup and Run	LIST:SETUP (List Setup & run)	15	1. Config. Parameters		4+2+1	**1. Point Dwell time**(*3) (*10) **2. Times to run:** 1 to 32767 0 – infinite **3. Trigger:** (**) [xxxx00xx] 0–SW Full, 1–HW Full, 2–HW Point, 3-SW Point **4. Direction** (**) [xxxxxx00] 0–Up, 1–Down, 2–Up & Down 3- Down & Up **5. Run Option:(**only SCPI) R – run (Optional) (Run in Binary is by default)		LIST:SETUP 2s,0,2,2,R
Fast Sweep and run (*5)	SWE:FAST:FREQ:SETUP (Fast Sweep Setup)	17	1. Start Freq (*) 2. Stop Freq (*) 3. Number of Points (1 to 32767) 4. 0 (Reserved) 5. Config. Param.		6 6 2 2 4+2+1			SWE:FAST:FREQ:SETUP 2GHz,10GHz,100,0,1s,10,0,0,R
Normal Sweep and Run (*6)	SWE:NORM:FREQ:SETUP (Normal Sweep Setup)	1C	1. Start Freq (*) 2. Stop Freq (*) 3. Step Freq (*) 4. 0 (Reserved) 5. Config. Param.		6 6 6 2 4+2+1			SWE:NORM:FREQ:SETUP 2GHz,8GHz,1G Hz,0,5ms, 200,2,2,R

(*) GHz, MHz, KHz, Hz, mlHz, in Binary all units are in mlHz
(**) In Binary mode, **Trigger and Direction** are 1 byte**, Trigger** location is in bits [03:02], **Direction** location is in bits [01:00]
(*3) us, ms, s (default us) , in Binary dwell time is in 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	5000000000000	8000000000000	30	0	3000000	2	Yes	Up
Binary	048C27395000	0746A5288000	001E	0000	002DC6C0	0002	4	4

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 1st Frequency: 21
Continue sending 21 commands for each next Frequency Point