MICRO LAMBDA WIRELESS, INC.

MLAT SERIES
PROGRAMABLE ATTENUATORS
10 MHz - 21 GHz

FEATURES

- > 30 dB Attenuator Range
- 0.5 dB Step Size
- Optional Level Flatness Correction
- Optional Internal Amplifier
- SPI & USB Control

APPLICATIONS

Test Equipment

DESCRIPTION

The **MLAT-Series** of Programable Attenuators are general purpose single channel programable attenuators suitable for a wide range of applications. They provide 0 to 30 dB attenuation in 0.5 dB steps over the 10 MHz to 21 GHz frequency range. The attenuator is housed in a compact package with SMA Female RF Connectors. A standard 10 pin and a USB Micro B are provided for power and control ports. The attenuator can be controlled via USB or SPI. Full software support is provided in the user manual and can be downloaded from our web site. Optional temperature ranges are available on special order.

Model No. **MLAT-1000A**

RF Specifications

Option A

Parameter	Frequency Range	Condition	Min.	Typ.	Max.	Units
Operating Frequency	-	-	0.01	0.01 - 26.5	21.0	GHz
Nominal Impedance	0.01 - 21.0 GHz	-	-	50.0	-	Ohms
Attenuation Range	0.01 - 21.0 GHz	0.5 dB Steps	0	-	31.5	dB
Insertion Loss	.01 - 8 GHz	@ 0 dB	-	2.8	3.3	dB
	8 - 15 GHz		-	4.9	5.4	
	15 - 21.0 GHz		-	6.5	7.0	
VSWR (All Ports)	.01 - 8 GHz	0 - 31.5 dB	-	1.4:1	1.7:1	
	8 - 15 GHz		-	1.7:1	2.0:1	
	15 - 21.0 GHz		-	1.9:1	2.1:1	
Attenuation Accuracy [1]	.01 - 8 GHz	0 - 31.5 dB	-		+/-(0.5 + 1.5% of State)	dB
	8 - 15 GHz		-		+/-(0.75 + 2.5% of State)	
	15 - 21.0 GHz		-		+/-(1.0 + 3.0% of State)	
Monoticity	-	-	-	0.01 - 21.0	-	GHz
J1 (RF Input Power, CW) [3]	0.01 - 21.0 GHz	0 - 31.5 dB	-	-	28	dBm
J2 (RF Output Power, CW) [3]	0.01 - 21.0 GHz	0 - 31.5 dB	-	-	19	dBm
Input IP3 [2]	-	0 - 31.5 dB	-	50	-	dBm
Switching Time [4]	0.01 - 21.0 GHz		-	20		us
Supply Voltage (VDC)	-	J1, 10 Pin SPI	4.0	5.0	6.0	Volts
		J2, USB	4.0	5.0	6.0	
Supply Current	-	-	-	50.0		mA
Digital Control Logic	-	-	-	2.7, 3.3, and 5V Logic	-	N/A
Operating Temperature	0.01 - 21.0 GHz	-	-0	-	50	°C
Storage Temperature	-	-	-55	-	105	°C

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Notes:

1. Referenced to insertion loss @ 0 dB. % = % of attenuator setting. i.e. 25 dB setting @ 15 GHz = +/-(0.75 + 0.025 * 25) = +/-1.375 dB accuracy.
2. Two-tone input power = 14 dBm per tone, Δf = 1 MHz, all attenuation states.
3. RF Input and RF output are DC blocked, Input and output are NOT bidirectional.
4. SPI and USB communication times are excluded. Measured @ RF, 10%/90%.

Option D: Level Flatness Correction—User Initiated

Parameter	Frequency Range	Condition	Min.	Typ.	Max.	Units
Operating Frequency	-	-	0.01	0.01 - 26.5	21.0	GHz
Calibration Range [1]	0.01 - 21.0 GHz	0.5 dB Steps	0	-	31.5	dB
Added Insertion Loss	.01 - 8 GHz	@ 0 dB	-	1.6	1.8	dB
	8 - 15 GHz		-	2.1	2.3	
	15 - 21.0 GHz		-	2.7	2.9	

See MLAT general specifications for all other product specs.

Notes:

1. Before calibration, all attenuation and calibration settings should be set to 0.0 dB.

Option D description:

This option adds a user initiated level flatness correction that is stored in nonvolatile memory. The frequency range, and step size can be defined, in MHz, and stored in nonvolatile memory. FA = start frequency, FB = end frequency, and FC = correction frequency increment (i.e. FA2000, FB8000, FC50). The source Cal level point SCL command, "SCL0.0" stores, in memory the RF output level that you would like to calibrate at. (i.e. 0.0 dBm). Note: The RF output of the attenuator, with all attenuation and correction set to minimum, must be greater than the SCL level setting, across the FA to FB range. Setting your signal source to FA, then measuring the RF output power of the attenuator, send (decrement) the LC command (LC-0.5) until the measured RF output reaches the desired "SCL" level, +/- 0.5 dB. Send the SC0 command to store the first calibration point (i.e. last LC setting sent LC-2.5 = 2000 MHz @ 0.0 dBm) into Cal memory location 0 (which would now read back as -2.5). Now increment the signal source frequency by FC (50 MHz), repeat the LC routine until SCL is reached, send SC1 command to store 2050 MHz @ 0.0 dBm. Repeat until FB is reached. The correction mode can be enabled / disabled via the C1 / C0 commands. With calibration complete, enable correction "C1". Send the signal source to 2000 MHz. Send the attenuator the frequency command F2000. The attenuator will pull the 2000 MHz correction data from nonvolatile memory, and set the RF output to be 0.0 dBm, +/-0.5 dB. You can now set the attenuator, attenuation level to any setting in the attenuators range (i.e. L-45.5). The RF level accuracy will be relative to the 0.0 dB Cal point insertion loss (-45.5 dBm, +/-0.5 dB). If you set the signal source frequency to a new frequency, set the attenuator frequency to the same number, and the attenuator will output the frequency / level corrected attenuation level setting. You can read the calibration table starting at memory location 500 (FA) to 2000 (FB). Read memory command = R500, 0 data = no correction, valid correction = a negative number between 0 an -31.5, in 0.5 increments. Please note: There are only 1500 memory locations to store data, for a full frequency range calibration, keep FC >= 25.0 MHz. If your signal source has abrupt RF power frequency band changes, select an FC increment that will match the frequency band changes. If the signal source is substituted, a new calibration run will be required.

Option E:

Parameter	Frequency Range	Condition	Min.	Typ.	Max.	Units
Operating Frequency	-	-	0.01	0.01 - 23.0	22	GHz
Gain			10	15		dB
Noise Figure				2.5	6	dB
P1 dB			14	17		dB
Psat			19	21		dBm
IP3				26		dBm
Additional Module Current				200	225	mA
Gain Temperature Coefficient				0.008		dB/°C
NF Temperature Coefficient				0.009		dB/°C

See MLAT general specifications for all other product specs.

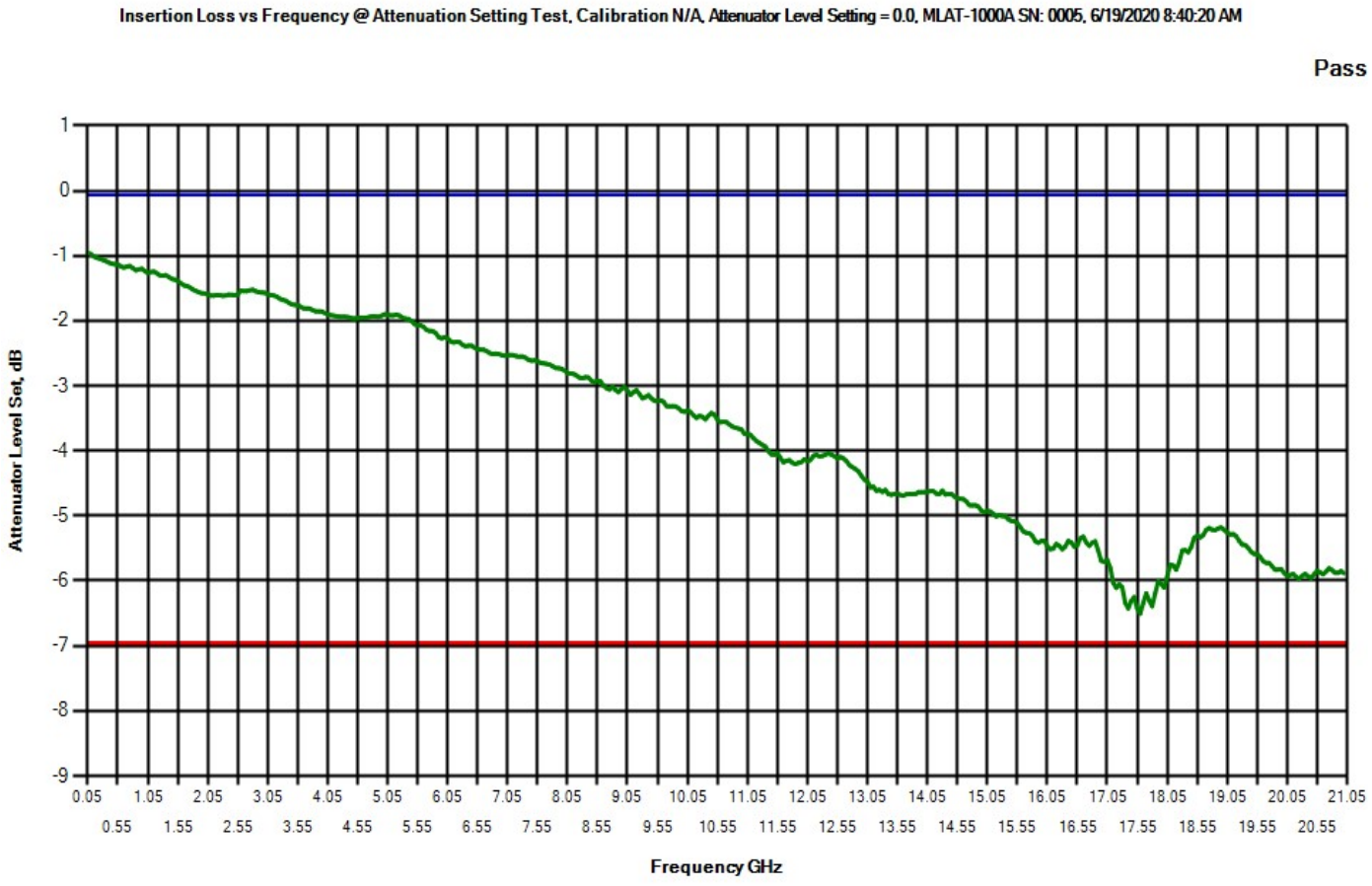
Notes:

1. Insertion loss of the optioned attenuator must be subtracted for correct gain numbers.
2. This option is available with options A and D.

Option E description:

This option adds an internal 10.0 to 22.0 GHz GaAs MMIC RF amplifier to the attenuators RF output port. This will eliminate the insertion loss associated with the attenuators RF path. This will lead to some gain from the attenuator, at the expense of frequency range, noise figure, harmonics, and increased power consumption.

Typical Performance Curves:

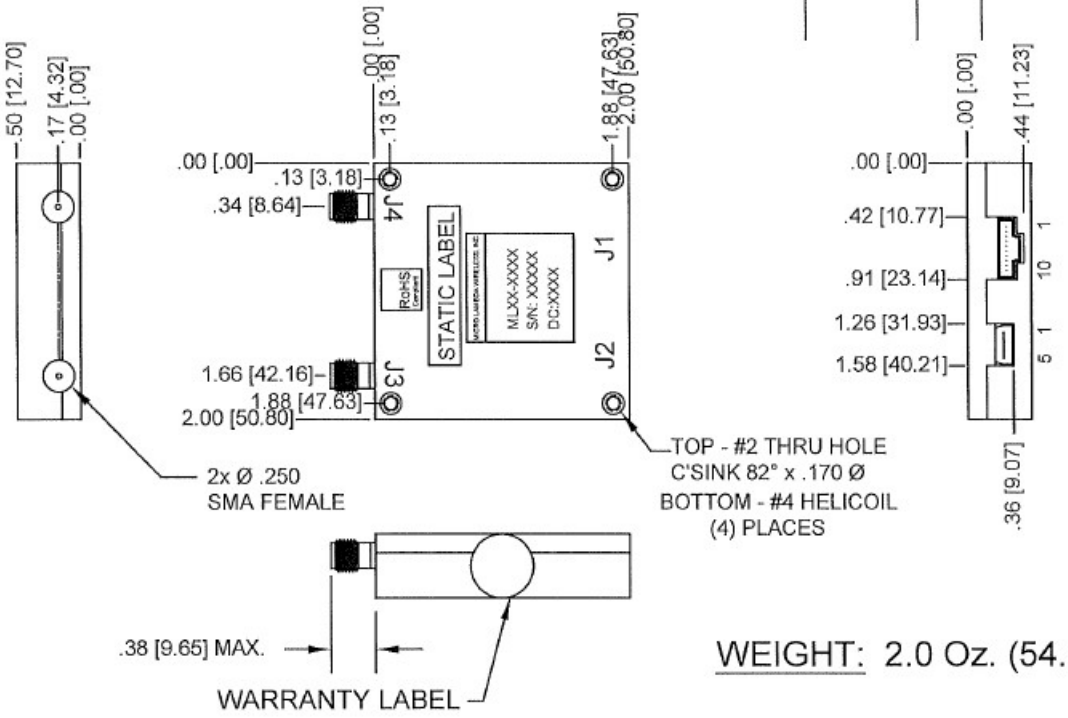


MLAT Attenuator Range Test
MLAT-1000A SN: 0005
Calibration = N/A
6/19/2020 10:11:39 AM

50.0	0.0 4.9	9.9	14.8	19.7	24.7	29.6	31.0	Pass
1000.0	0.0 5.0	10.0	14.9	19.9	24.8	29.8	31.2	Pass
1500.0	0.0 5.0	10.0	14.9	19.9	24.8	29.8	31.2	Pass
2000.0	0.0 5.0	10.0	14.9	19.9	24.8	29.8	31.2	Pass
2500.0	0.0 5.0	10.0	14.9	19.9	24.8	29.8	31.2	Pass
3000.0	0.0 5.0	10.1	15.0	20.0	25.0	30.0	31.4	Pass
3500.0	0.0 5.0	10.0	14.9	19.9	24.9	29.9	31.3	Pass
4000.0	0.0 4.9	9.9	14.8	19.8	24.8	29.8	31.2	Pass
4500.0	0.0 4.9	9.9	14.8	19.8	24.8	29.8	31.2	Pass
5000.0	0.0 4.9	10.0	14.9	19.9	24.9	29.9	31.4	Pass
5500.0	0.0 5.0	10.0	14.9	20.0	24.9	30.0	31.4	Pass
6000.0	0.0 4.8	9.8	14.8	19.8	24.8	29.8	31.2	Pass
6500.0	0.0 4.9	9.9	14.8	19.8	24.7	29.8	31.2	Pass
7000.0	0.0 4.9	9.9	14.8	19.8	24.8	29.9	31.4	Pass
7500.0	0.0 4.9	9.9	14.8	19.8	24.8	30.0	31.4	Pass
8000.0	0.0 4.9	9.9	14.8	19.9	24.9	30.0	31.4	Pass
8500.0	0.0 4.9	9.9	14.8	19.8	24.8	30.0	31.4	Pass
9000.0	0.0 4.9	10.0	14.9	20.0	25.0	30.1	31.5	Pass
9500.0	0.0 4.9	9.9	14.8	19.9	24.9	30.0	31.4	Pass
10000.0	0.0 4.9	9.9	14.8	19.9	24.9	30.0	31.4	Pass
10500.0	0.0 4.9	9.9	14.8	19.9	24.9	30.0	31.4	Pass
11000.0	0.0 4.9	9.9	14.8	19.9	24.9	30.0	31.4	Pass
11500.0	0.0 4.8	9.8	14.6	19.7	24.7	29.8	31.2	Pass
12000.0	0.0 4.8	9.8	14.6	19.7	24.7	29.8	31.2	Pass
12500.0	0.0 4.9	10.0	14.9	20.0	24.9	30.1	31.4	Pass
13000.0	0.0 4.9	9.9	14.9	20.0	24.9	30.1	31.5	Pass
13500.0	0.0 4.8	9.8	14.7	19.8	24.7	29.9	31.3	Pass
14000.0	0.0 4.9	10.0	14.9	20.0	25.0	30.2	31.7	Pass
14500.0	0.0 4.9	10.0	14.9	20.0	25.0	30.3	31.7	Pass
15000.0	0.0 4.9	10.0	14.9	20.0	25.0	30.2	31.6	Pass
15500.0	0.0 4.9	9.9	14.8	19.9	24.8	30.0	31.4	Pass
16000.0	0.0 4.8	9.7	14.6	19.6	24.6	29.7	31.1	Pass
16500.0	0.0 4.9	9.8	14.7	19.7	24.7	29.8	31.1	Pass
17000.0	0.0 4.7	9.5	14.4	19.4	24.2	29.4	30.7	Pass
17500.0	0.0 4.5	9.4	14.1	19.1	23.9	29.0	30.3	Pass
18000.0	0.0 4.6	9.7	14.4	19.4	24.2	29.3	30.6	Pass
18500.0	0.0 5.0	10.2	15.0	20.1	24.9	30.0	31.3	Pass
19000.0	0.0 4.9	10.0	14.9	19.9	24.8	29.9	31.2	Pass
19500.0	0.0 4.9	10.0	14.8	19.9	24.8	29.9	31.2	Pass
20000.0	0.0 4.8	10.0	14.8	19.8	24.7	29.8	31.1	Pass
20500.0	0.0 4.8	10.0	14.7	19.8	24.6	29.7	31.0	Pass
21000.0	0.0 4.8	9.9	14.7	19.8	24.6	29.8	31.1	Pass

6/19/2020 10:32:16 AM
Number of failures = 0
Test Status = Pass

REV	DESCRIPTIONS	DATE	APP'D	NOTES
-	PRELIMINARY DRAWING #	11/21/19	DS	
A	INITIAL RELEASE	8/18/2020		



WEIGHT: 2.0 Oz. (54.0 g.)

J1

POWER / SPI INTERFACE

PIN	FUNCTION
1	MOSI - DATA IN
2	MISO - DATA OUT
3	CLOCK - SERIAL CLOCK
4	SS - SLAVE SELECT (*)
5	GROUND - LOGIC
6	N/C
7	N/C
8	N/C
9	+ 5V (IF NO USB CONN.)
10	GROUND

J2

USB INTERFACE (MICRO-B)

PIN	FUNCTION
1	+ V (+ 5V)
2	D -
3	D +
4	GROUND
5	GROUND

J3: RF INPUT, SMA FEMALE
J4: RF OUTPUT, SMA FEMALE

NOTES:

1. J1 MALE: MOLEX# 5015681007
2. J1 MATES WITH FEMALE: MOLEX# 5013301000
3. CRIMP PIN: MOLEX#5013340000
4. J1 POWER SUPPLY INPUTS NOT REQUIRED FOR USB OPERATION.
5. SMA ENGAGE/DISENGAGE TORQUE: 2 INCH-POUNDS MAX.
6. SMA MATING TORQUE (ROTATIONAL): 8 INCH POUNDS MAX.
7. SMA CONTACT RETENTION: 6 LBS. MIN. AXIAL FORCE ON MATING END. 4 IN-OZ MIN. RADIAL TORQUE.
8. (*) ACTIVE LOW

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCE ARE :
FRACTIONS ± DECIMALS .xx ±.02 [.51] .xxx ±.010 [.254] ANGLES ±

MATERIAL: ALUMINUM

FINISH: NICKEL

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS		DATE
DRAWN	N.NGUYEN	02/03/2021
CHECKED	DS	2/3/21
ISSUED		

MICRO LAMBDA WIRELESS, INC.

MLAT ATTENUATOR 2" X 2" X 0.5"

SIZE	CAGE No	DWG. NO.	REV.
	0RN63	99 - 0221 - 001	A