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Evaluating the ADRF6821 450 MHz to 2800 MHz, DPD RFIC with Integrated Fractional-N PLL and VCO

FEATURES

Full featured evaluation board for the ADRF6821
Single supply: 5.6 V
ACE software for control

EVALUATION KIT CONTENTS

ADRF6821-EVALZ evaluation board

EQUIPMENT NEEDED

SDP-S controller board
Analog signal sources
Power supply of 5.6 V (1 A capability required)
PC running Windows® XP or Windows
USB 2.0 port, recommended
Spectrum analyzer

SOFTWARE NEEDED

Analysis Control Evaluation (ACE)

DOCUMENTS NEEDED

ADRF6821 data sheet

GENERAL DESCRIPTION

The ADRF6821-EVALZ evaluates the performance of the ADRF6821. A functional block diagram and photograph of the evaluation board is shown in Figure 1. The evaluation board contains the ADRF6821, a connector suited for the SDP-S controller board, power supply connectors, regulators, and subminiature Version A (SMA) connectors. The ADRF6821-EVALZ requires an SDP-S controller board to program the ADRF6821. The ADRF6821-EVALZ is a 4-layer Rogers printed circuit board (PCB).

The ADRF6821 is a high performance, wideband demodulator solution that supports input radio frequencies (RF) ranging from 450 MHz to 2800 MHz. Highly integrated, the device consists of a 2:1 input RF switch; integrated RF balun; quadrature demodulator, integrated phase-locked loop (PLL)/voltage controlled oscillator (VCO); and integrated intermediate frequency (IF) amplifiers and analog-to-digital (ADC) drivers. The device supports input/output bandwidths up to 500 MHz and includes 15 dB of programmable attenuation. The integrated PLL/VCO within the ADRF6821 provides a 2× local oscillator (LO) signal for a range of 900 MHz to 5600 MHz.

This user guide describes the evaluation board and software for the ADRF6821. The ADRF6821 data sheet provides additional information and should be consulted when using the evaluation board.

ADRF6821-EVALZ EVALUATION BOARD PHOTOGRAPH AND FUNCTIONAL BLOCK DIAGRAM

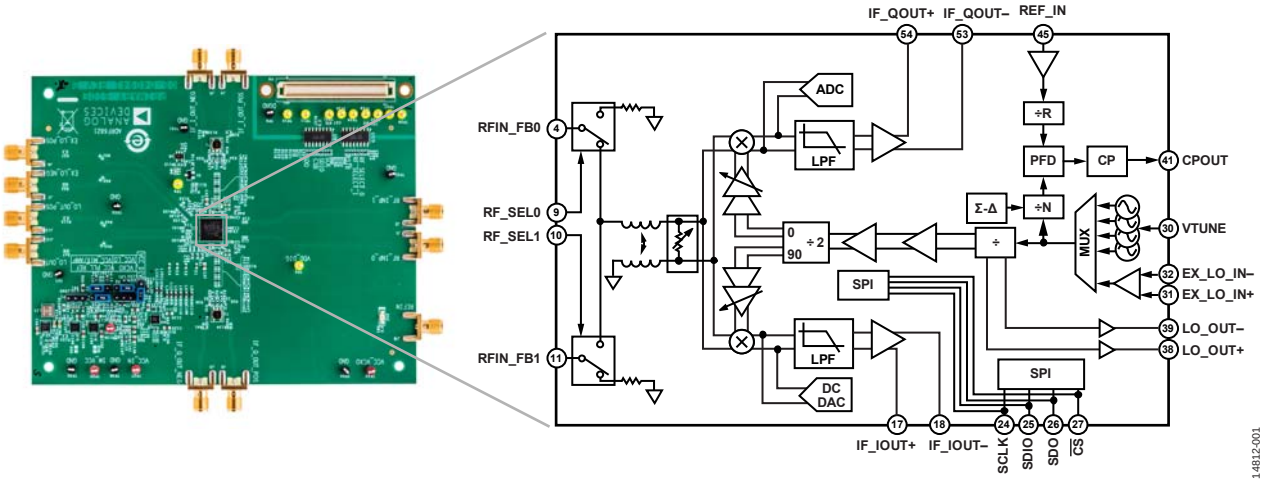

Figure 1.

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REVISION HISTORY

5/2017—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

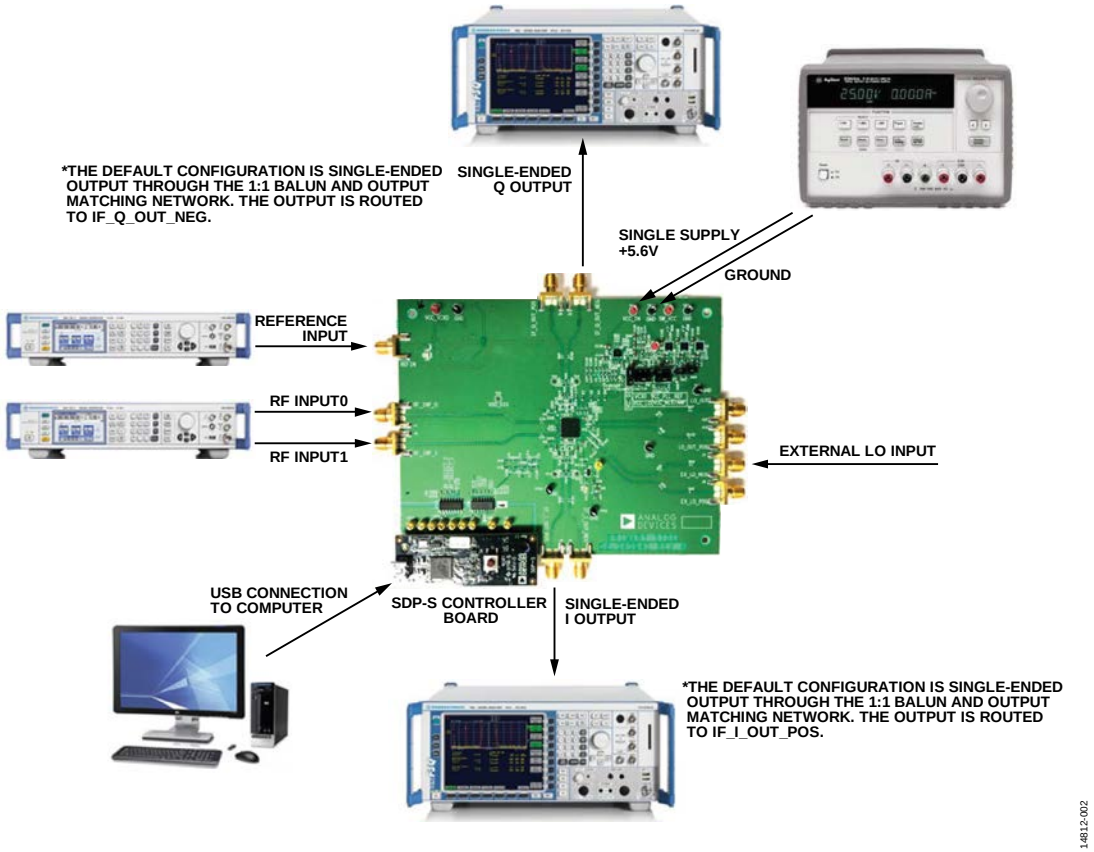

Figure 2. ADRF6821-EVALZ Typical Measurement Setup

The ADRF6821-EVALZ provides the support circuitry required to operate the ADRF6821 in various modes and configurations. Figure 2 shows the typical measurement setup that evaluates the performance of the ADRF6821.

POWER SUPPLY

The ADRF6821-EVALZ requires a single 5.6 V power source. The power supply design on the ADRF6821-EVALZ consists of low dropout dc regulators that regulate the 5.6 V power source to 3.3 V power rails for the main integrated circuit (IC).

RF INPUTS

The ADRF6821 supports two single-ended, 50 Ω terminated RF inputs. The operational frequency range of the RF inputs is from 450 MHz to 2800 MHz and the inputs must be ac-coupled. The high isolation 2:1 radio frequency (RF) switch enables selecting either one of the RF inputs via the serial peripheral interface (SPI) port or the general-purpose input/output (GPIO) pins, RF_SEL0 and RF_SEL1.

LO GENERATION

The ADRF6821 offers two alternatives to generating the differential local oscillator (LO) input signal: externally via a high frequency, low phase noise LO signal or internally via the on-chip fractional-N synthesizer and on-chip voltage controlled oscillators (VCOs).

For an internal LO configuration using the on-chip fractional-N synthesizer, apply a low phase noise reference signal to the reference input, shown in Figure 2.

The phase-locked loop (PLL) reference input can support a wide frequency range because the dividing blocks or multiply blocks can increase or decrease the reference frequency to the desired phase frequency detector (PFD) frequency value. The integrated synthesizer enables continuous LO coverage from 900 MHz to 5600 MHz.

The PLL filter components populated on the evaluation board are for a 20 kHz bandwidth (see Figure 24).

For optimum performance using an external LO source, drive the LO inputs using the EX_LO_NEG and EX_LO_POS connectors on the evaluation board differentially. The wide input range of the external LO input spans from 900 MHz to 5600 MHz. Unless an ac-coupled balun generates the differential LO, the inputs must be ac-coupled. The input impedance of the differential LO signals is 100 Ω and must be taken into account when driving differentially. For the default configuration of the LO inputs on the ADRF6821-EVALZ, apply a single-ended LO input to the SMA labeled EX_LO_NEG and the on-board balun converts the signal to differential.

I AND Q OUTPUTS

The ADRF6821 I and Q outputs have a differential impedance of 20 Ω as looking into the I/Q output pins. External series 25 Ω resistors on each differential line optimizes the performance of the ADRF6821. The output impedance with the 25 Ω series resistors displays as 70 Ω differential for both I and Q. The 70 Ω differential output impedance terminates with 100 Ω differential for optimal performance, providing a good output impedance match and linearity performance.

For measurement purposes with instruments that have 50 Ω input impedance, the evaluation board employs a 1:1 transformer (TC1-1-13MX+) and a resistive matching network, shown in Figure 20). The TC1-1-13MX+ is a wide bandwidth (4.5 MHz to 3000 MHz) 1:1 transformer with a flat passband response and converts single-ended 50 Ω resistance to 50 Ω differential resistance. A resistive matching network converts the 50 Ω differential impedance to 100 Ω differential.

The circuit topology allows the 70 Ω I/Q output impedance to terminate with a 100 Ω impedance in a 50 Ω measurement environment. The resistive matching network introduces a loss around 7.5 dB; therefore, the user must take into account the associated loss in measurements.

The ADRF6821-EVALZ is configured for single-ended outputs in default mode. For a single-ended I output, use the IF_I_OUT_POS connector with the on-board balun. For a single-ended Q output, use the IF_Q_OUT_NEG connector with the on-board balun.

SERIAL PORT INTERFACE (SPI)

The SPI of the ADRF6821, consisting of the SCLK, SDIO, SDO, and $\overline{CS}$ pins, is controlled via an external SDP-S controller board and the ACE software.

EVALUATION BOARD SOFTWARE AND QUICK START PROCEEDURES

The ADRF6821-EVALZ along with the SDP-S controller board is configured with a USB friendly interface to allow programmability of the ADRF6821 registers. The Analog Devices, Inc., ACE software provides a user friendly experience for complete control of the evaluation board and features.

SOFTWARE REQUIREMENTS AND INSTALLATION

Installing the ACE Software Suite

Download the ACE installation executable **ACEInstall_Version.exe** from the Analog Devices website.

Run **ACEInstall_Version.exe** to begin the installation process. The default path where the ACE software is installed on the PC is **C:\Program Files (x86)\Analog Devices\ACE.** For convenience, create a desktop icon for the ACE software. Find **ACE.exe** under the default path and double-click to run the ACE software. Alternatively, the ACE program can run from the **Start** menu by navigating to the **Analog Devices** folder, and run the ACE software under the **ACE** folder.

ADRF6821 GRAPHICAL USER INTERFACE (GUI) QUICK START

Connect the SDP-S controller board with the USB cable connected to the computer and power up the ADRF6821-EVALZ. Initially, the 5.6 V power supply draws about 40 mA. When the evaluation board is fully configured, the power supply draws about 650mA. The following steps outline how to begin using the ACE software:

1. Double-click the ACE shortcut (Figure 3) available under the **C:\Program Files (x86)\Analog Devices\ACE** directory.

*Figure 3. **ACE.exe** Shortcut Icon*

2. When the software main window opens, the software automatically detects the ADRF6821-EVALZ. Double-click the **ADRF6821 Board** icon shown in Figure 4. This brings the user to **ADRF6821 Board** tab (see Figure 5).

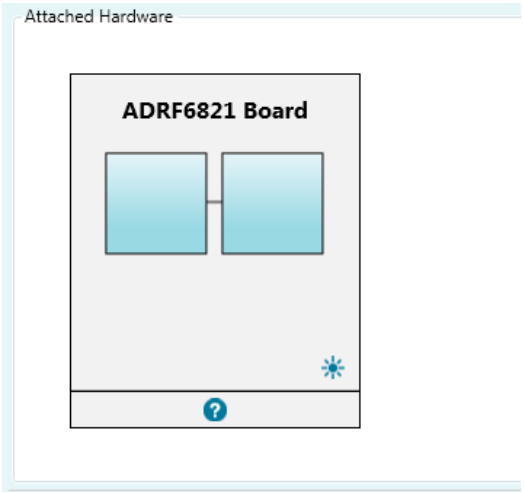

Figure 4. ACE Software Start Page when the ADRF6821 Connects

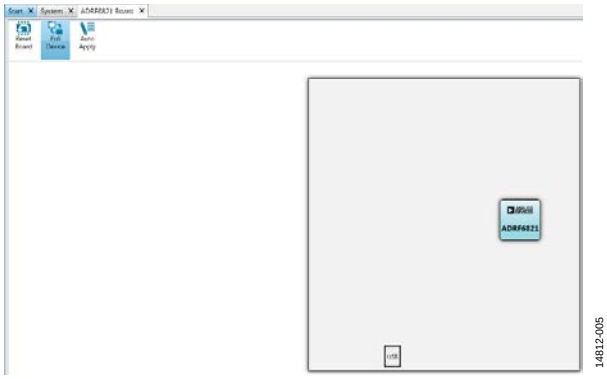

*Figure 5. **ADRF6821 Board** Tab View*

3. From the **ADRF6821 Board** tab, double-click the **ADRF6821** icon to open the **ADRF6821** tab (see Figure 6). The **ADRF6821** tab allows the user to configure the ADRF6821 in any desired configuration.
4. Set the **2×LO Freq** field to twice the desired LO frequency.
5. Adjust the channel spacing for PLL/VCO steps by using the **Ch Spacing** field.
6. Enter the reference frequency and the R divider value into the fields placed under the **REF In** field in the GUI. Ensure the PFD frequency stays within the data sheet limits.
7. Click the **PLL Adjust** button to lock the PLL and VCO. Check the on-board LED (DS1) or the LOCK_DETECT register on the ADRF6821 to ensure the PLL/VCO is locked.
8. Turn on the LO buffer to quadrature divider by clicking the triangle buffer icon above **LO Out Level** spin box.
9. Click the **Set Enables** checkbox to turn on all RF, IF, and divider paths.
10. Select the desired RF input by clicking the **RF Sel w/ SPI** checkbox and selecting either **RF Input 0** or **RF Input 1**.
11. Check the signal level at either I or Q output connectors. The resistive matching network at the I and Q output schematic introduces a 7.5 dB loss.

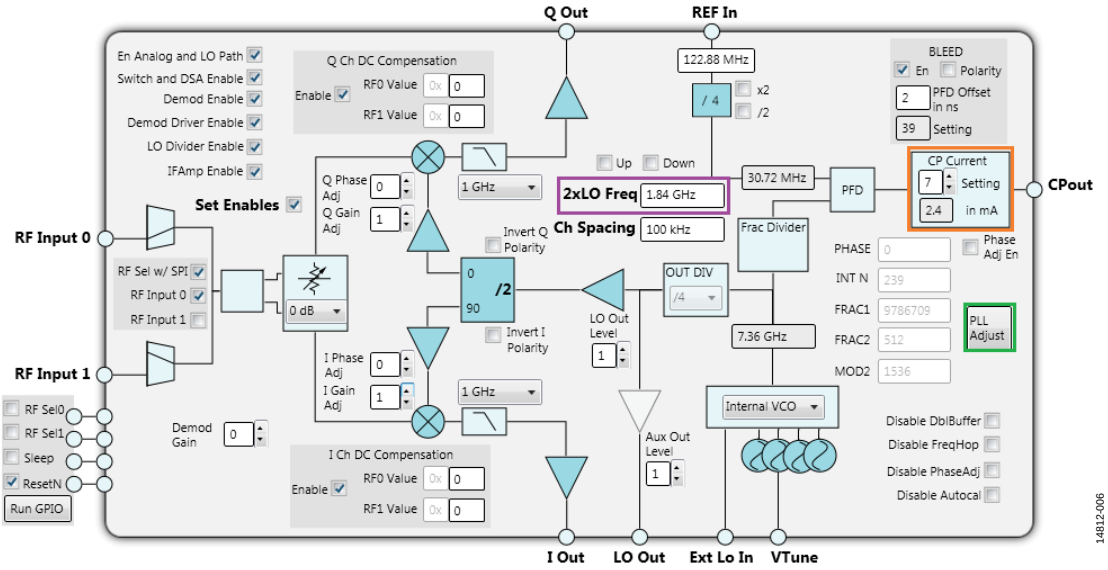

Figure 6. ADRF6821 Tab

ADRF6821 GUI COMPONENTS

This section describes the components within the ACE software GUI, which enables thorough control of all the elements of the ADRF6821.

ADRF6821 Board Tab

The **ADRF6821 Board** tab includes the **Reset Board** button, the **Poll Device** button, and the **Auto Apply** button (see Figure 7).

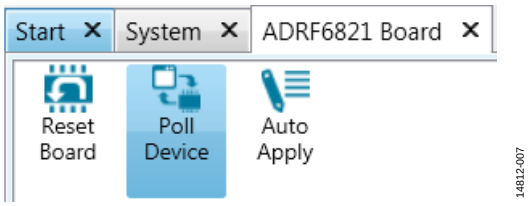

*Figure 7. **ADRF6821 Board** Tab*

The **Reset Board** button applies a soft reset to the device. The **Auto Apply** button applies the changes made to the GUI without the need to click **Apply Changes** after every change. The **Poll Device** button is not employed within the ADRF6821 GUI.

ADRF6821 Tab

Figure 6 shows the **ADRF6821** tab, which displays the main controls required to configure the device.

There are four user-controllable elements within the GUI. The following describes the four elements:

- By clicking the **PLL Adjust** button (see Figure 8), the user activates a series of predefined register writes to initiate an autocalibration to lock the PLL/VCO.

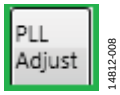

*Figure 8. **PLL Adjust** Button*

- The entry fields within the GUI enable manual entry of a desired value (for example, see Figure 9). Input values are written and entered by pressing **Enter**. The changes made for the PLL/VCO related controls and fields are applied with the **PLL Adjust** button to initiate the locking process. For controls other than the PLL/VCO, click **Apply Changes** button.

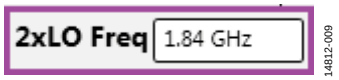

*Figure 9. **2×LO Freq** Entry Field*

- Spin boxes, check boxes, and dropdown menus allow users to select predefined values. These elements do not start a register write operation and users must click the **PLL Adjust** button to produce the PLL/VCO related register writes and the **Apply Changes** button for all other controls. Figure 10 shows an example of a spin box. Figure 11 shows a dropdown menu item to select between the internal VCO and external LO configurations.

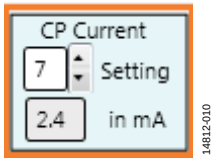

*Figure 10. **CP Current Setting** Spin Box*

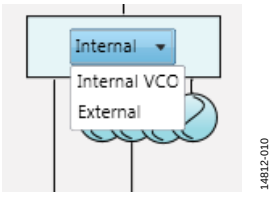

Figure 11. Configuration Dropdown Menu

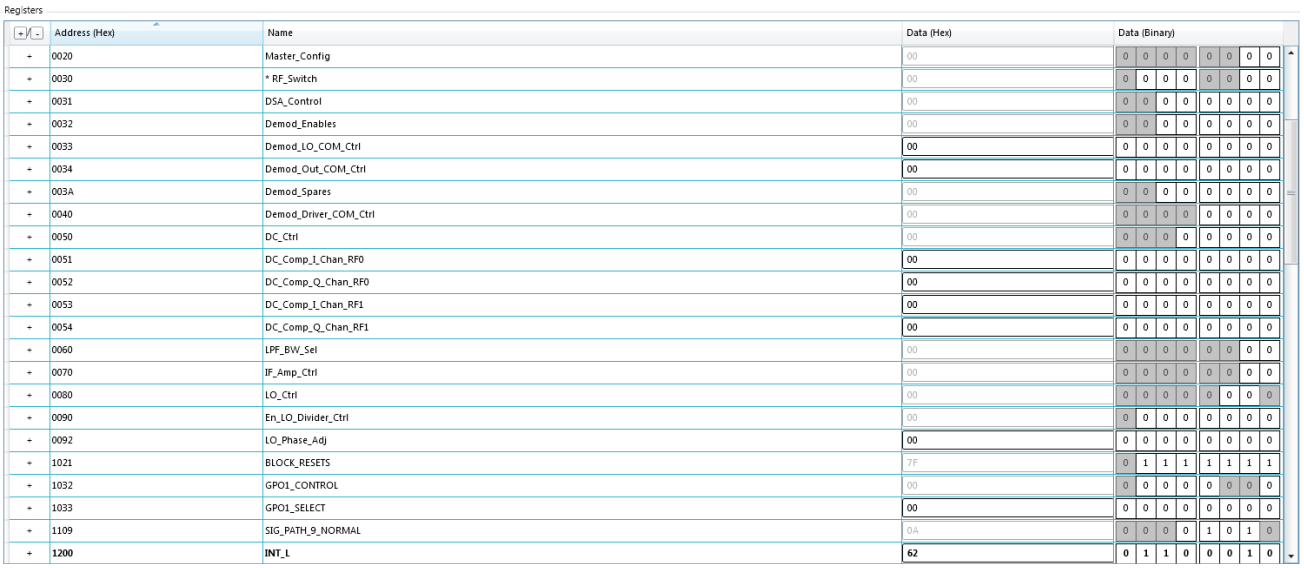

*Figure 12. **ADRF6821 Memory Map** Tab*

- The user can enable or disable some of the components by clicking associated controllable graphics. Controllable graphics do not automatically start a register write operation and the user must click the **Apply Changes** button or the **PLL Adjust** button to produce the related register writes.
  When a controllable graphic displays as gray (see Figure 13), the component is disabled. When a controllable graphic displays as blue (see Figure 14), the component is enabled.

Figure 13. Disabled Component

Figure 14. Enabled Component

  Some of the components have a pale blue color (see Figure 15), indicating the graphical object is not controllable by clicking on it.

Figure 15. Noncontrollable Component

ADRF6821 Memory Map Tab

The **Proceed to Memory Map** button (see Figure 16) in the **ADRF6821** tab directs the user to the ADRF6821 memory map for bit control of the register map (see Figure 12).

*Figure 16. **Proceed to Memory Map** Button*

The register write and reads are performed with the + and - buttons of the **ADRF6821 Memory Map** tab (see Figure 12). All changes made in the GUI simultaneously apply to the **ADRF6821 Memory Map** tab and changes made in the **ADRF6821 Memory Map** tab simultaneously apply to the GUI.

CHECKING THE USB CONNECTIVITY

If the user encounters an error while configuring the device, check the USB connectivity of the evaluation board under the **System** tab (see Figure 7). Figure 17 shows the **Subsystem_1** window where the user can observe the connectivity of the SDP-S board and the ADRF6821-EVALZ.

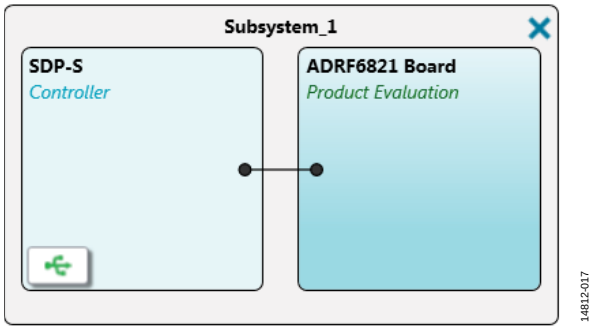

Figure 17. ADRF6821 ACE GUI System Tab

In the **SDP-S Controller** pane, there is a USB button. When the button is green, the USB is connected. Clicking the USB button reveals the connection options menu between the SDP-S controller board and the evaluation board. Ensure the **ADRF6821 Board** option in the **System** tab is selected. The **ADRF6821 Board (Local Only)** option does not provide connectivity.

Users can also check USB connectivity in the status bar of the ACE software, located in the bottom left of the GUI. **State,** which indicates the USB connectivity, must show **Good** at all times.

UPDATES TO THE ACE SOFTWARE PLUG-INS

Analog Devices periodically updates the ACE software and the device plug-ins to ensure the best possible user experience.

Update the ACE if there is indication of a new version when running the ACE software.

EVALUATION BOARD SCHEMATICS AND ARTWORK

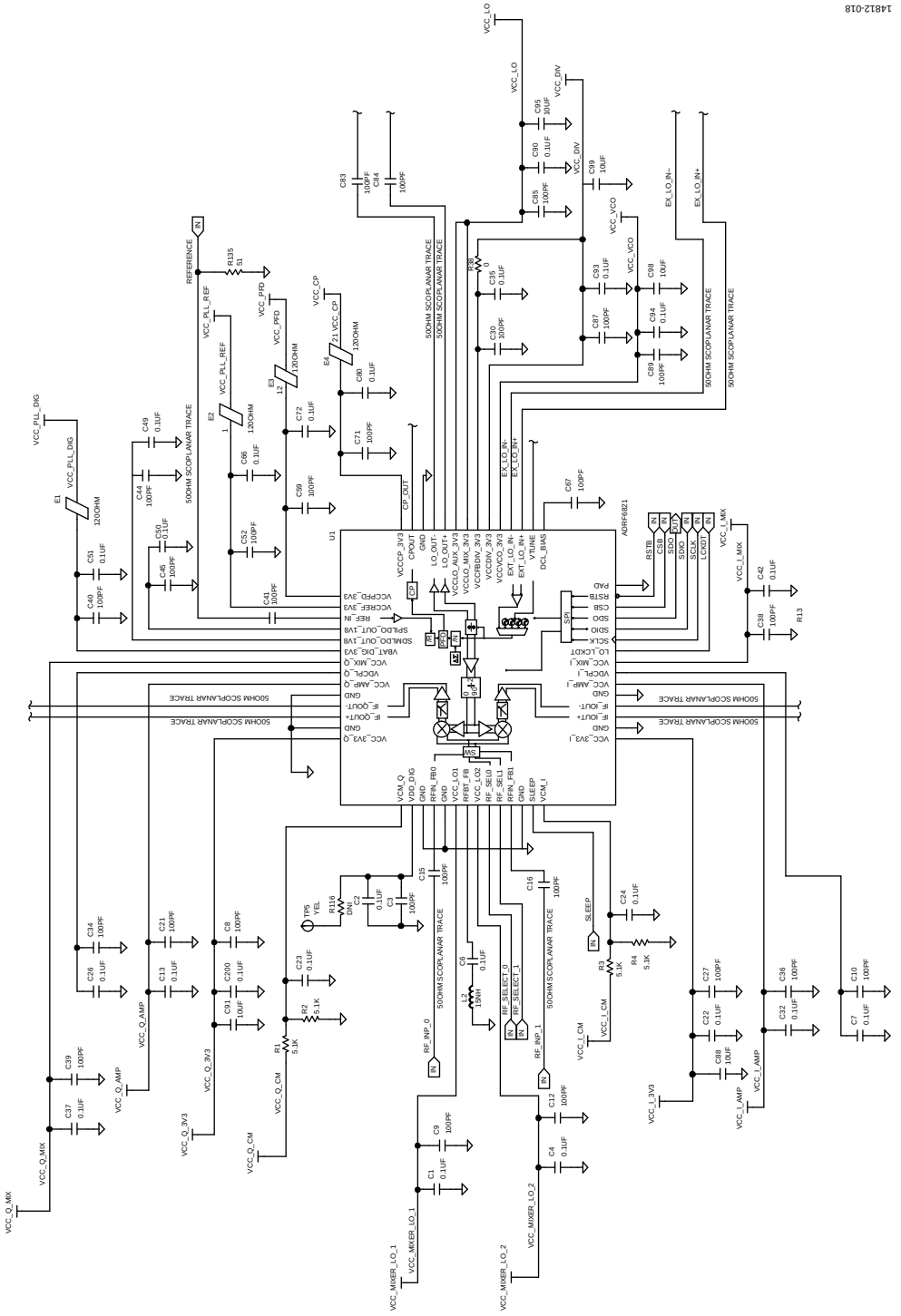

Figure 18. ADRF6821-EVALZ Schematic

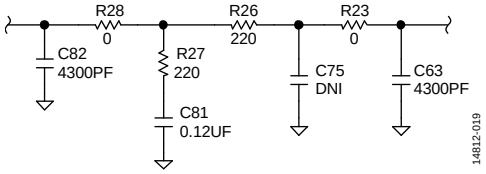

Figure 19. Loop Filter

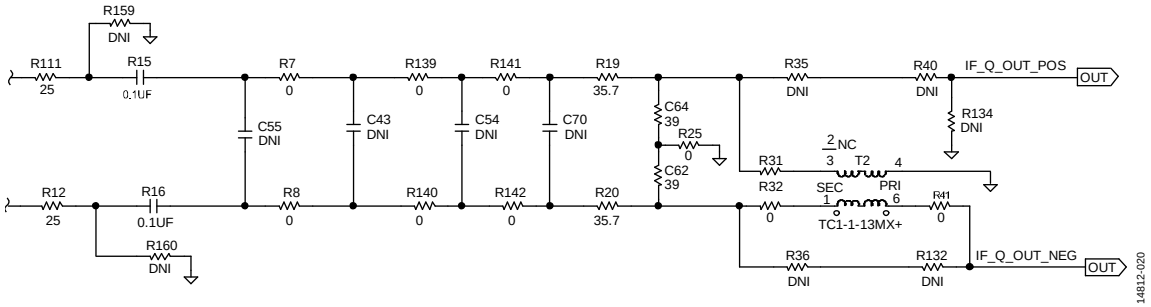

Figure 20. I/Q Output Schematic

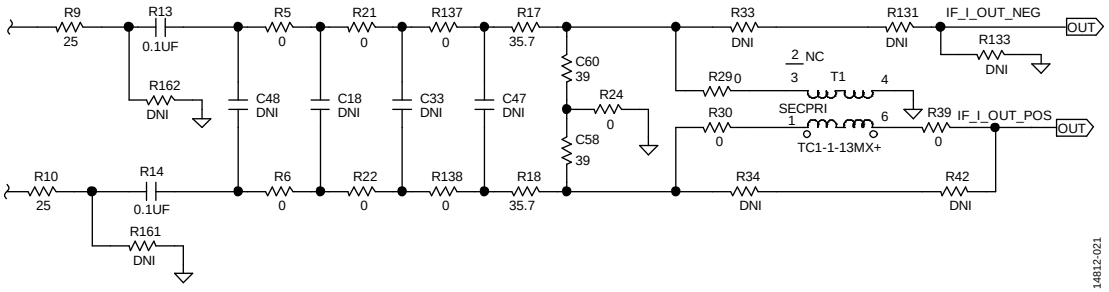

Figure 21. Q Output Schematic

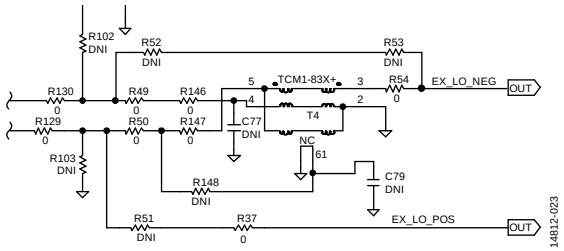

Figure 22. LO Output Schematic

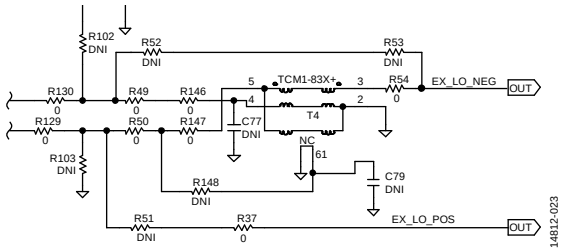

Figure 23. External LO Input Schematic

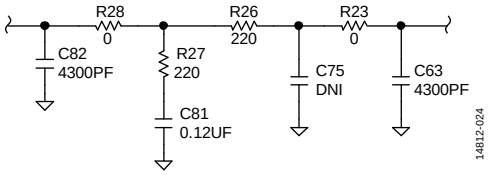

Figure 24. ADRF6821-EVALZ PLL Filter Schematic

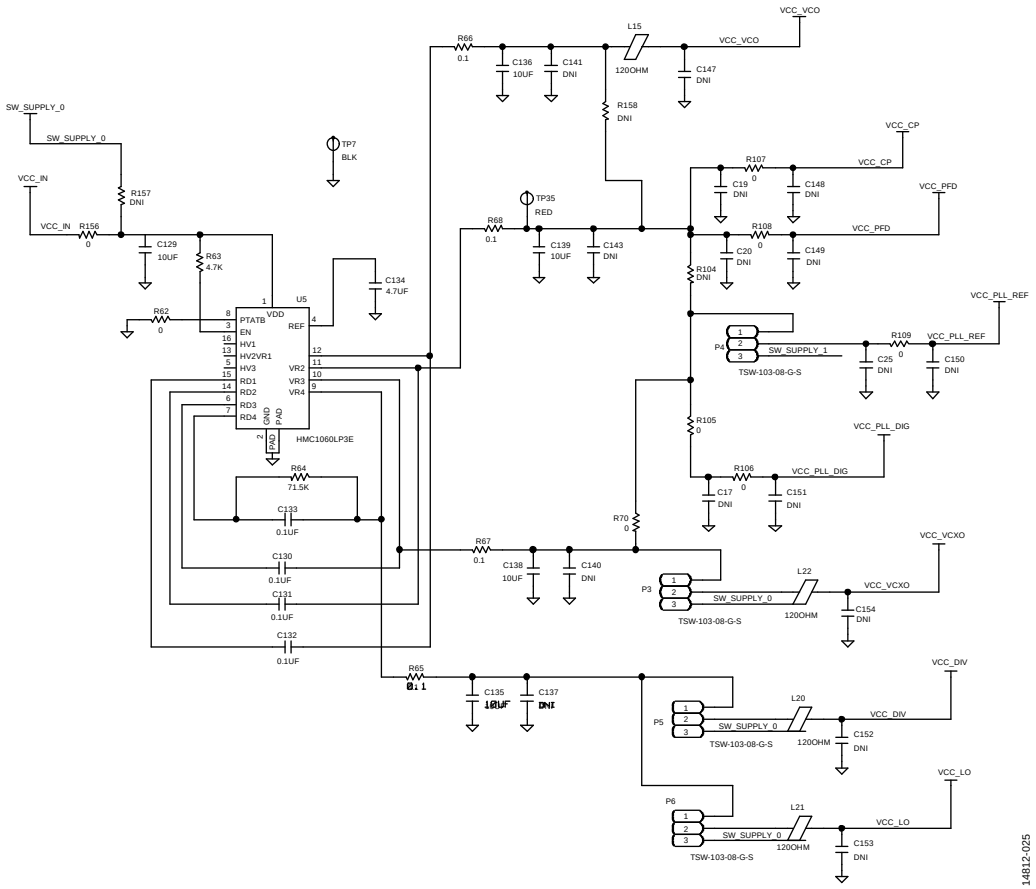

Figure 25. PLL/VCO Supply Circuit

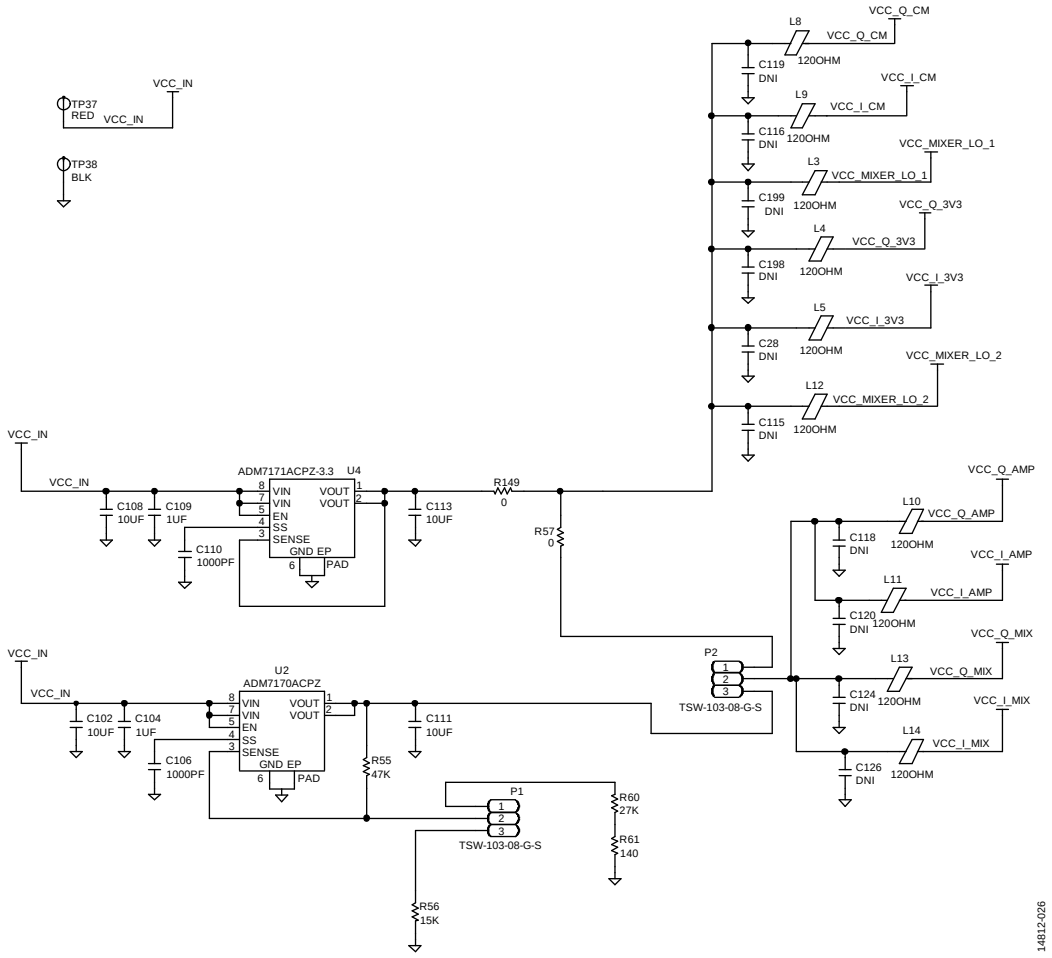

Figure 26. RF/IF Supply Circuit

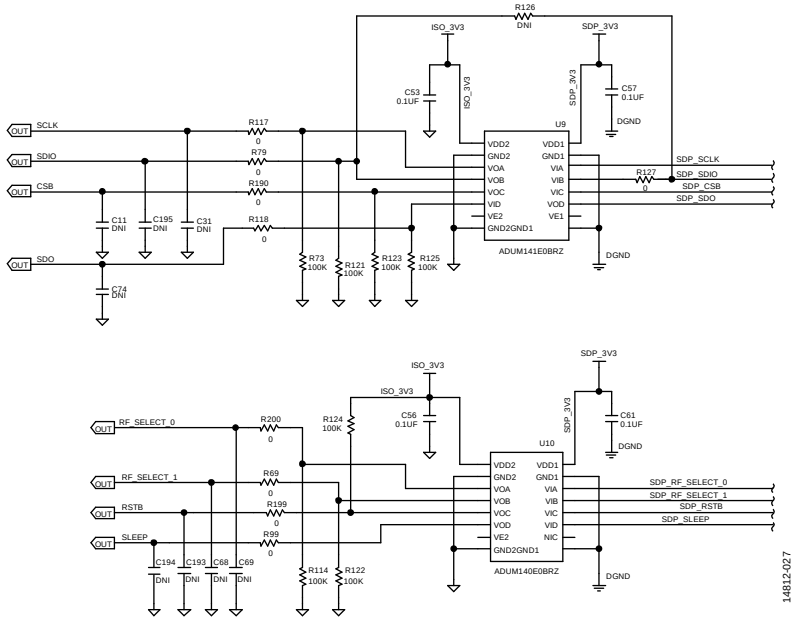

Figure 27. SPI GPIO Isolators

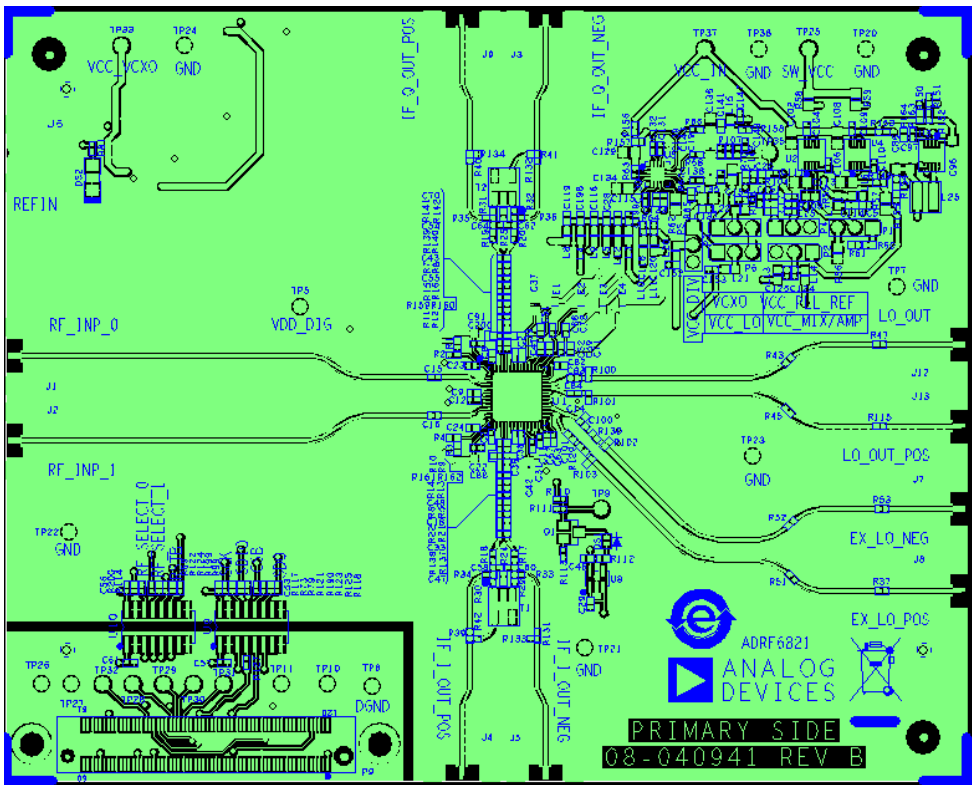

Figure 28. ADRF6821-EVALZ Top Silk Screen

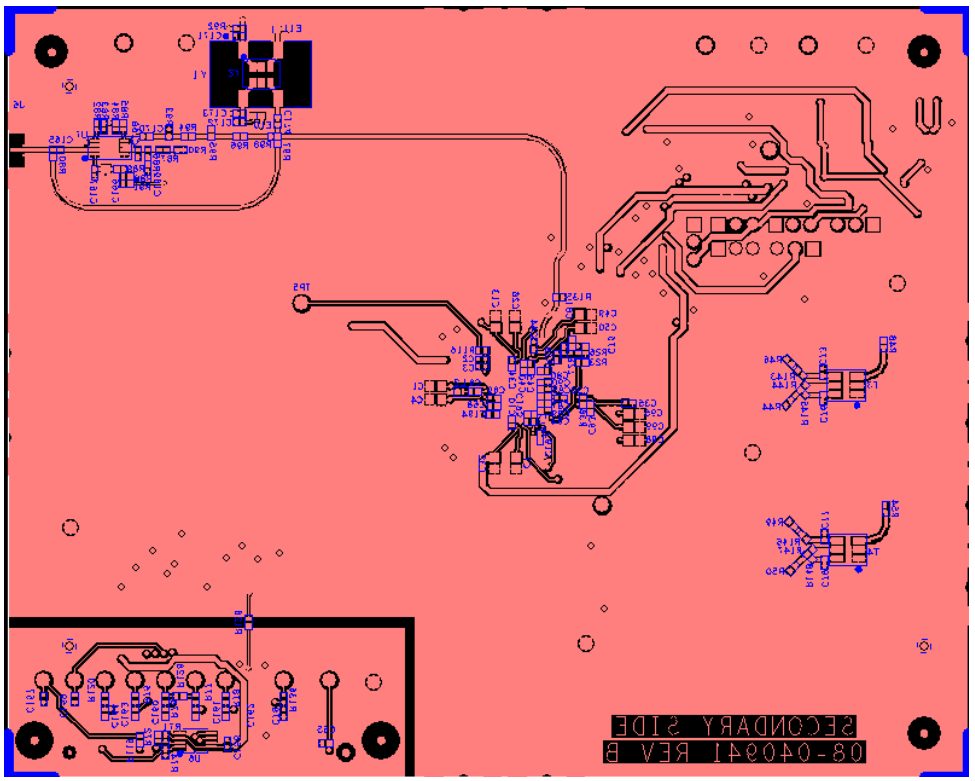

Figure 29. ADRF6821-EVALZ Bottom Silk Screen

ORDERING INFORMATION

BILL OF MATERIALS

Table 1.

Reference Designator	Description	Manufacturer	Part Number
C1, C4, C7, C13, C26, C32, C37,C42	Ceramic capacitors, C0G (NP0), general purpose, 0.1 µF, C0603	Murata	GCM188R72A104KA64D
C3, C8 to C10, C12, C15 to C16, C18, C21, C27, C30, C33, C34, C36, C38 to C41, C43 to C45, C47, C48, C52, C54, C55, C59, C67, C71, C70, C83 to C85, C87, C89, C100, C101	Ceramic capacitors, C0G (NP0), general purpose, 100 pF, C0402	Murata	GRM1555C1H101JA01D
C95, C98, C99, C102, C108, C111, C113, C115, C116, C118 to C120, C124, C126, C129, C135, C136, C138, C139, C198, C199	Ceramic capacitors, X5R, general purpose, 10 µF, C0603	Murata	GRM188R61E106MA73D
C17, C19, C20, C25, C28, C29, C46, C104, C109	Ceramic capacitors, X5R, general purpose, 1 µF, C0402	Murata	GRM155R61C105MA12
C2, C5, C6, C11, C22 to C24, C31, C35, C51, C53, C56, C57, C61, C66, C68, C69, C72 to C74, C76, C77, C79, C80, C90, C93, C94, R15, R16, C114, C130 to C133, C137, C140, C141, C143, C147 to C154, C158, C170, C193 to C195, C200	Ceramic capacitors, X7R, general purpose, 0.1 µF, C0402	Murata	GRM155R71C104KA88D
C134	Ceramic capacitor, X5R, 4.7 µF, C0603	TDK	C1608X5R1C475K080AC
C65, C78, C106, C110, C157, C159 to C164	Ceramic capacitors, X7R, general purpose, 1000 pF, C0402	Murata	GRM15XR71H102KA86
R13, R14, C172, C165	Ceramic capacitor, X5R, general purpose, 0.1 µF, C0402	Murata	GRM155R61A104KA01D
C166	Ceramic capacitor, X6S, general purpose, 4.7 µF, C0603	Murata	GRM188C81C475KE11D
C167	Multilayer ceramic capacitor, X5R, 0.47 µF, C0402	TDK	C1005X5R1C474K
C168	Ceramic capacitor, 0.33 µF, C0402	Panasonic	0402YD333KAT2A
C169	Ceramic capacitor, chip, X5R, 2.2 µF, C0402	TDK	C1005X5R0J225M
C171, C174	Ceramic capacitor, chip, X8R, 0.01 µF, C0402	TDK	C1005X8R1E103K
C173	Multilayer ceramic capacitor, NP0, 10 pF, C0402	Yageo	CC0402JRNP09BN100
C49, C50	Multilayer ceramic capacitors, chip, X7R, 0.1 µF, C0603	Vishay	VJ0603Y104KXA
C58, C60, C62, C64, R102, R103	Resistors, film, SMD, 39 Ω, R0402	Panasonic	ERJ-2GEJ390X
C63, C82	Ceramic capacitors, U2J, general purpose, 4300 pF, C0402	Murata	GRM1557U1A432JA01D
C75	Ceramic capacitor, X7R, general purpose, 0.0047 µF, C0402	Murata	GRM155R71E472KA01D
C81	Ceramic capacitor, chip, 0.12 µF, C0402	Kemet	C0402C124J5RAC
C86, C96, C97	Ceramic capacitors, X5R, general purpose, 22 µF, C0603	Murata	GRM188R61A226ME15D
C88, C91	Ceramic capacitors, X5R, 10 µF, C0402	Samsung	CL05A106MP5NUNC
DS1	Green LED, low current, LED0402	Rohm	SML-P11MTT86
DS2	Green LED, 560 nm, LED1206H77	Dialight	597-3311-407NF
E1 to E4	Chip ferrite beads, 120 Ω, L0402	Murata Manufacturing	BLM15EG121SN1D
E10, E11	Chip ferrite beads, 47 Ω, L0402	Murata Manufacturing	BLM15BB470SN1D
J1 to J9, J12, J13	PCB connectors, SMA, 50 Ω, end launch jack receptacle, CNSMAL562W375H166	Cinch Connectivity Solutions	142-0701-851
L3 to L5, L7 to L16, L20 to L22	Chip ferrite beads 120 Ω, L0603	Panasonic	EXC-3BP121H

Reference Designator	Description	Manufacturer	Part Number
L2	Inductor chip, 0402, 15 nH, L0402-2	Coilcraft	0402HP-15NXJLU
L25	Inductor shielded power, 6.8 µH, LSMSQ157H122	Coilcraft	XAL4030-682MEC
P1 to P6	PCB connectors, BERG header, solder termination, male 3-pin, CNBERG1X3H205LD36	Samtec	TSW-103-08-G-S
P9	PCB connector, vertical type, SMD receptacle, CNHRSFX8-120S-SV_A (see UG-291)	Hirose Electric	FX8-120S-SV(21)
Q1	NPN transistor, surface mount, small signal, SOT23	Diodes Incorporated	BC848C-7-F
R1 to R4	Metal film resistor, chip, 5.1 kΩ, R0402	Panasonic	ERA-2AEB512X
R9 to R12	High frequency resistors, thin film, chip, 25 Ω, R0402_B	Vishay Precision Group	CH0402-25RJFPT
R100, R101	High frequency resistors, chip, 50 Ω, R0402	Vishay Precision Group	FC0402E50R0FST1
R5 to R8, R21 to R25, R28 to R32, R37 to R39, R40 to 48, R50 to R54, R69, R79, R80, R87 to R90, R92, R97 to R99, R104 to R109, R112, R113, R115 to R120, R126 to R134, R136 to R152, R154 to R164, R190, R199, R200	Resistors, chip, SMD, jumper, 0 Ω, R0402	Panasonic	ERJ-2GE0R00X
R110	Precision resistor, thick film, chip	Panasonic	ERJ-2RKF1102X
R111	Precision resistor, thick film, chip, 10 kΩ, R0402	Panasonic	ERJ-2RKF1002X
R135	Resistors, film, SMD, 51 Ω, R0402	Panasonic	ERJ-2GEJ510X
R82 to R85, R153	Standard resistor, thick film, chip, 10 kΩ, R0402	Vishay Precision Group	CRCW040210K0JNED
R17 to R20	General purpose resistor, chip, 35.7 Ω, R0402	Yageo	RC0402FR-0735R7L
R26, R27	Resistors, thick film, chip, 220 Ω, R0402	Multicomp	0402WGF2200TCE
R55	Precision resistor, thick film, chip, 47 kΩ, R0402	Panasonic	ERJ-2RKF4702X
R56	Resistor, thin film, chip, 15 kΩ, R0603	Yageo	RT0603BRB0715KL
R57 to R59, R62, R70	Resistors, film, SMD, 0 Ω, R0603	Panasonic	ERJ-3GEY0R00V
R60	Precision resistor, thick film, chip, 27 kΩ, R0402	Panasonic	ERJ-2RKF2702X
R61	Precision resistor, thick film, chip, 140 kΩ, R0402	Panasonic	ERJ-2RKF1400X
R63, R86	Precision resistor, thick film, chip, 4.7 kΩ, R0402	Panasonic	ERJ-2RKF4701X
R64	Standard resistor, thick film, chip, 71.5 kΩ, R0402	Vishay Precision Group	CRCW040271K5FKED
R65 to R68	Resistor, thick film, 0.1 Ω, R0402	Panasonic	ERJ-2BSFR10X
R71 to R74, R114, R121 to R125	Resistor, thick film, chip, 100 kΩ, R0402	Panasonic	ERJ-2GEJ104X
R75 to R78	Precision resistor, thick film, chip, 1 kΩ, R0402	Panasonic	ERJ-2RKF1001X
R81	Resistor, film, SMD, 1.1 kΩ, 0402	Panasonic	ERJ-2GEJ112X
R91	Resistor, thick film, chip, 10 Ω, R0402	Panasonic	ERJ-2RKF10R0X
R93	Precision resistor, thick film, chip, 150 Ω, R0402	Panasonic	ERJ-2RKF1500X
R94	Precision resistor, thick film, chip, 130 Ω, R0402	Panasonic	ERJ-2RKF1300X
R95	Precision resistor, thick film, chip, 100 Ω, R0402	Panasonic	ERJ-2RKF1000X
R96	Precision resistor, thick film, chip, 47 Ω, R0402	Panasonic	ERJ-2GEJ470X
T1, T2	Transformer RF, TSMSQ150H160	Mini Circuits	TC1-1-13MX+
T3, T4	Transformer RF, 50 Ω, 10 MHz to 8000 MHz, preliminary, TSML150W160H160	Mini Circuits	TCM1-83X+
TP5, TP9 to TP11, TP26 to TP32	PCB connector yellow test points	Components Corporation	TP-104-01-04
TP6, TP7, TP20 to TP24, TP38	PCB connector black test points, CNLOOPTP	Components Corporation	TP-104-01-00
TP25, TP33, TP35, TP37	PCB connector red test points, CNLOOPTP	Components Corporation	TP-104-01-02

Reference Designator	Description	Manufacturer	Part Number
U1	IC, 450 MHz to 2800 MHz, digital predistortion (DPD) radio frequency integrated circuit (RFIC) with integrated fractional-N phase-locked loop (PLL) and voltage controlled oscillator (VCO), QFN 56-lead, 8 mm × 8 mm	Analog Devices	ADRF6821
U10	IC, quad digital isolator, 16-lead SOIC	Analog Devices	ADuM140E0BRZ
U2	IC, ultralow noise, high power supply rejection ratio (PSRR), fast transient response, CMOS, low dropout regulator (LDO), DFN 8-lead, 3 mm × 3 mm	Analog Devices	ADM7170ACPZ
U3	IC, low quiescent current buck regulator, QFN 8-lead, 3 mm × 3 mm	Analog Devices	ADP2370ACPZ-3.3
U4	IC, ultralow noise, high PSRR, fast transient response CMOS, LDO, DFN 8-lead, 3 × 3 mm	Analog Devices	ADM7171ACPZ-3.3
U5	IC, quad low noise, high PSRR, linear voltage regulator, LP3	Analog Devices	HMC1060LP3E
U6	IC, 32 kB serial EEPROM, MSOP8	Microchip Technology	24LC32A-I/MS
U7	IC, clock generator with integer-N PLL, 0.1 MHz to 500 MHz, 8-lead MSOP	Analog Devices	HMC1031MS8E
U8	IC, 150 mA, low quiescent current, CMOS linear register, 1.8 V output voltage, 5-lead TSOT	Analog Devices	ADP121-AUJZ18
U9	IC, quad digital isolators, 16-lead SOIC	Analog Devices	ADUM141E0BRZ
Y1	IC ,voltage controlled crystal oscillator (VCXO) ultralow phase noise oscillator, 50.000 MHz, LCC4H210	Crystek Corporation	CVHD-950-50.000
Y2	IC, VCXO oscillator, 50.000 MHz, YSML197W126H67	Bliley Technologies	V105A1927

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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