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.

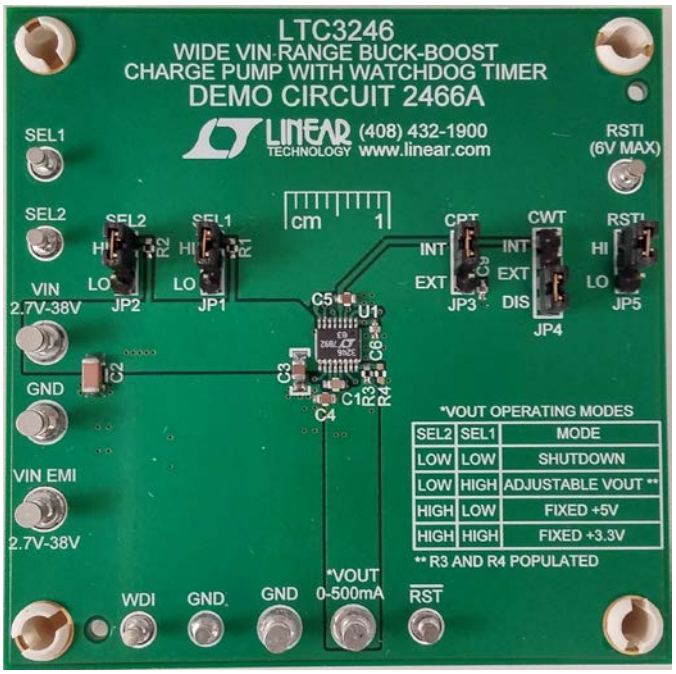
Design files for this circuit board are available at http://www.linear.com/demo/DC2466A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

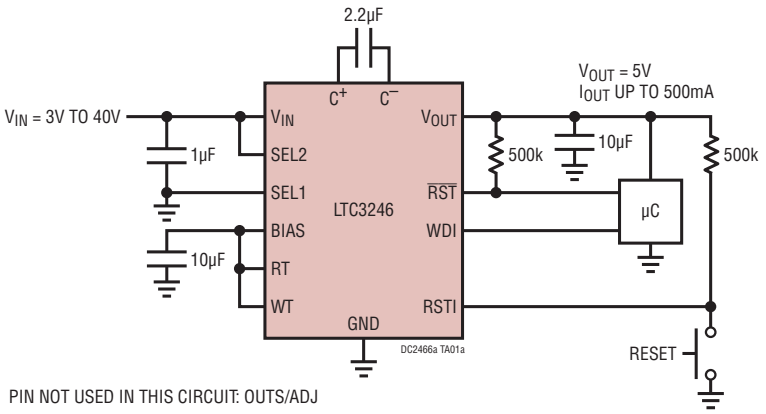
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	V_{IN} Input Voltage Range		2.7		38	V
V_{ADJ}	SEL2 = LOW, SEL1 = HIGH	2.7V < V_{IN} < 38V	1.07	1.1	1.13	V
V_{OUTS_5}	SEL2 = HIGH, SEL1 = LOW	2.7V < V_{IN} < 38V	4.8	5.0	5.2	V
V_{OUTS_3}	SEL2 = HIGH, SEL1 = HIGH	2.7V < V_{IN} < 38V	3.17	3.3	3.43	V

BOARD PHOTO

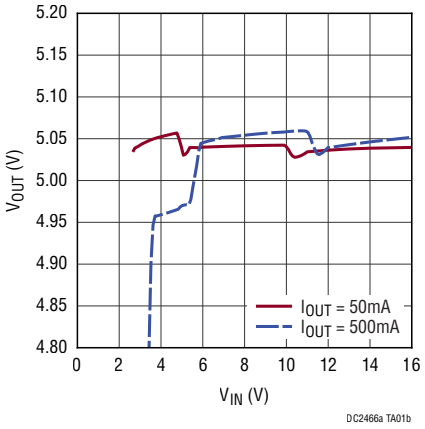


TYPICAL APPLICATIONS

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 VOUT is regulating at 3.3V and that the input current is about ½ of the output current. The LTC3246 is in 2:1 mode.
4. Decrease PS1 to 5V and observe that VOUT 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 VOUT 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 VOUT is regulating at 5V and that the input current is about ½ of the output current. The LTC3246 is in 2:1 mode.
10. Decrease PS1 to 9V and observe that VOUT 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 VOUT 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 VOUT.

    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 $\overline{RST}$ 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 $\overline{RST}$ turret is high.
17. Decrease the pulse period below 4.5ms and observe the voltage on the $\overline{RST}$ is pulsing again.
18. Slowly increase the pulse period to above 220ms and observed the voltage on the $\overline{RST}$ turret returns and stays at VOUT when the period is between about 10ms and about 160ms. The voltage on the $\overline{RST}$ 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.

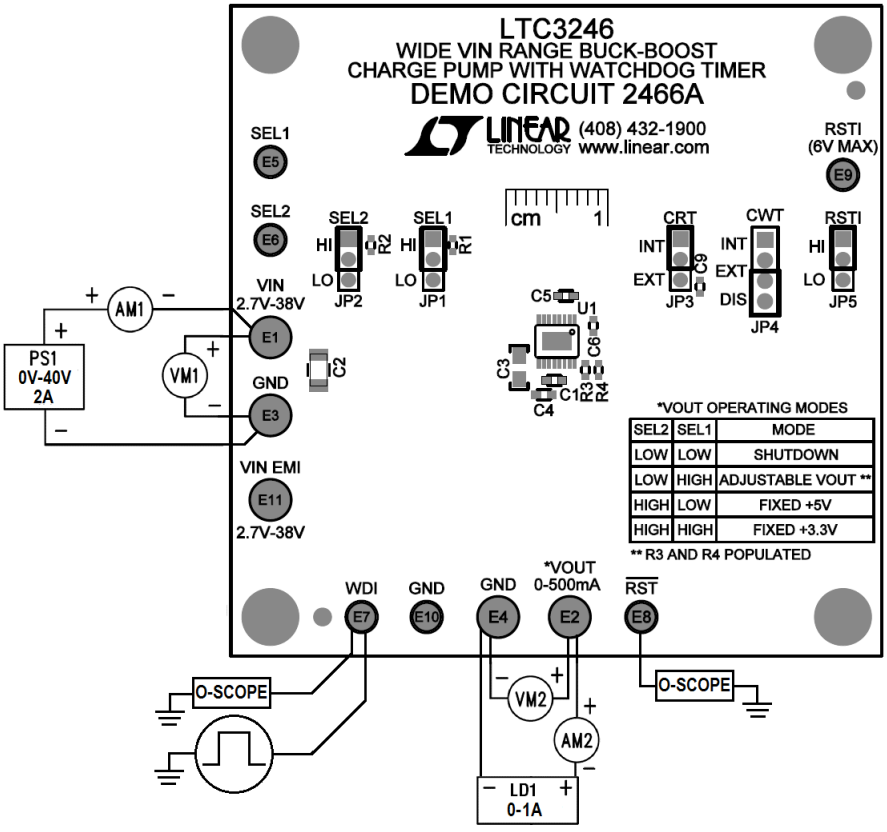


Figure 1. Proper Measurement Equipment Setup for DC2466A

QUICK START PROCEDURE

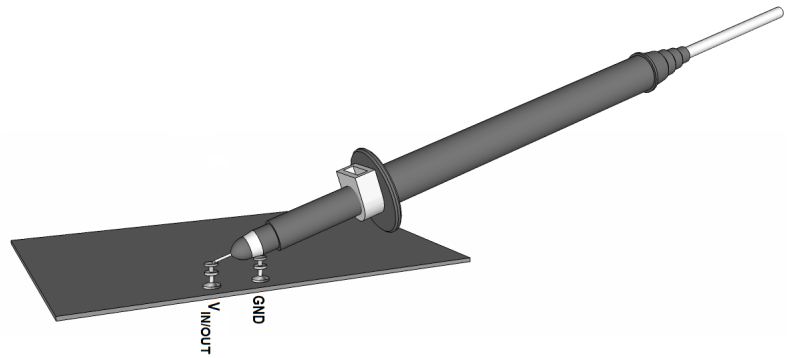


Figure 2. Measuring Input or Output Ripple

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.

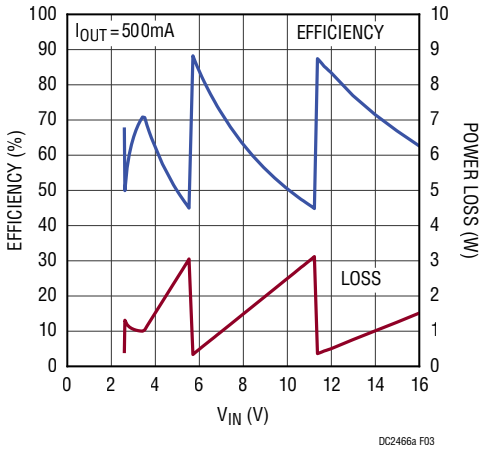


Figure 3. 5V Efficiency and Power Loss vs Input Voltage

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

APPLICATIONS INFORMATION

Figures 5, 6, and 7 show the CISPR 25 class 5 peak conducted and radiated emissions. The data was collected using the ALSE antenna method and a CISPR25 LISN for conducted emissions. The EMI tests were conducted using a 14V input on the VIN EMI input terminal, a 10Ω resistor on VOUT with VOUT set to 5V.

Linear Technology has made every effort to provide useful and accurate EMI data, but it remains the responsibility of the customer to ensure product compliance.

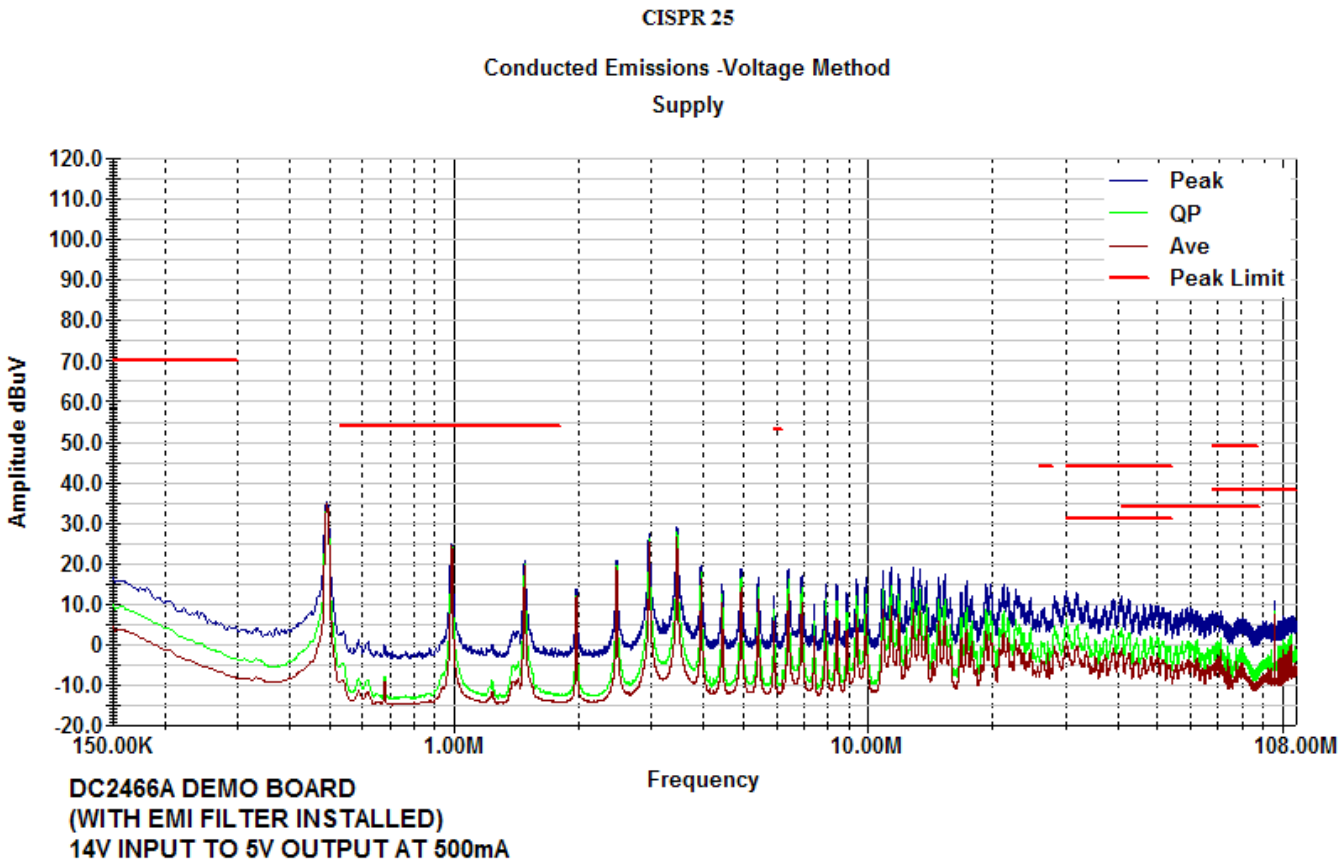


Figure 5. CISPR25 Conducted Emissions

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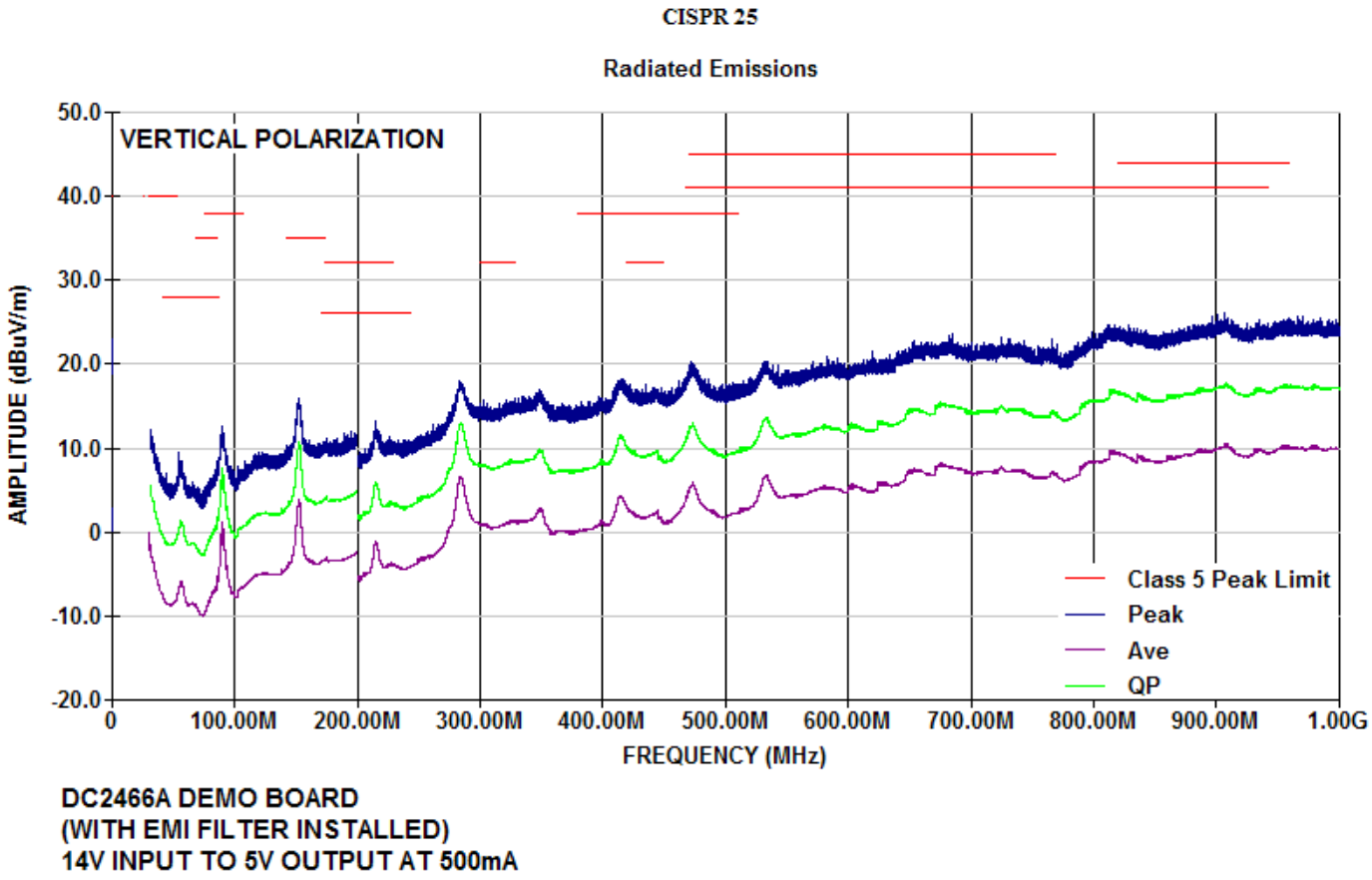


Figure 6. CISPR25 Radiated Emissions with Vertical Polarization

APPLICATIONS INFORMATION

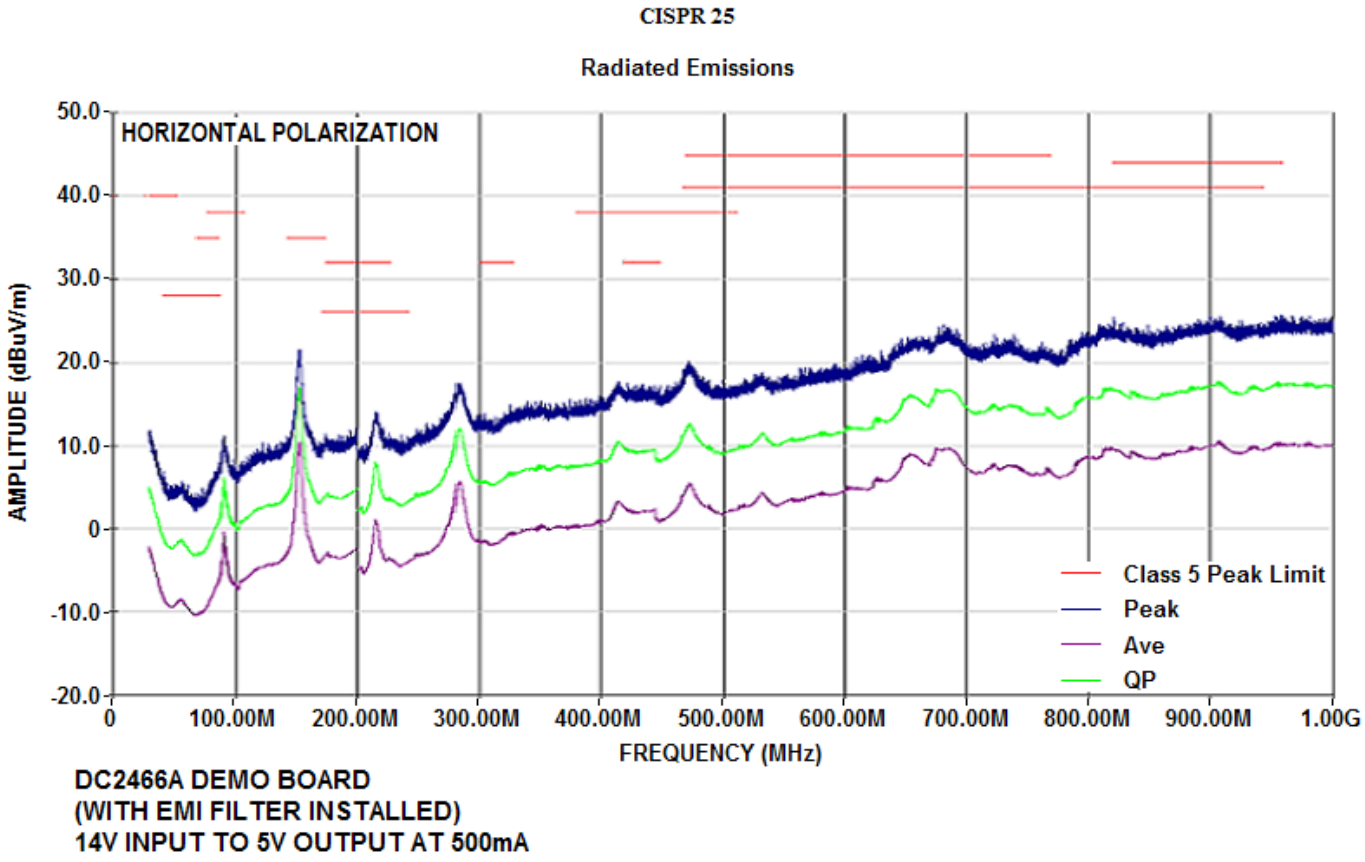
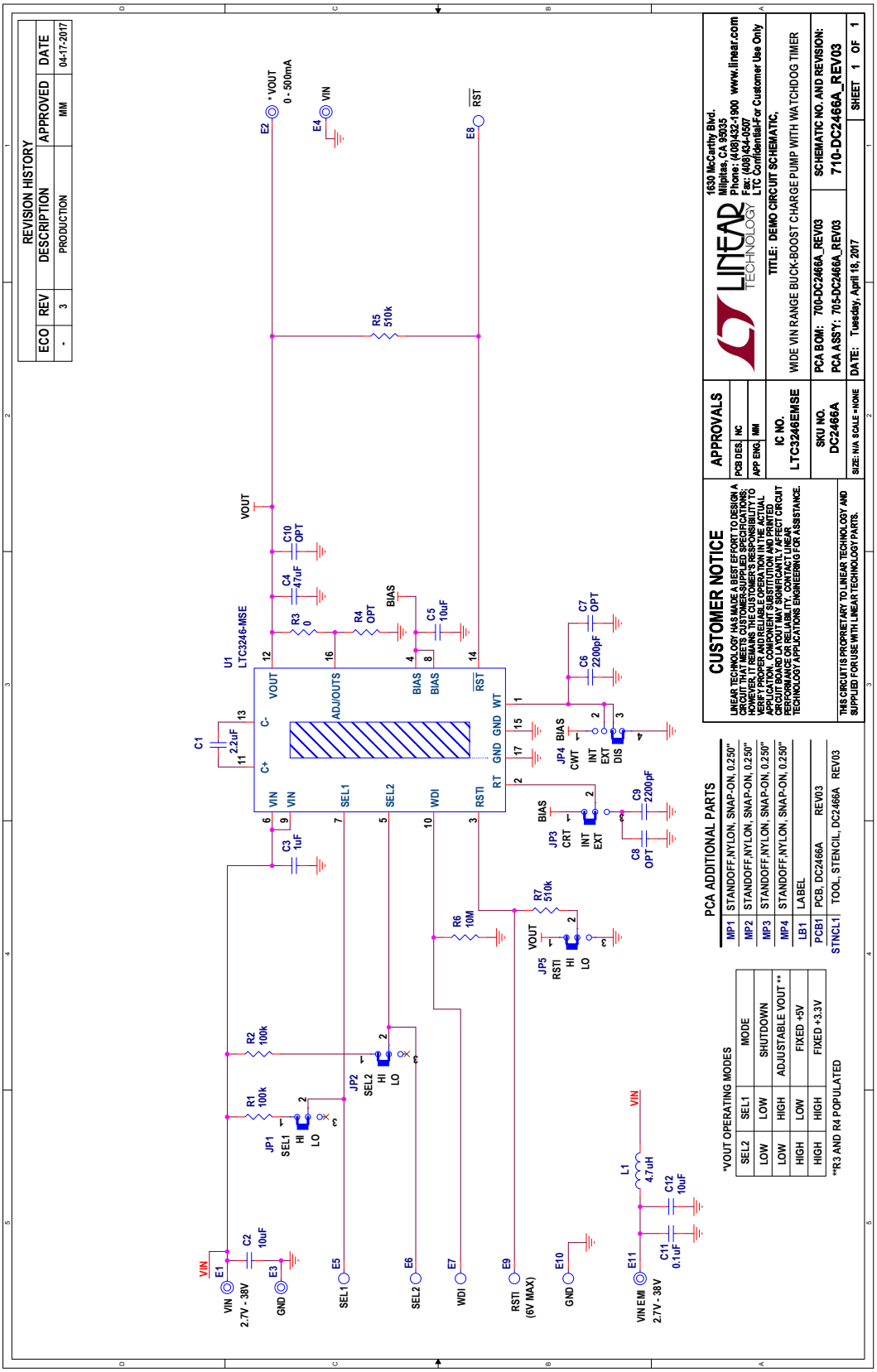


Figure 7. CISPR25 Radiated Emissions with Horizontal Polarization

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, 2.2µF, X5R, 10V, 10%, 0603	MURATA GRM188R61A225KE34D
2	1	C3	CAP, 1µF, X7R, 50V, 10%, 0805	MURATA GRM21BR71H105KA12L
3	1	C4	CAP, 47µF, X5R, 6.3V, 20%, 0603	MURATA GRM188R60J476ME15D
4	1	C5	CAP, 10µF, 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, 10µF, 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, 0.1µF, X7R, 50V, 10%, 0402	MURATA GRM155R71H104KE14D
11	1	L1	IND, 4.7µH, FERRITE, 20%, 1.95A, 90mΩ, 3mm × 2.5mm × 1.5mm	TDK VLF302515MT-4R7M
12	2	R1, R2	RES,100kΩ, 5%, 1/16W, 0402	YAGEO RC0402JR-07100KL
13	1	R3	RES, 0Ω, 1/16W, 0402	ROHM MCR01MZPJ000
14	0	R4	RES, OPTION, 0402	
15	2	R5, R7	RES, 510kΩ, 5%, 1/16W, 0402	VISHAY CRCW0402510KJNED
16	1	R6	RES, 10MΩ, 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, 1×3, 2mm, THT, STR	WURTH ELEKTRONIK 62000311121
20	1	JP4	CONN, HDR, MALE, 1×4, 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



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