

LTC3246EMSE Wide V_{IN} Range Buck-Boost Charge Pump with Watchdog Timer

DESCRIPTION

Demonstration circuit 2466A is a buck-boost 500mA charge pump with pin selectable output voltages and includes a watchdog timer featuring the [LTC®3246EMSE](#). The LTC3246 operates with a wide input voltage range from 2.7V to 38V and is engineered for diagnostic coverage for ISO 262262 compliant systems. The wide V_{IN} operating range will allow the LTC3246 to provide up to 500mA sufficiently during an automotive cold crank.

The LTC3246 data sheet gives a complete description of the device, operation and application information. The data sheet must be read in conjunction with this demo manual.

Design files for this circuit board are available at <http://www.linear.com/demo/DC2466A>

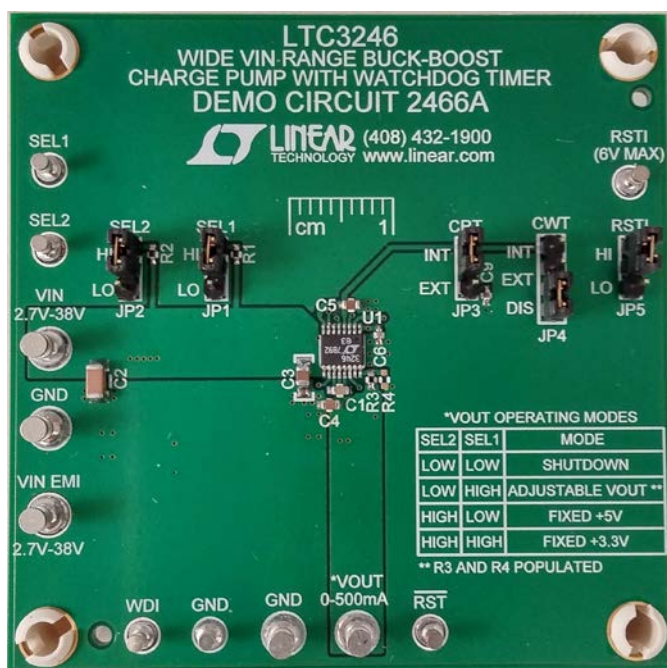
LT, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks of Analog Devices, Inc. All other trademarks are the property of their respective owners.

PERFORMANCE SUMMARY

Specifications are at $T_A = 25^\circ\text{C}$

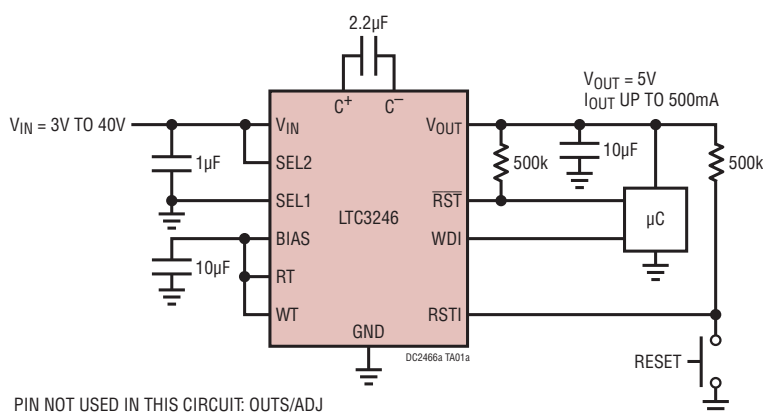
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	V_{IN} Input Voltage Range		2.7		38	V
V_{ADJ}	SEL2 = LOW, SEL1 = HIGH	$2.7\text{V} < V_{IN} < 38\text{V}$	1.07	1.1	1.13	V
V_{OUTS_5}	SEL2 = HIGH, SEL1 = LOW	$2.7\text{V} < V_{IN} < 38\text{V}$	4.8	5.0	5.2	V
V_{OUTS_3}	SEL2 = HIGH, SEL1 = HIGH	$2.7\text{V} < V_{IN} < 38\text{V}$	3.17	3.3	3.43	V

BOARD PHOTO

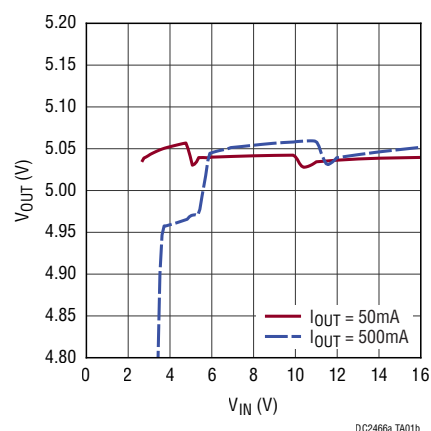


TYPICAL APPLICATIONS

Regulated 5V Output with Pushbutton Reset



Output Voltage vs Input Voltage



QUICK START PROCEDURE

Refer to Figure 1 for the proper measurement equipment setup and jumper settings and follow the procedure below.

NOTE: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the V_{IN} or V_{OUT} and GND terminals. See Figure 2 for proper scope probe technique.

1. Make sure the jumper settings are as follows:

JP1: SEL1 is on the HI position

JP2: SEL2 is on the HI position

JP3: CRT is on the INT position

JP4: CWT is on the DIS position

JP5: RSTI is on the HI position

2. Set PS1 to 14V and then turn on.

3. Slowly increase LD1 to 500mA and observe V_{OUT} is regulating at 3.3V and that the input current is about $\frac{1}{2}$ of the output current. The LTC3246 is in 2:1 mode.

4. Decrease PS1 to 5V and observe that V_{OUT} is 3.3V and the input current is about equal to the output current. The LTC3246 is in 1:1 mode.

5. Decrease PS1 to 3V and observe that V_{OUT} is 3.3V and the input current is about 2x the output current. The LTC3246 is in 1:2 mode.

6. Turn off PS1 and set LD1 to 0A.

7. Set the SEL1 jumper, JP1, to the LO position.

8. Set PS1 to 14V and then turn on.

9. Slowly increase LD1 to 500mA and observe V_{OUT} is regulating at 5V and that the input current is about $\frac{1}{2}$ of the output current. The LTC3246 is in 2:1 mode.

10. Decrease PS1 to 9V and observe that V_{OUT} is 5V and the input current is about equal to the output current. The LTC3246 is in 1:1 mode.

11. Decrease PS1 to 3.3V and observe that V_{OUT} is 5V and the input current is about 2x the output current. The LTC3246 is in 1:2 mode.

12. Set PS1 to 14V and then turn off LD1.

13. Short the RSTI turret to GND and observe that the voltage on the $\overline{RST}$ turret is near 0V.

14. Remove the short on the RSTI turret and observe with an oscilloscope that the voltage on the $\overline{RST}$ turret returns to about V_{OUT} .

Note: The reset time can be adjusted by setting the CRT jumper, JP3, to the EXT position and using external capacitors if desired. The external CRT capacitor, C9, is populated with a 2.2nF to match the times referenced in the data sheet. The reset time can be increased by placing a parallel capacitor on the

QUICK START PROCEDURE

optional C8 capacitor pads on the bottom side of the board.

15. Set the CWT jumper, JP4, to the EXT positions and observe that the voltage on the $\overline{\text{RST}}$ turret is pulsing between 0V and VOUT.
 16. Set a pulse generator with a 0 to 5V, 1ms pulse width and a 20ms period on the WDI turret. Observe the voltage on the $\overline{\text{RST}}$ turret is high.
 17. Decrease the pulse period below 4.5ms and observe the voltage on the $\overline{\text{RST}}$ is pulsing again.
 18. Slowly increase the pulse period to above 220ms and observed the voltage on the $\overline{\text{RST}}$ turret returns and stays at VOUT when the period is between about 10ms and about 160ms. The voltage on the $\overline{\text{RST}}$ turret starts to pulse again when the pulse period on the WDI turret increases above 220ms.
- Note:** The watchdog time can be adjusted using external capacitors if desired. The external WDT capacitor, C6, is populated with a 2.2nF to match the times referenced in the data sheet. The watchdog time can be increased by placing a parallel capacitor on the optional C7 capacitor pads on the bottom side of the board.
19. To observe the internal watchdog time, set the CWT jumper, JP4, to the INT position. The watchdog upper boundary will now be about 1.6s and the lower boundary is about 50ms.
 20. Turn off the loads, pulse generator and supply when done evaluation.
 21. Return the jumpers to their default settings as shown in Figure 1 if desired.

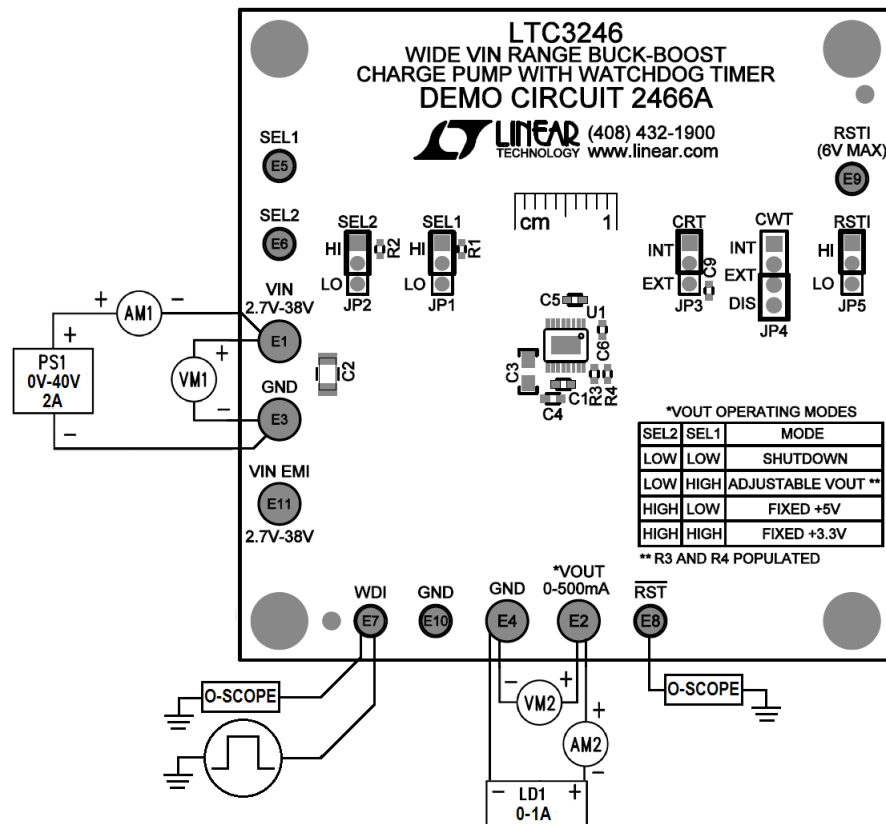


Figure 1. Proper Measurement Equipment Setup for DC2466A

QUICK START PROCEDURE

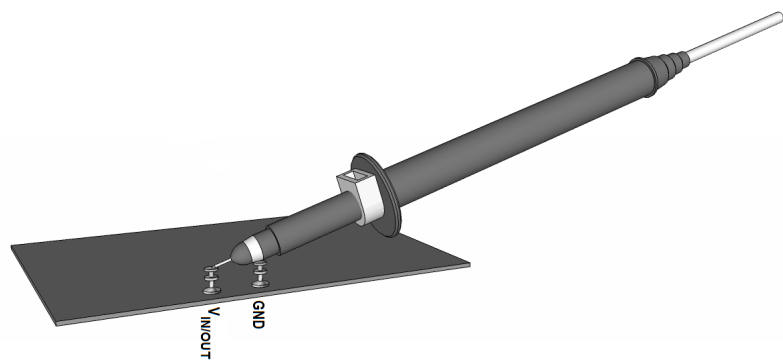


Figure 2. Measuring Input or Output Ripple

APPLICATIONS INFORMATION

Figures 3 and 4 illustrate how the efficiency and power loss changes as the input voltage increases for the 5V and 3.3V output settings.

A 47μF output capacitor was used on the demo board to provide better output ripple with voltages below 3.3V. Refer to the VOUT ripple and capacitor selection of the data sheet for more information on output capacitor selection.

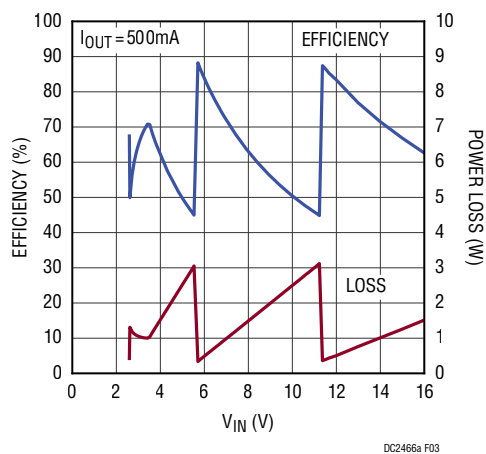


Figure 3. 5V Efficiency and Power Loss vs Input Voltage



Figure 4. 3.3V Efficiency and Power Loss vs Input Voltage

APPLICATIONS INFORMATION

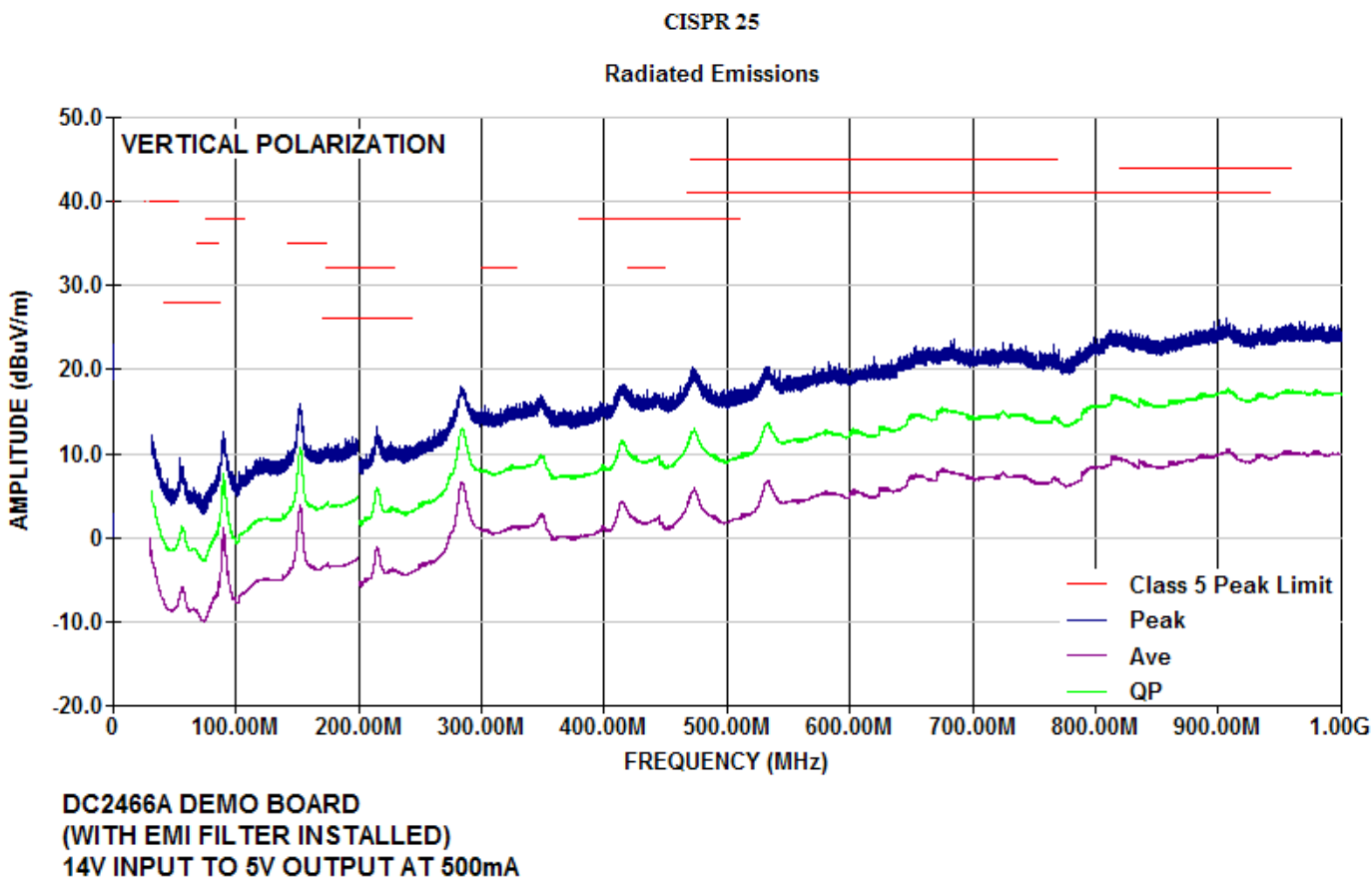


Figure 6. CISPR25 Radiated Emissions with Vertical Polarization

APPLICATIONS INFORMATION

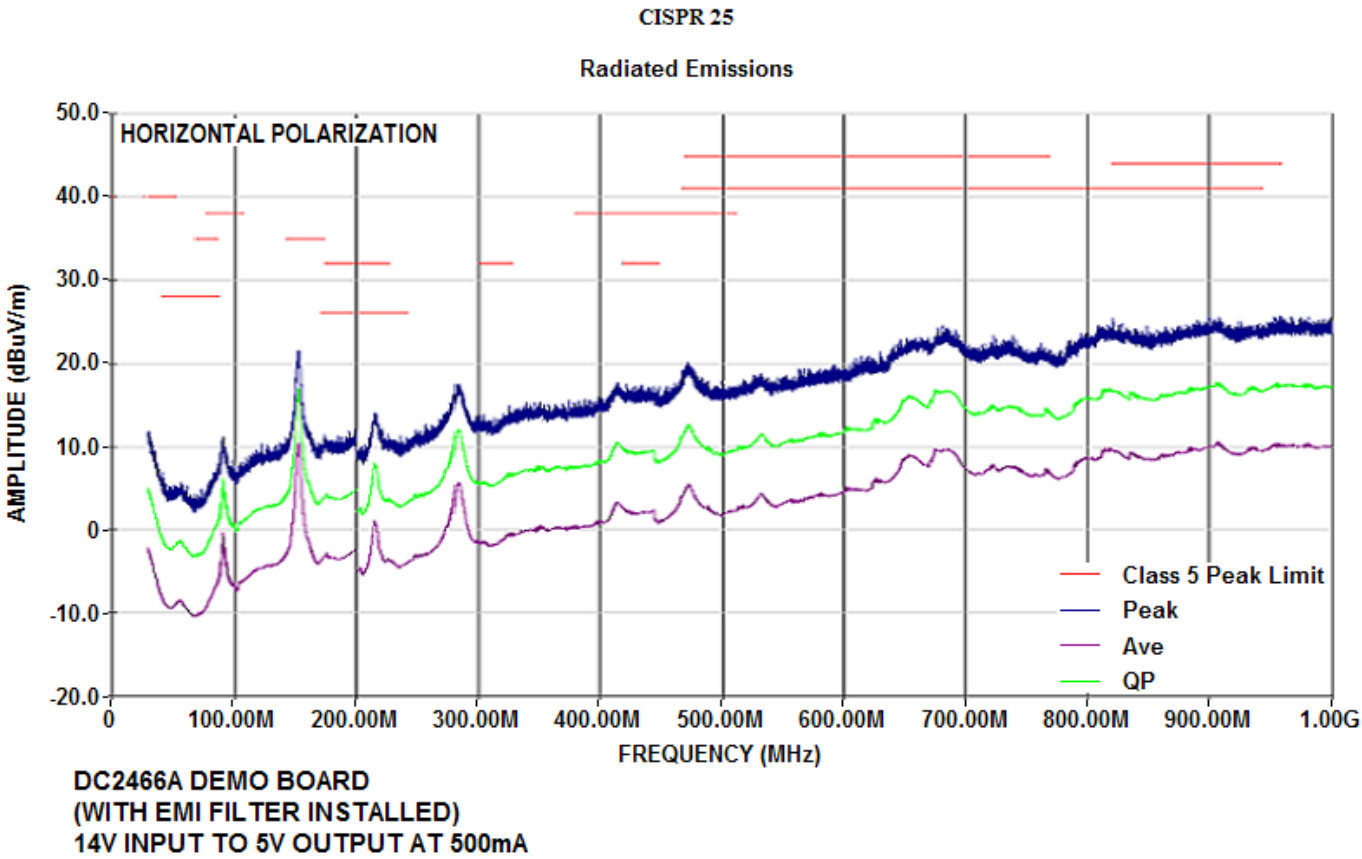


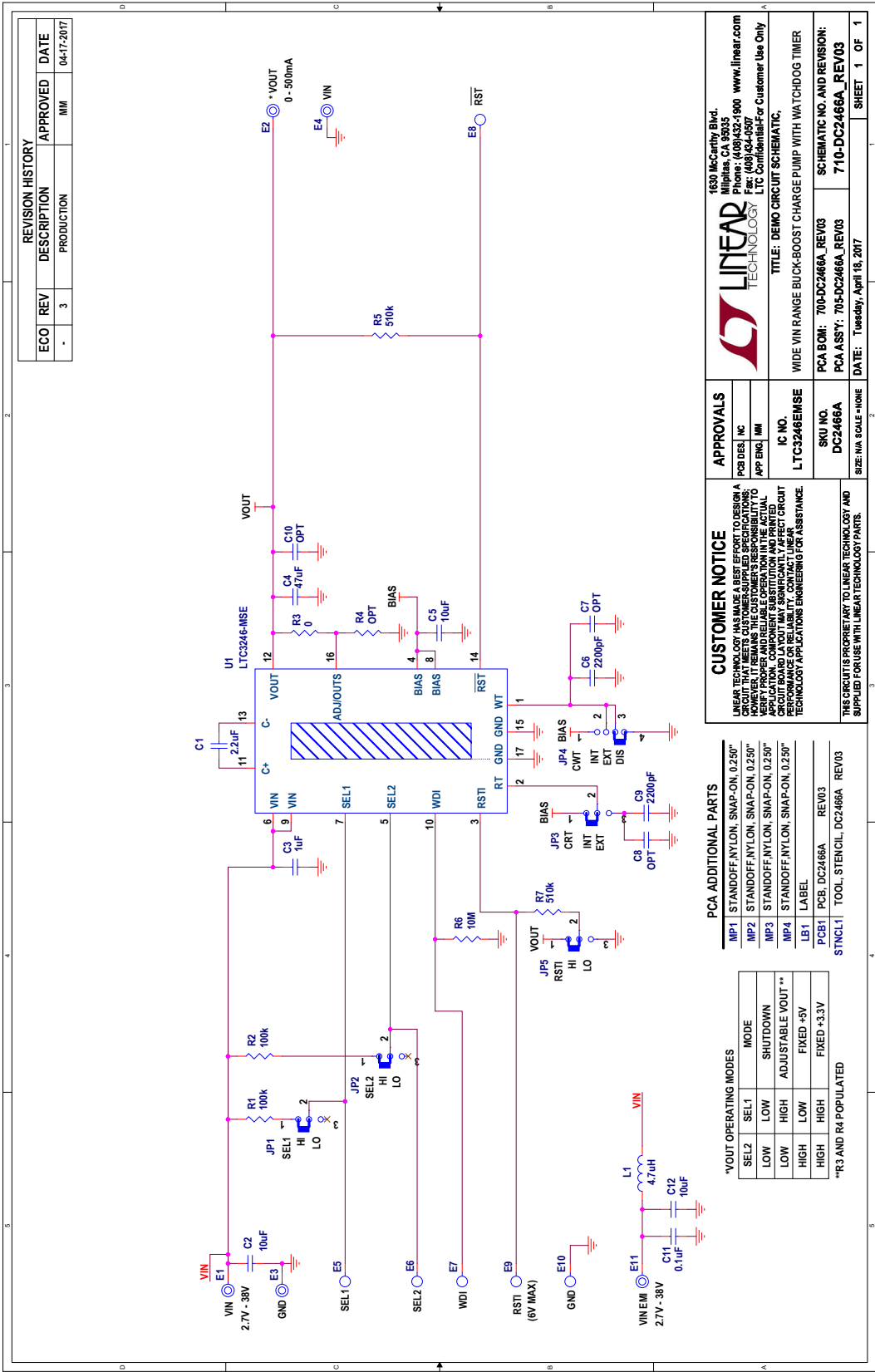
Figure 7. CISPR25 Radiated Emissions with Horizontal Polarization

DEMO MANUAL DC2466A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, 2.2 μ F, X5R, 10V, 10%, 0603	MURATA GRM188R61A225KE34D
2	1	C3	CAP, 1 μ F, X7R, 50V, 10%, 0805	MURATA GRM21BR71H105KA12L
3	1	C4	CAP, 47 μ F, X5R, 6.3V, 20%, 0603	MURATA GRM188R60J476ME15D
4	1	C5	CAP, 10 μ F, 6.3V, 10%, X5R, 0603	TDK CORPORATION C1608X5R0J106K080AB
5	1	U1	IC, WIDE V_{IN} RANGE BB CHARGE PUMP WITH WD TIMER	LINEAR TECHNOLOGY LTC3246EMSE#PBF
Additional Demo Board Circuit Components				
6	2	C2, C12	CAP, 10 μ F, X5R, 50V, 10%, 1206	TDK C3216X5R1H106K
7	2	C6, C9	CAP, 2200pF, C0G, 25V, 5%, 0402	KEMET C0402C222J3GACTU
8	0	C7, C8	CAP, OPTION, 0402	
9	0	C10	CAP, OPTION, 0805	
10	1	C11	CAP, 0.1 μ F, X7R, 50V, 10%, 0402	MURATA GRM155R71H104KE14D
11	1	L1	IND, 4.7 μ H, FERRITE, 20%, 1.95A, 90m Ω , 3mm $\times$ 2.5mm $\times$ 1.5mm	TDK VLF302515MT-4R7M
12	2	R1, R2	RES, 100k Ω , 5%, 1/16W, 0402	YAGEO RC0402JR-07100KL
13	1	R3	RES, 0 Ω , 1/16W, 0402	ROHM MCR01MZPJ000
14	0	R4	RES, OPTION, 0402	
15	2	R5, R7	RES, 510k Ω , 5%, 1/16W, 0402	VISHAY CRCW0402510KJNED
16	1	R6	RES, 10M Ω , 5%, 1/16W, 0402	VISHAY CRCW040210M0JNED
Hardware: For Demo Board Only				
17	5	E1 TO E4, E11	TEST POINT, TURRET, 0.094", MTG HOLE	MILL-MAX 2501-2-00-80-00-00-07-0
18	6	E5 TO E10	TEST POINT, TURRET, 0.064", MTG HOLE	MILL-MAX 2308-2-00-80-00-00-07-0
19	4	JP1, JP2, JP3, JP5	CONN, HDR, MALE, 1 $\times$ 3, 2mm, THT, STR	WURTH ELEKTRONIK 62000311121
20	1	JP4	CONN, HDR, MALE, 1 $\times$ 4, 2mm, THT, STR	WURTH ELEKTRONIK 62000411121
21	4	MP1 TO MP4	STANDOFF, NYLON, SNAP-ON, 0.250"	KEYSTONE 8831
22	5	XJP1 TO XJP5	CONN, SHUNT, FEMALE, 2 POS, 2mm	WURTH ELEKTRONIK 60800213421

SCHEMATIC DIAGRAM



DEMO MANUAL DC2466A

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Analog Devices Inc.:](#)

[DC2466A](#)