
HPMX-5001

Demonstration Circuit Board

Application Brief 102

Introduction

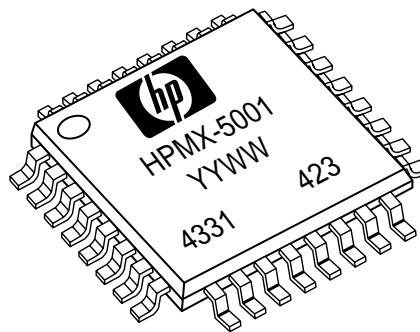
The circuit board described is designed for use with the HPMX-5001 up/down converter MMIC. It allows testing the MMIC for 1900 MHz applications such as DECT, and 2.4 GHz applications such as wireless LANs.

Assembly Notes

Table 1, on pages 2 and 3, lists the parts you will need to assemble the circuit board for either 1900 MHz or 2400 MHz operation.

Figures 2, 3 and 4 show parts placement on the top and bottom sides of the board.

- 1) **Always** use bypass capacitors on the V_{CC} lines. V_{CC} can be set anywhere from 2.7 to 5.5 Volts.
It is strongly recommended that you do not exceed the maximum IC voltage ratings shown on the IC data sheet.
- 2) The SMA connectors used should be the type that go straight down on the board, EF Johnson part number 142-0701-211.



- 3) Since there are components on both sides of the board, it is recommended that the top side components be installed first. The bottom side components will probably have to be soldered down by hand.

Using the Board

The board can be used to test performance of the up and down converting mixers, the frequency doubler and the dual modulus prescaler. The 900 MHz LO signal is injected at the VCOTNKS

connection. The circuit board has pads near the VCO tank pins (20, 21) that will allow the installation of tank circuit components.

Figures 5 - 10 show different test equipment set-ups for measuring performance of the different sections of the IC. The set-ups shown are for reference only – feel free to use alternative equipment and set-ups that you may be more familiar with.

Table 1. HPMX-5001 Demonstration board components for 1900 MHz operation, using a 110 MHz first IF.

Part/ Port/Pin Label	Value	Size/ part No.	Description
Gnd			Ground plane connection
V _{CC}			V _{CC} . Four V _{CC} points are locally decoupled to the ground plane with 10 nF // 100 pF.
P1			TXCTRL. Upconverting mixer turn on / off. Active: short to ground. Not active: open or V _{CC} . ESD sensitive.
P2		EFJ-142-0701-211	Receive IF output. 50 Ω SMA connector. Narrow band match at 111 MHz (1900 MHz board), or 250 MHz (2500 MHz board).
P3		EFJ-142-0701-211	Transmit IF input. 50 Ω SMA connector. Broadband match from 30 MHz to 300 MHz.
P4		EFJ-142-0701-211	Receive RF input. 50 Ω SMA connector. Semi narrow band match from 1880-1900 MHz (1900 MHz board) or 2400-2500 MHz (2500 MHz board).
P5		EFJ-142-0701-211	Transmit RF output. 50 Ω SMA connector. Semi narrow band match from 1880-1900 MHz (1900 MHz board), 2400-2500 MHz (2500 MHz board).
P6		EFJ-142-0701-211	LO input. 50 Ω SMA connector. Broadband match from 100 MHz to 1500 MHz.
P7			Prescaler output. Oscilloscope probe connector, connects to HP54003-61617 10:1 probe 1 MΩ // 8 pF. This represents maximum specified load condition (trace capacitance is 2 pF).
P8			Prescaler mode control. 1/33: short to ground: 1/32: open or V _{CC}
P9			LOCTRL. VCO and prescaler turn on / off. Active: short to ground. Not active: open or V _{CC} . ESD sensitive.
P10			RXCTRL. Downconverting mixer turn on / off. Active: short to ground. Not active: open or V _{CC} . ESD sensitive.
R1	270 Ω	0805	Matching resistor for transmit IF input.
R2	51.1 Ω	0805	Damping resistor in matching network of transmit output.
R3			See X3
R4	51.1 Ω	0805	Matching resistor for LO input.
R5	51.1 Ω	0805	Damping resistor in prescaler output that suppresses unwanted higher order prescaler spurs in transmit and receive spectra.
R6	20 Ω	0805	Damping resistor in LO input.
R7	1100 Ω	0805	Damping resistor in DIVMC control input.
R8	1100 Ω	0805	Damping resistor in LOCTRL control input.
R9	1100 Ω	0805	Damping resistor in RXCTRL control input.
R10	1100 Ω	0805	Damping resistor in TXCTRL control input.
R11	10 Ω	0603	VCOVCC decoupling resistor.
R12	10 Ω	0603	DIVVCC decoupling resistor.
C1	6.8 pF	0805	Tuning capacitor in receive IF matching network.
C2	8.2 pF	0805	Tuning capacitor in receive IF matching network.
C3,C4	1 nF	0805 or 0504	Transmit IF input coupling capacitors.
C5	3.3 pF	0504 or 0603	Receive RF complementary input tuning capacitor.
C6	2.7 pF	0805	Receive RF input tuning capacitor.
C7	22 pF	0805	Transmit RF output tuning capacitor. <i>For 2.5 GHz use 3.3 pF chip cap.</i>
C8	12 pF	0805 or 0504	VCO input coupling capacitor.
C9	2.2 nF	0805 or 0504	Prescaler output coupling capacitor.

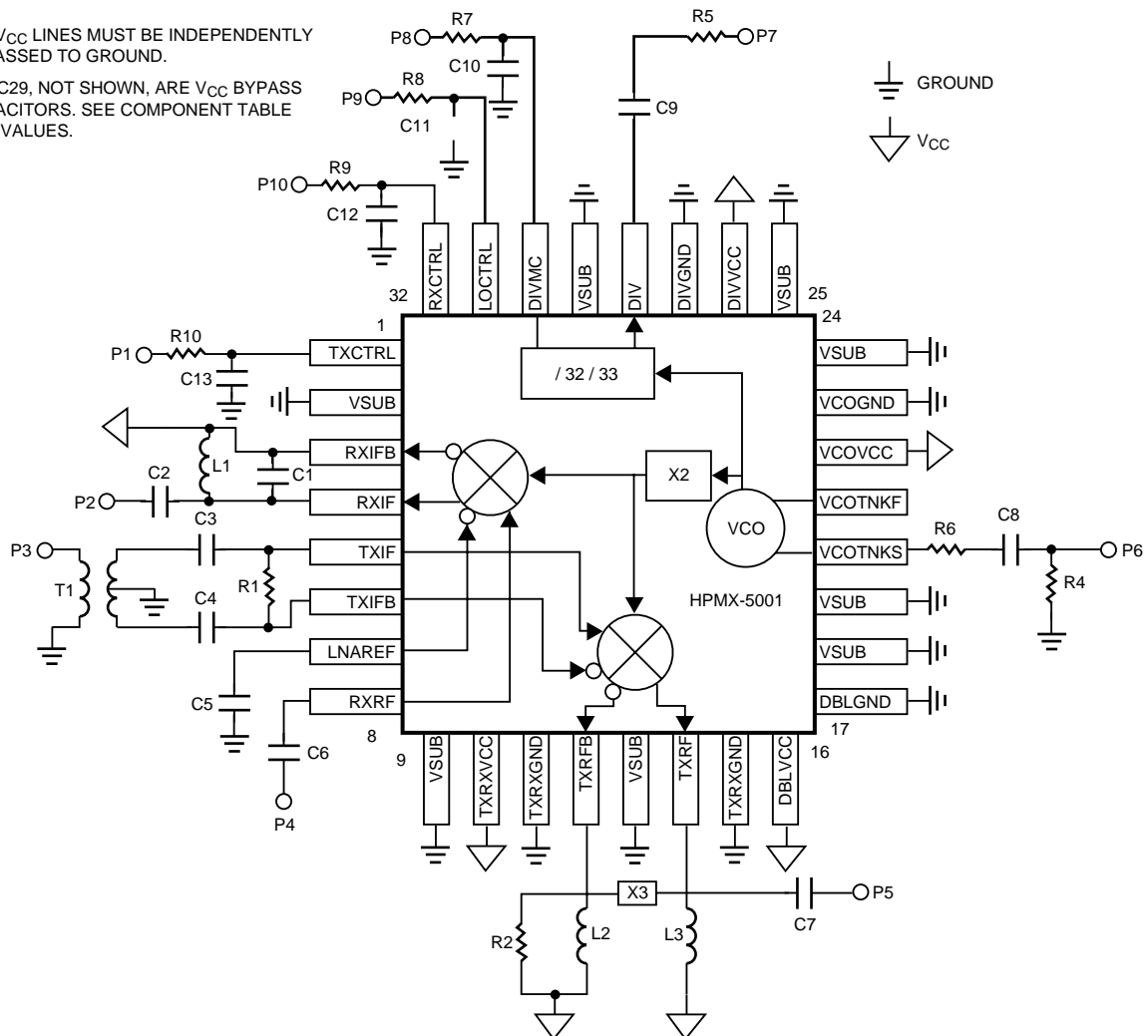
Table 1. (Continued)

Part/ Port/Pin Label	Value	Size/ part No.	Description
C10	1 nF	0805 or 0504	DIVMC control input decoupling capacitor.
C11	1 nF	0504	LOCTRL control input decoupling capacitor.
C12	1 nF	0805 or 0504	RXCTRL control input decoupling capacitor.
C13	1 nF	0805 or 0504	TXCTRL control input decoupling capacitor.
C14	10 pF	0805 or 0504	TXRFB V _{CC} decoupling capacitor.
C15	10 pF	0805 or 0504	TXRF V _{CC} decoupling capacitor.
C16	10 nF	0805 or 0504	TXRFB V _{CC} decoupling capacitor.
C17	10 nF	0805 or 0504	TXRF V _{CC} decoupling capacitor.
C18	10 pF	0805 or 0504	TXRF V _{CC} decoupling capacitor.
C19	100 pF	0805 or 0504	RXIF V _{CC} decoupling capacitor.
C20	10 nF	0805 or 0504	RXIF V _{CC} decoupling capacitor.
C21	100 pF	0805 or 0504	RXIF V _{CC} decoupling capacitor.
C22	100 pF	0805 or 0504	DIVVCC decoupling capacitor.
C23	100 nF	0805 or 0504	DIVVCC decoupling capacitor.
C24	10 nF	0805 or 0504	VCOVCC decoupling capacitor.
C25	100 pF	0805 or 0504	VCOVCC decoupling capacitor.
C26	10 nF	0805 or 0504	DBLVCC decoupling capacitor.
C27	100 pF	0805 or 0504	DBLVCC decoupling capacitor.
C28	100 pF	0805 or 0504	TXRXVCC decoupling capacitor.
C29	10 nF	0805 or 0504	TXRXVCC decoupling capacitor.
C30	-		Not used
C31	10 nF	0805 or 0504	DIVVCC decoupling capacitor.
L1	120 nH	0805	Receive IF output matching inductor. Coilcraft surface mount 0805 series
L2	3.3 nH	0805	Transmit complementary output bias inductor. Coilcraft surface mount 0805 series
L3	3.3 nH	0805	Transmit output matching inductor. Coilcraft surface mount 0805 series
T1			Transmit IF input transformer: unbalanced to balanced 1 to 2. Part number: T4-1-X65.
X3	300 Ω	0805	Transmit output matching resistor. This resistor sets output VSWR and available output power. <i>For 2.5 GHz operation, use a 3.3 nH chip inductor.</i>

Table 2. Component changes for different IF frequencies.

IF Frequency	C1 (pF)	C2 (pF)	L1 (nH)	VSWR
110 MHz	6.8	8.2	120	1.3:1
200 MHz	1.0	3.9	100	1.3:1
250 MHz	1.2	3.9	56	1.3:1
300 MHz	1.2	3.9	39	1.3:1

NOTE: ALL V_{CC} LINES MUST BE INDEPENDENTLY BYPASSED TO GROUND.
 C14-C29, NOT SHOWN, ARE V_{CC} BYPASS CAPACITORS. SEE COMPONENT TABLE FOR VALUES.

**Figure 1. HPMX-5001 Demonstration Board Schematic Diagram.**

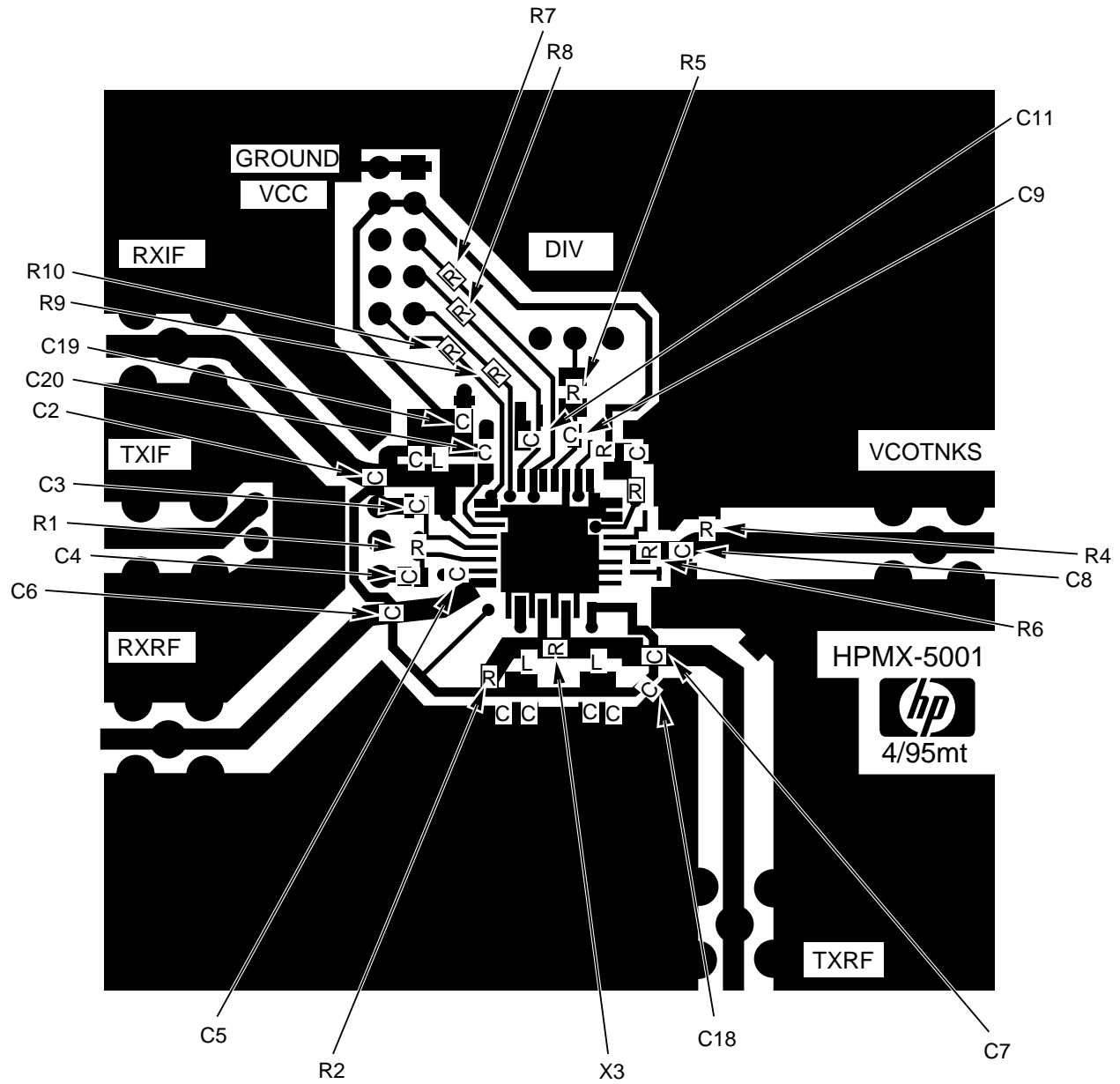


Figure 2. Parts placement on the top side of circuit board. The IC (not shown) mounts on this side of the board. Additional component designations are shown in Figure 3.

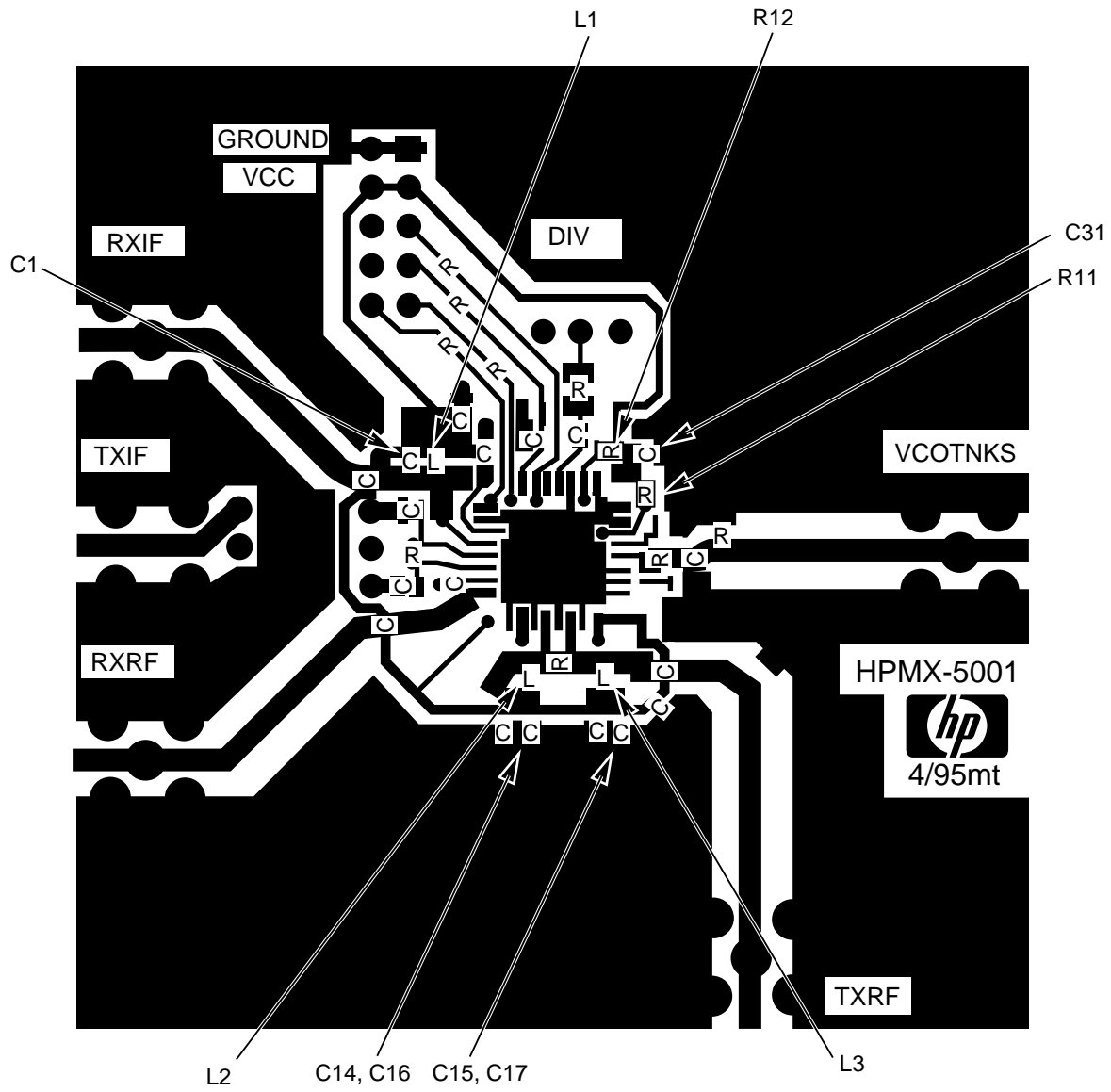


Figure 3. Remaining component placement for top side of circuit board. All other top-side components are shown in Figure 2.

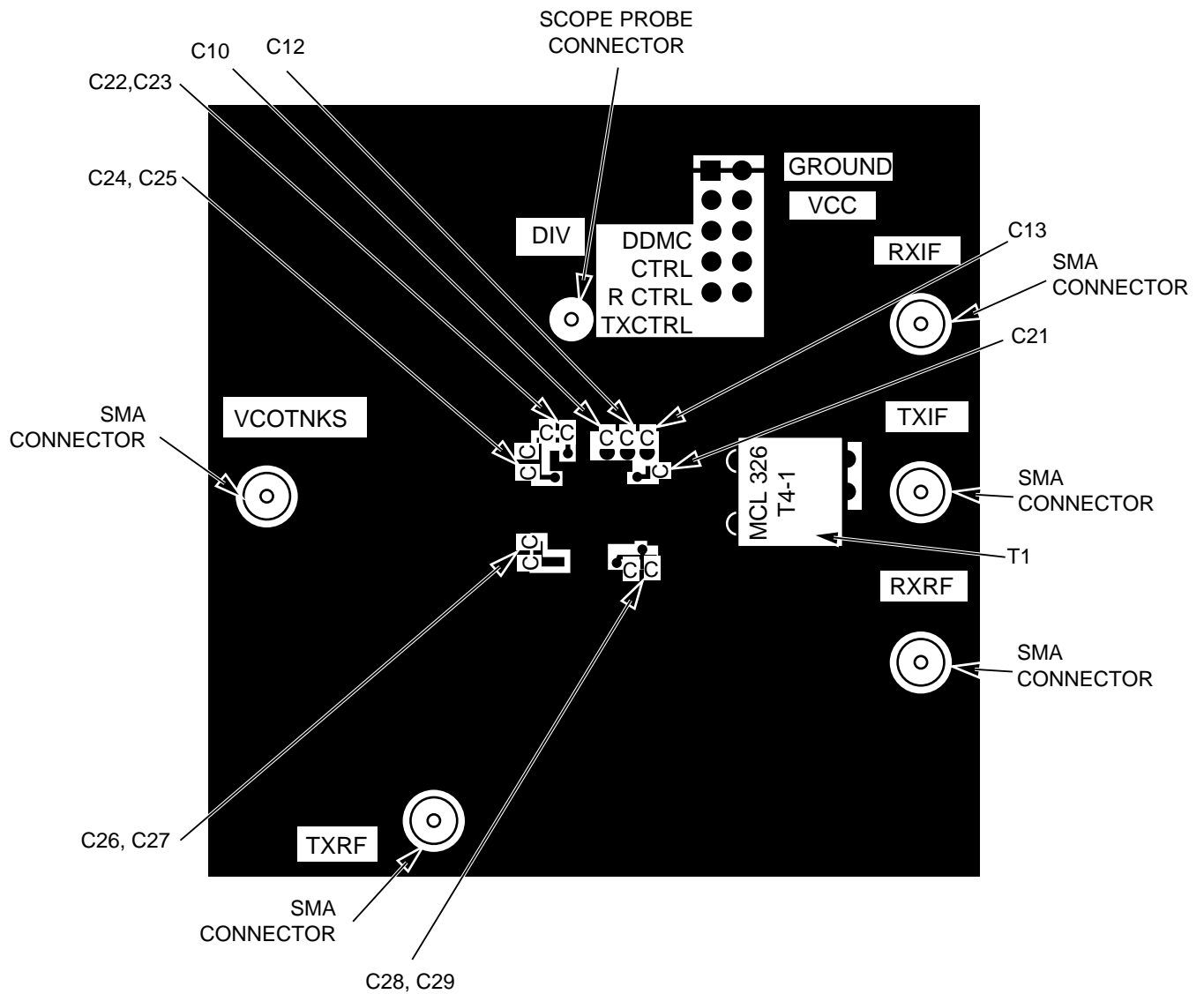


Figure 4. Component placement for the bottom side of the board. The SMA connectors can be mounted on either side of the board. Top side component placement is shown in Figures 2 and 3.

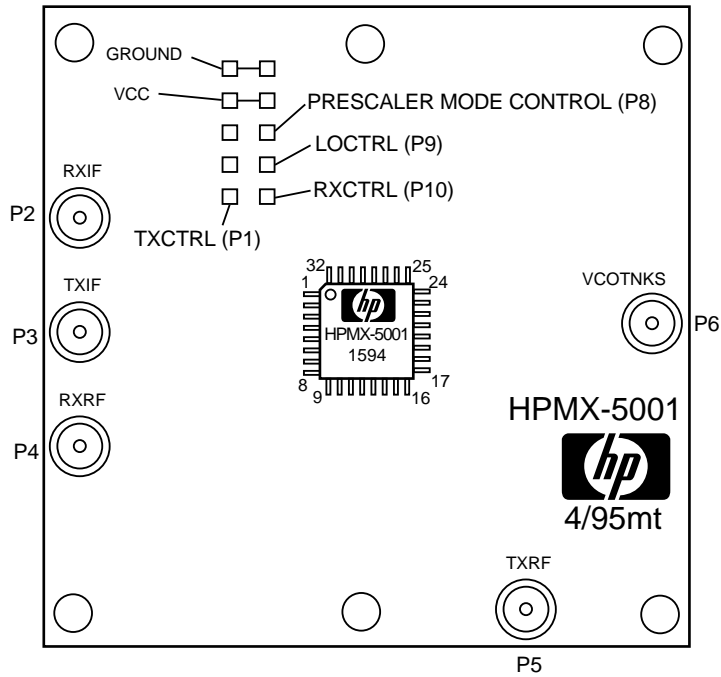


Figure 5. Detail view of board showing “P” designations used in Table 1.

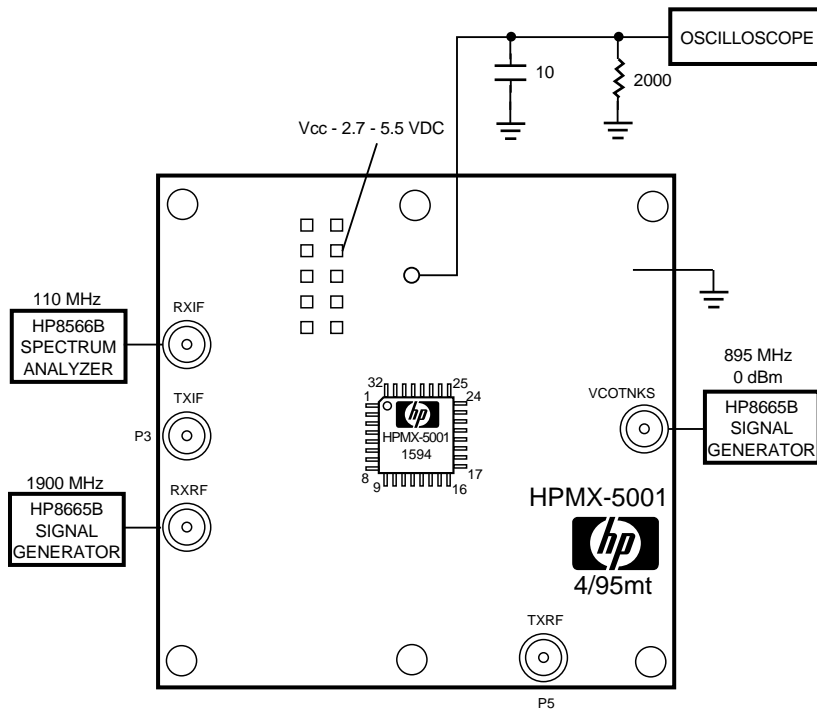


Figure 6. Test equipment set-up for measuring down converter gain, P_{1dB} , and LO suppression.

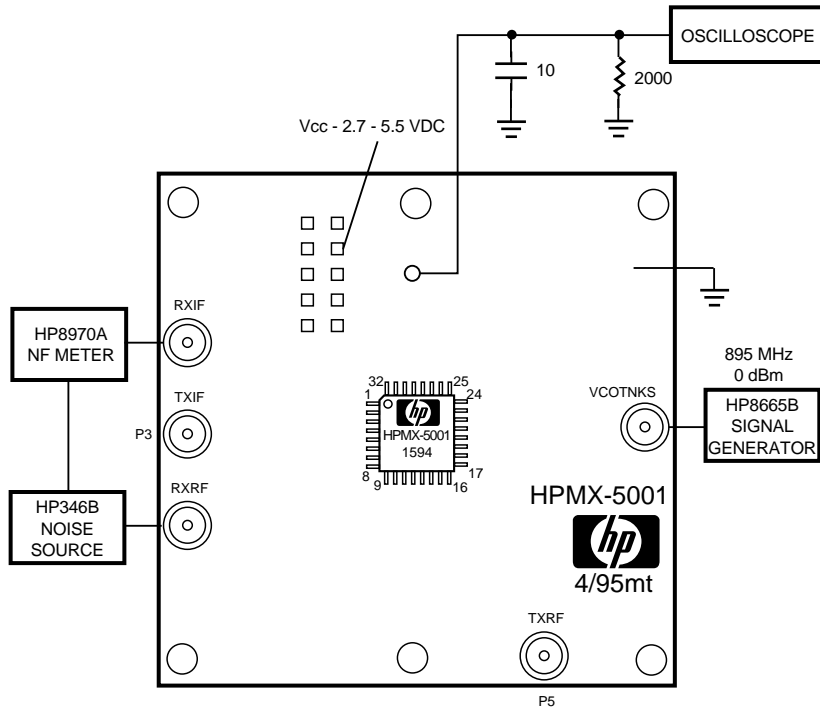


Figure 7. Test equipment set-up for measuring down converter noise figure.

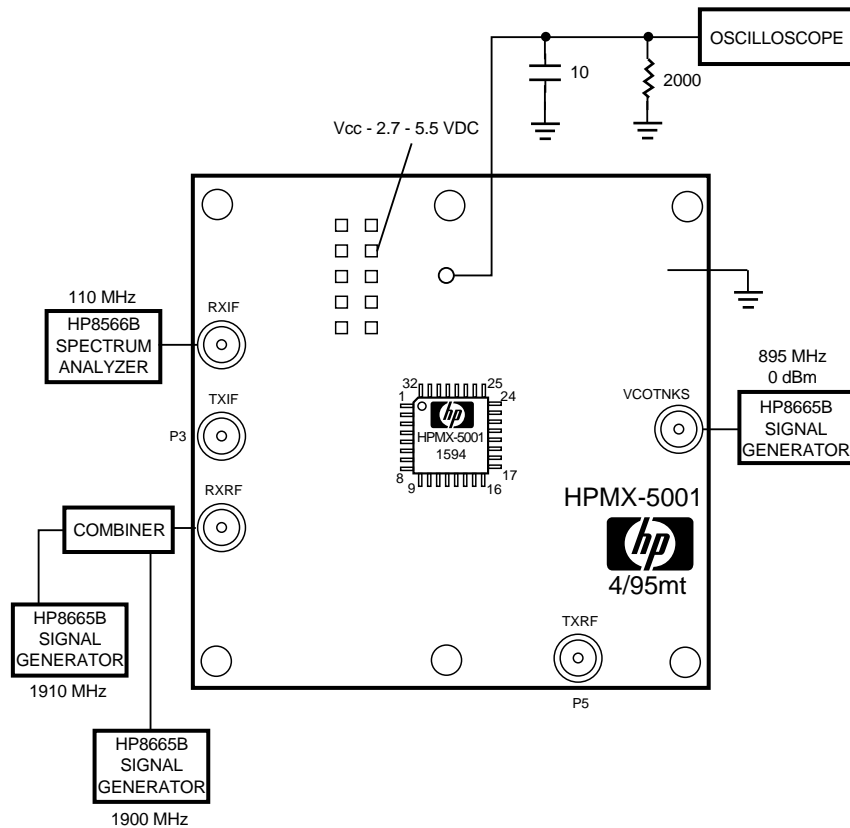


Figure 8. Test equipment set-up for measuring down converter third order intercept point.

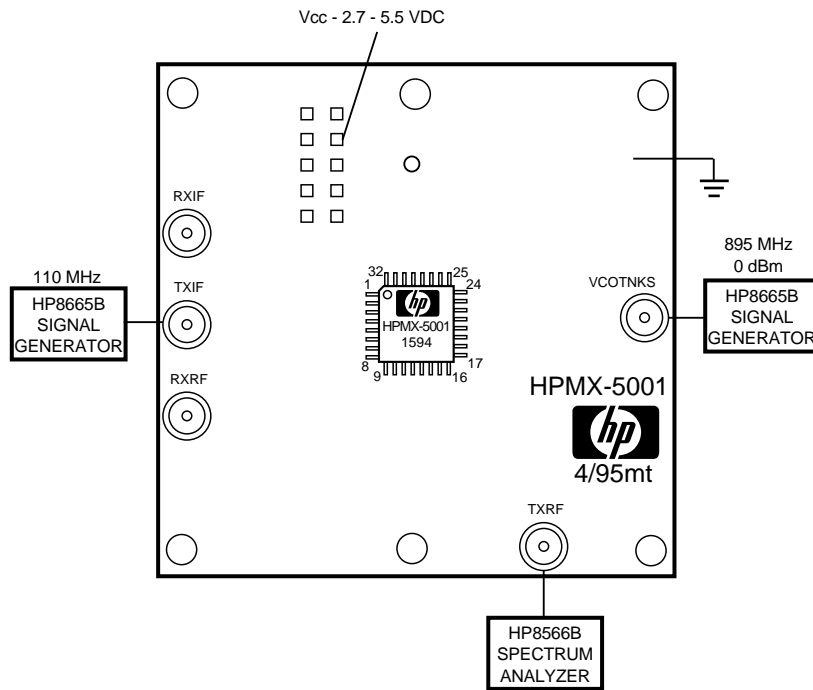


Figure 9. Test equipment set-up for measuring upconverter gain, P_{1dB} , and LO suppression.

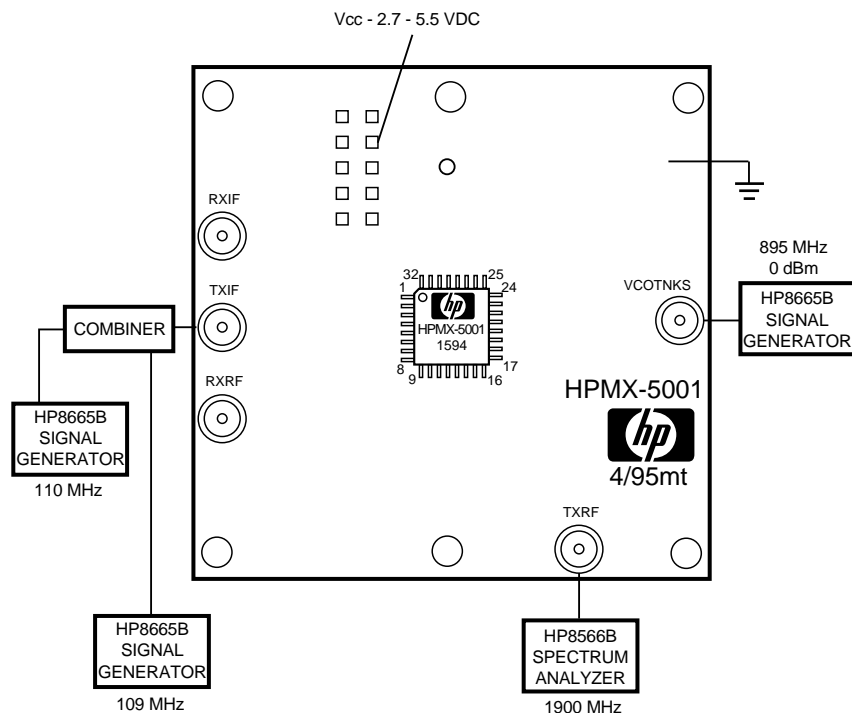


Figure 10. Test equipment set-up for measuring upconverter third order intermodulation.

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Data Subject to Change

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