



## **ERASynth Micro: USB-Powered, Low-Priced, Open Source, RF Signal Generator**

# **DATASHEET**



## GENERAL DESCRIPTION

ERASynth Micro is an open source analog RF signal generator featuring an Arduino Micro micro-controller and a touch display. ERASynth Micro uses advanced PLL/VCO technology, coupled with an internal ultra-low phase noise frequency reference to form a programmable analog signal generator capable of generating a low phase noise signals up to 6.4 GHz. ERASynth Micro provides fast frequency switching and fine-tuning resolution using a dual loop PLL architecture. ERASynth Micro also offers frequency, amplitude and pulse modulation capabilities. The frequency tuning and control commands are loaded into the instrument via the serial interface or via Touch Display or Windows GUI.



## FEATURES

**Architecture:** Dual loop Fractional-N PLL driven by a 10 MHz reference.

**Frequency Range:** 12.5 MHz to 6.4 GHz

**Amplitude Range:** -50 to +15 dBm

**Phase Noise:** -115 dBc/Hz @ 1 GHz output and 10 kHz offset

**Frequency Switching Time:** <1ms

**Reference:** Ultra-low noise 50 MHz VCXO locked to a  $\pm 500$  ppb TCXO

**MCU:** ATMEGA32U4-MU (same as in the Arduino Micro board)

### Interfaces:

- Touch Display Module (3.2" Nextion NX4024T032)
- Micro-USB for power input and serial access
- REF IN (SMA) for external reference input
- REF Out (SMA) for 10 MHz reference output
- RF Out (SMA)
- Expansion connector: External trigger input, external modulation input, microphone input, GPIO (I2C) and SPI

**Dimensions:** 57 cm x 118 cm x 23 cm

**Weight:** 120g

**Power Input:** 5V

**Power Consumption:** 2W

**Enclosure:** Injection molded plastic case

**Open Source:** Schematics, embedded Arduino code, LCD screen source code and RS-232 command set

**Modulation:** AM, FM, Pulse (Internal and external)

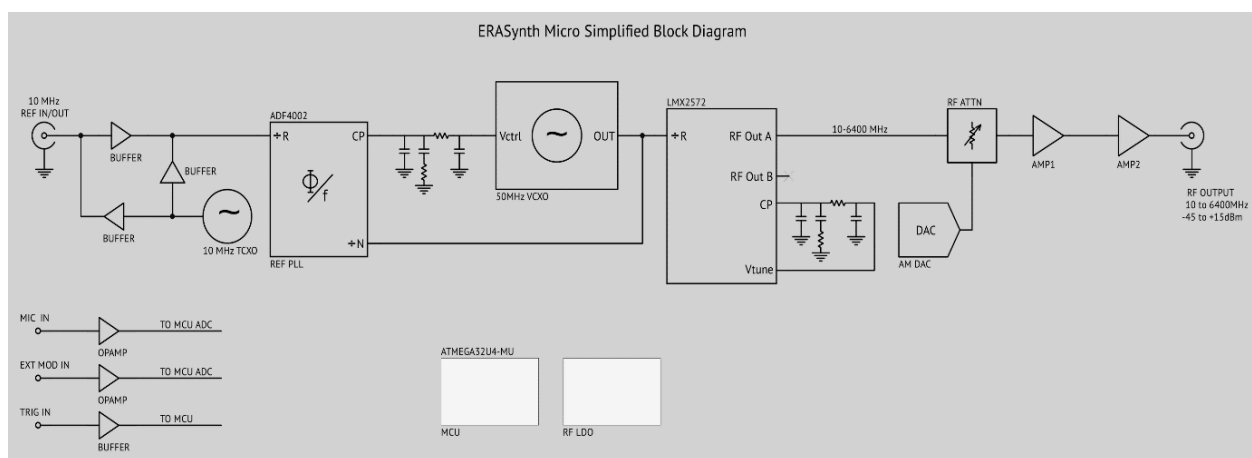


Figure 1: ERASynth Micro general block diagram

## ELECTRICAL CHARACTERISTICS

	Minimum	Typical	Maximum
<b>Supply Voltage</b>	4.5 V	5 V	5.2 V
<b>Supply Current</b>		400 mA	
<b>Supply Current, RF Out Muted</b>		200 mA	
<b>Minimum Output Power</b>		-50 dBm	
<b>Maximum Output Power</b>		15 dBm	
<b>Output Level Accuracy</b>		± 1.5 dB	
<b>Output Power Resolution</b>		1 dB	
<b>Frequency Resolution</b>	1 Hz		
<b>Frequency Accuracy</b>		±500 ppb	
<b>Minimum Dwell Time*</b>	1 ms		
<b>External Reference Input Level</b>	-10 dBm	0 dBm	+10 dBm
<b>External Reference Locking Range</b>		10 MHz ± 30 ppm	
<b>External Trigger Low Level Input Voltage</b>	0 V		0.7 V
<b>External Trigger High Level Input Voltage</b>	2 V		3.3 V
<b>External Modulation Input Voltage Level</b>			± 2.5 V
<b>RF Output Impedance</b>		50 Ohm	

\* Dwell time: Duration of each signal point in a sweep sequence set by user.

## THERMAL CHARACTERISTICS

**Operating temperature range:** 0 to +50 °C

**Non-operating temperature range:** -40 to +85 °C

**Warm-up time:** 10 minutes

## EXPANSION CONNECTOR PINOUT

Description	Type	Row1	Row2	Type	Description
Master Input Slave Output	Input/Output	MISO	5V	Output	Filtered 5V Output
Clock	Input/Output	CLK	MOSI	Input/Output	Master Output Slave Input
Reset	Input/Output	RST	GND	Power	Ground
Ground	Power	GND	IO2	Input/Output	General Purpose IO2
Ground	Power	GND	VIN	Input	Voltage Input (5V typ.)
Ground	Power	GND	MOD	Input	Ext. Modulation Input
Ground	Power	GND	MIC	Input	Microphone (Electret) Input
Ground	Power	GND	TRIG	Input	Trigger Input (Sweep&Pulse)
Ground	Power	GND	3V3	Output	Regulated 3V3 Output
Ground	Power	GND	IO1	Input/Output	General Purpose IO1

## TYPICAL PERFORMANCE

### 1) Output Power

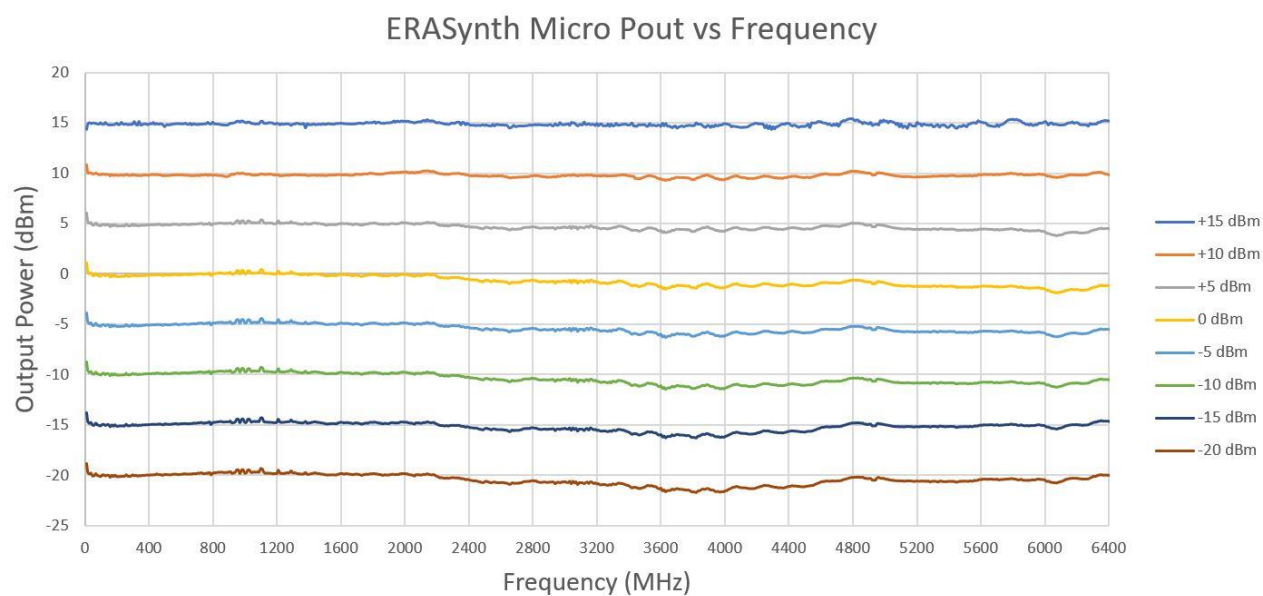


Figure 2: ERASynth Micro Power Output vs Frequency

## 2) Spectral Purity

### Broadband Non-Harmonic Spurious Emissions

Frequency	dBc (typical) at 0 dBm specified output power
12.5 MHz – 6.4 GHz	-48 dBc

### Harmonics (2nd or 3rd harmonics, whichever is worse)

Frequency	dBc (typical) at 0 dBm specified output power
100 MHz	-13 dBc
1 GHz	-16 dBc
2 GHz	-26 dBc
3 GHz	-36 dBc
6 GHz	-43 dBc

### Sub-Harmonics (1/2 or 1/3 harmonics, whichever is worse)

Frequency	dBc (typical) at 0 dBm specified output power
30 MHz	-86 dBc
100 MHz	-67 dBc
1 GHz	-59 dBc
3 GHz	-70 dBc
6 GHz	-68 dBc



### 3) Phase Noise

Frequency Offset (@ 1GHz output)	dBc (typical)
100 Hz	-74 dBc/Hz
1 kHz	-105 dBc/Hz
10 kHz	-123 dBc/Hz
100 kHz	-128 dBc/Hz
1 MHz	-142 dBc/Hz
10 MHz	-143 dBc/Hz
100 MHz	-143 dBc/Hz

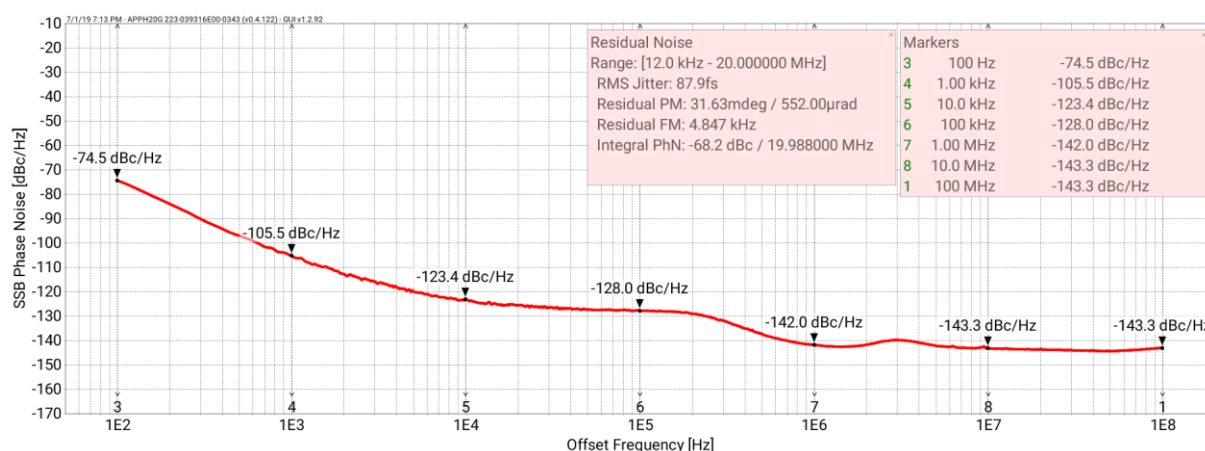


Figure 3: Phase Noise @ 1GHz output

## 4) Modulation

### Amplitude Modulation (AM)

Modulation Depth	28 dB (typ) (*)
Maximum Depth (Linear)	99%
Depth resolution	1%
Internal Modulation Waveforms	Sine, Triangle, Ramp, Square
Maximum Internal Modulation Frequency	15 kHz (typ)
Maximum External Modulation Frequency	20 kHz (typ)
External Input (MOD Input)	$\pm 2.5$ V (typ)
External Input (MOD Input) Impedance	10 k $\Omega$ (typ)
*Measured with power set at max. amplitude range. AM is clipped when available power (min. or max.) is reached.	

### Frequency Modulation (FM)

Maximum Deviation	12.5~25 MHz	10 kHz
	25~50 MHz	25 kHz
	50~100 MHz	50 kHz
	100~200 MHz	100 kHz
	200~400 MHz	200 kHz
	400~800 MHz	400 kHz
	800~1600 MHz	800 kHz
	1600~3200 MHz	1600 kHz
	3200~6400 MHz	3200 kHz
Internal Modulation Waveforms	Sine, Triangle, Ramp, Square	
Maximum Internal Modulation Frequency	15 kHz (typ)	
Maximum External Modulation Frequency	20 kHz (typ)	
External Input (MOD Input)	$\pm 2.5$ V (typ)	
External Input (MOD Input) Impedance	10 k $\Omega$ (typ)	

**Pulse Modulation**

On/Off Ratio	100 MHz	49 dB (typ)
	1 GHz	50 dB (typ)
	3 GHz	57 dB (typ)
	6 GHz	48 dB (typ)
Minimum Pulse Width	50 $\mu$ s (typ)	
Minimum Pulse Period	100 $\mu$ s (typ)	
Maximum Pulse Period	999 s	
Rise Time (10 to 90%)	15 $\mu$ s (typ)	
Fall Time (10 to 90%)	5 $\mu$ s (typ)	
External Input (TRIG Input)	+3.3 V = RF ON, 0 V = RF OFF	
External Input (TRIG Input) Impedance	5 k $\Omega$ (typ)	