LTC5596
Linduino Shield 100MHz to 40 GHz RMS Power Detector

DESCRIPTION

Demonstration circuit DC2870A is a Linduino® shield for Mean-Squared Power Detector LTC®5596. It is set up for quick evaluation of RMS RF power measurement using the Arduino/Linduino compatible platform and software download available here. When connected to PC with USB cable, accurate power level can be monitored using the graphic user interface.

The LTC5596 is a wide dynamic range linear-in-dB Mean Squared RF Power Detector, operational from 100MHz to 40GHz. The Linduino (DC2026C) platform provides 10-bit ADC at 4.9mV/LSB resolution with 5V default reference voltage. Input dynamic range with 1dB accuracy is up to 35dB depending on frequency. The detector output slope is normally 6 LSB/dB. The DC2870A Demo Circuit is optimized for wide operational frequency signals up to 40GHz using the 2.9mm SMK edge mount connector. Input impedance is internally matched to 50Ω. It is suitable for RMS measurements of high crest factor waveforms up to 12dB peak-to-average. No external coupling capacitor is necessary if DC voltage at RF_{IN} pin is kept below 1.0V. On board 3.3V regulator provides power to the shield by jumper JP1. Contact applications support for more information.

Design files for this circuit board are available.

ABSOLUTE MAXIMUM INPUT RATINGS

(Note 1)

Supply Voltage(V_{CC}):	+3.8V
DC Voltage at RF_{IN}:	–0.3V to 1.0V
DC Voltage at FLTR:	–0.3V to 0.4V
DC Voltage at EN:	–0.3V to 3.8V
RF_{IN} Input Power-Average:	+15dBm
T_{JMAX}	150°C
Case Operating Temperature Range	–40°C to 105°C
Storage Temperature Range	–65°C to 150°C

Note 1: Voltage on all pins must not exceed V_{CC} + 0.3V or be less than –0.3V.

CAUTION: This part is sensitive to electrostatic discharge (ESD). Observe proper ESD precautions when handling the LTC5596.

TEST SETUP

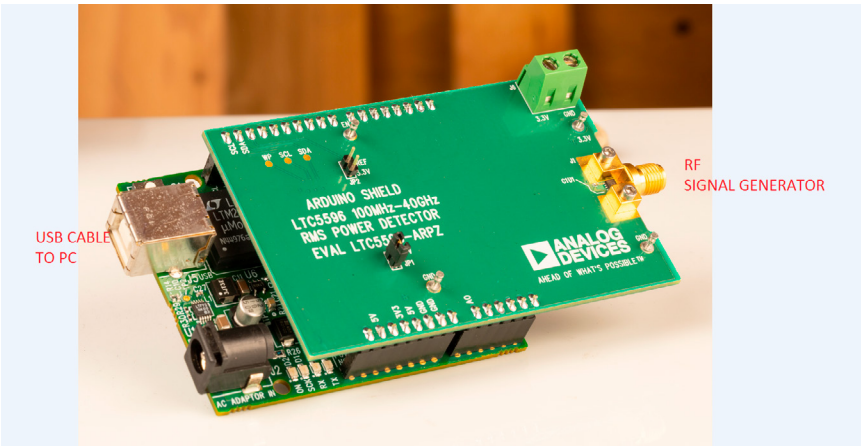


Figure 1. Test Setup for RF Performance Measurements

NOTES ON TEST EQUIPMENT AND SETUP

- Use a high performance signal generator with accurate output power levels up to 40GHz, such as Rohde Schwarz SMF100A.
- Demo Board DC2870A includes the SMK 2.9mm connector for best performance up to 40GHz.
- Connecting cable for RF signal should be rated up to 40GHz for the best performance.
- Optional input attenuation can be used to improve return loss, but also shifts the log intercept point accordingly.

QUICK START PROCEDURE

1. Remove the DC2870A from its protective packaging in an ESD-safe working area, connect USB cable to PC(see Figure 1).
2. Set JP1 which provides the 3.3V to V_{CC} by the on board regulator.
3. Go to www.analog.com, download and install QuikEval if it's not yet installed.
4. The Eval Kit comes with a Linduino board pre-loaded with firmware. Follow Figure 2 to re-load the firmware if necessary, which can be downloaded from www.analog.com.
5. Download LTC5596 GUI, and install all necessary drivers onto PC from the LTC5596 product page. Follow instruction from QuikEval which will automatically download the GUI.
6. Connect USB cable from PC to Linduino board. Connect the RF input to the signal generator at the 2.92mm connector
7. Set the frequency and power level (less than +10dBm) of the signal generator.
8. Open LTC5596 GUI, and set the frequency of signal to be measured. Push "READ" to measure RF power. Using the default calibration would be loading the nominal slope and intercept from LTC5596 data sheet values. See Figure 3.
9. For higher accuracy, Calibration can be performed using the GUI at various frequency with two point calibration. Set input power level to the corresponding calibration points on the GUI, and calibrate accordingly by clicking the corresponding button.
10. Read RF power using the GUI.

DEMO BOARD USAGE NOTES

1. Demo Board DC2870A has provisions for inter-stage filter cap. Additional capacitor (C3) can be added to slow down the transient response to reduce the output ripple. The range for C3 is 10pF to 1nF.
2. Output power is calculated using slope and intercept.
3. ADC count • 4.9mV/slope + intercept = output power. Slope is derived from two point calibration in the linear region of transfer function.
4. A minimum two point calibration is necessary for most applications. Additional calibration points will improve the accuracy of the power detection.

DEMO BOARD USAGE NOTES

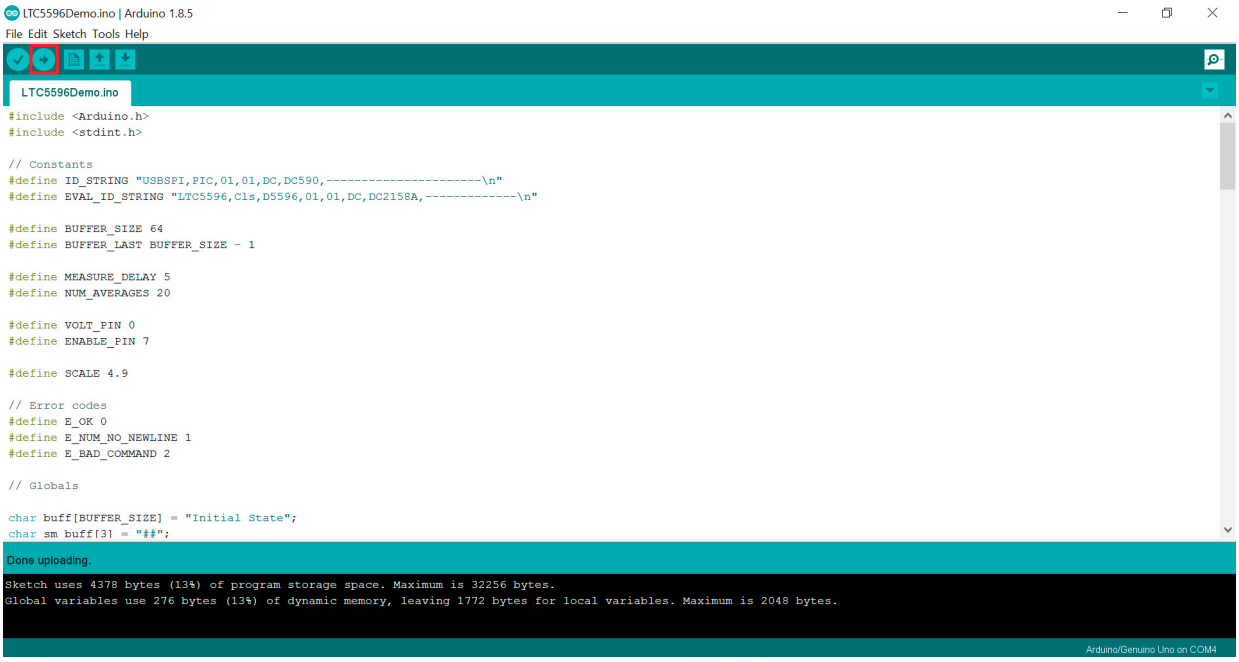


Figure 2. Firmware Re-Load (Only If Necessary)

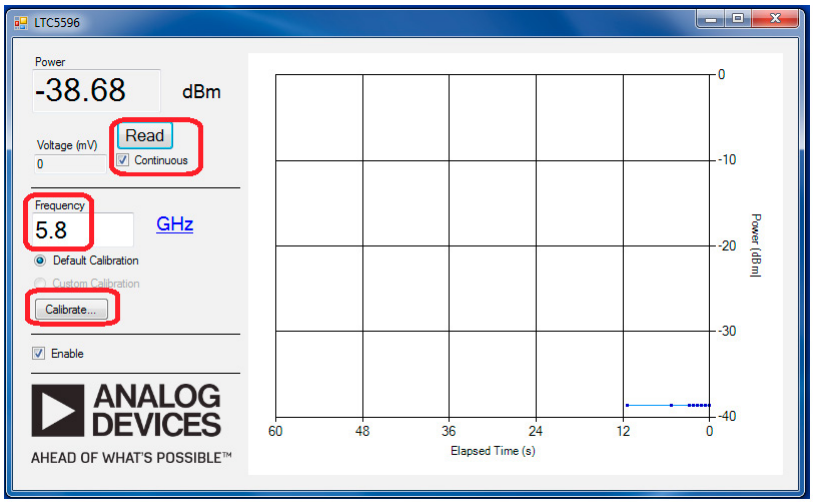


Figure 3. GUI

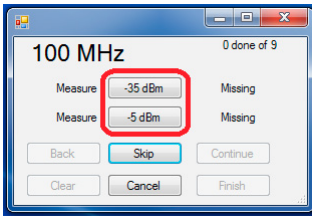
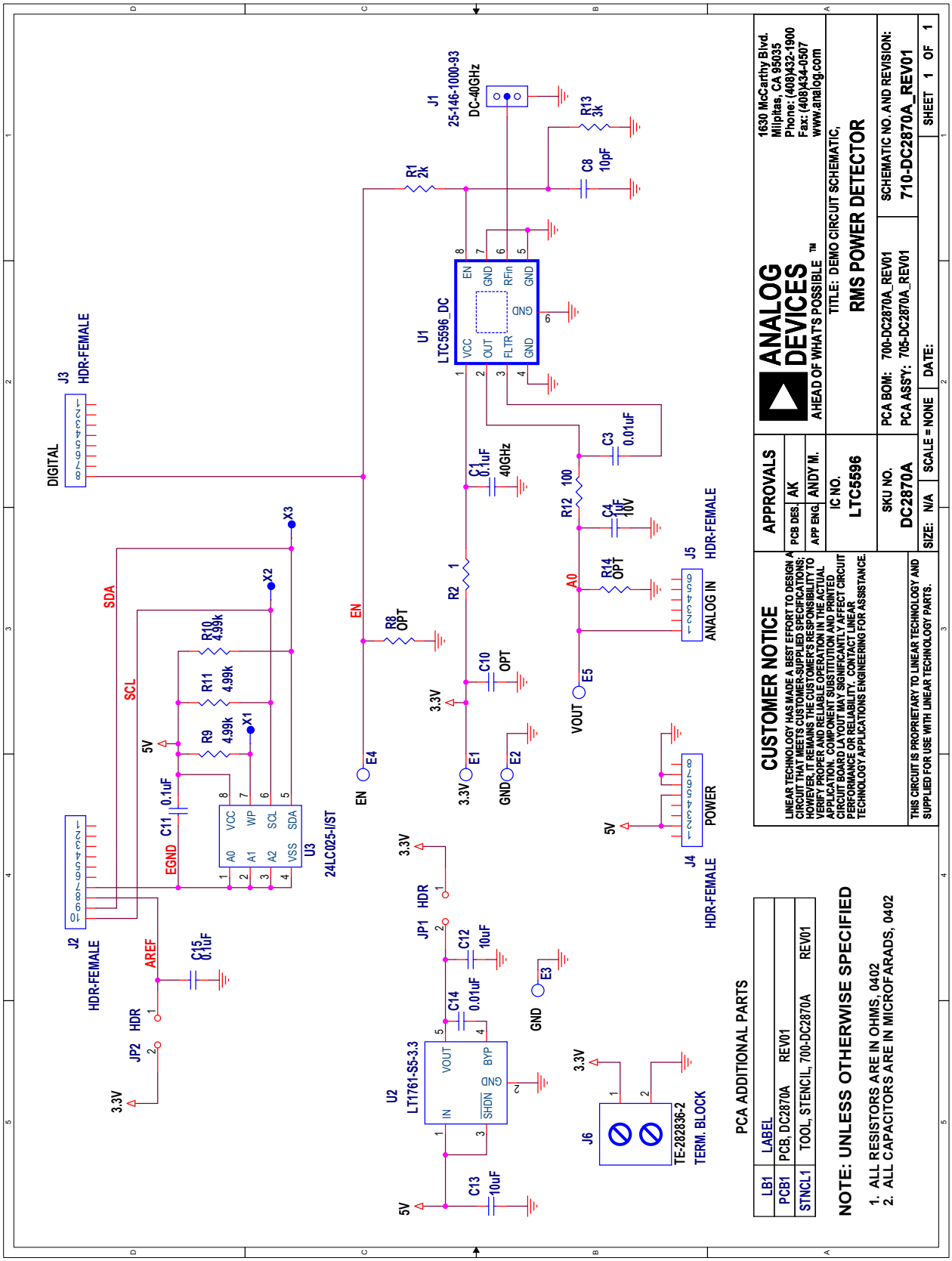


Figure 4. Calibration

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., CX Series, (16kHz to 40GHz), 0.1µF, YD, 16V, 10%, 0402	AVX, CX02YD104KAT2
2	2	C3, C14	CAP., 0.01µF, X7R, 16V, 10%, 0402	MURATA, GRM155R71C103KA01D NIC, NMC0402X7R103K16TRPF
3	1	C4	CAP., 1µF, X5R, 10V, 10%, 0402	MURATA, GRM155R61A105KE15D AVX, 0402ZD105KAT2 TDK, C1005X5R1A105K050BB
4	1	C8	CAP., 10pF, NP0, 50V, 10%, 0402	AVX, 04025A100KAT2A
5	0	C10	CAP., OPTION, 0402	
6	2	C11, C15	CAP., 0.1µF, X7R, 16V, 10%, 0402	AVX, 0402YC104KAT2A Taiyo Yuden, EMK105B7104KV-F TDK, C1005X7R1C104K050BC
7	2	C12, C13	CAP CER 10UF 6.3V X5R 0402	TDK Corporation, C1005X5R0J106M050BC
8	5	E1, E2, E3, E4, E5	TEST POINT, TURRET, 0.064", MTG. HOLE	MILL-MAX, 2308-2-00-80-00-00-07-0
9	1	J1	CONN., SMA, 2.9mm, JACK TO EDGE LUNCH, DC-40GHz	SRI CONNECTOR GAGE, 25-146-1000-93
10	1	J2	CONN., HDR, FEMALE, 1x10, 2.54mm, THT, STR	SULLINS CONNECTOR SOLUTIONS, PPPC101LFBN-RC
11	2	J3, J4	CONN., HDR, FEMALE, 1x8, 2.54mm, STR, THT	SULLINS CONNECTOR SOLUTIONS, PPPC081LFBN-RC
12	1	J5	CONN., HDR., FEMALE, 1x6, 2.54mm, THT, STR	SULLINS CONNECTOR SOLUTIONS, PPPC061LFBN-RC
13	1	J6	CONN., TERM. BLOCK, RCPT, 1x2, 5mm, SIDE ENTRY, THT	TE CONNECTIVITY, 282836-2
14	2	JP1, JP2	CONN., HDR, MALE, 1x2, 2mm, VERT, STR, THT, 10u" AU	SAMTEC, TMM-102-02-L-S
15	1	LB1	LABEL SPEC, DEMO BOARD SERIAL NUMBER	BRADY, THT-96-717-10
16	1	PCB1	PCB, DC2870A	ANALOG DEVICES INC., 600-DC2870A
17	1	R1	RES., AEC-Q200, 2k OHMS, 1%, 1/16W, 0402	VISHAY, CRCW04022K00FKED NIC, NRC04F2001TRF
18	1	R2	RES., 1 OHM, 1%, 1/16W, 0402	VISHAY, CRCW04021R00FKED
19	0	R8, R14	RES., OPTION, 0402	
20	3	R9, R10, R11	RES., 4.99k OHMS, 1%, 1/16W, 0402	NIC, NRC04F4991TRF VISHAY, CRCW04024K99FKED YAGEO, RC0402FR-074K99L
21	1	R12	RES., 100 OHMS, 1%, 1/16W, 0402	NIC, NRC04F1000TRF YAGEO, RC0402FR-07100RL
22	1	R13	RES., 3k OHMS, 5%, 1/16W, 0402	VISHAY, CRCW04023K00JNED
23	1	STNCL1	TOOL, STENCIL, 700-DC2870A	ANALOG DEVICES INC., 830-DC2870A
24	1	U1	IC, 100MHz to 40GHz Linear-in-dB RMS Power Detector with 35dB Dynamic Range	LINEAR TECH, LTC5596_DC#PBF
25	1	U2	IC, LOW NOISE, LDO MICROPOWER REG., TSOT23-5	LINEAR TECH., LT1761ES5-3.3#PBF LINEAR TECH., LT1761ES5-3.3#TRPBF
26	1	U3	IC, MEMORY, EEPROM, 2Kb (256x8), TSSOP-8, 400kHz	MICROCHIP, 24LC025-I/ST MICROCHIP, 24LC025T-I/ST

SCHEMATIC DIAGRAM



Rev. 0

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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