

NCP1081 Evaluation Board User's Manual

PoE-PD Interface & Flyback Controller Board



NCP1081REF12VC4GEVB

General

The NCP1081REF12VC4GEVB board allows easy implementation and evaluation of a Power-over-Ethernet powered equipment that is able to operate with an assigned power level up to 25.5 W. The evaluation board is based on PoE Powered Device controller NCP1081 (U2) with integrated PoE PD interface controller and Flyback DC/DC controller. The Flyback converter on this NCP1081 based reference design generates a 12 V output voltage that is isolated from the Ethernet link conductors.



**Figure 1. Operational NCP1081REF12VC4GEVB
showing Basic Interconnections**

The NCP1081REF12VC4GEVB board is designed as a PoE splitter: having a PoE-enabled Ethernet port (labeled “PoE IN”) as input and generating an isolated 12 V supply while passing through the data to another Ethernet port (labeled “ETH OUT”).

Quick Start Guide

Step 1: Make sure the jumper is mounted on header P3 (labeled “MPS”).

Step 2: Insert the Ethernet cable (cf. blue cable in the picture on the left) coming from the PSE in the Ethernet connector J2 labeled “PoE IN”.

Step 3: Observe the status LEDs.

If the PSE powers up the system, the green POWER-ON LED (labeled “PWRON”) should be ON.

The status of the yellow LED (labeled “NCL”) depends on the PSE being used.

Step 4: Optionally connect the turret terminals that are labeled “GND” and “12V” to a DC electronic load (cf. black and red clips in the picture on the left). The DC electronic load behind the NCP1081 EVB should be operational over a 11 V to 13 V voltage range.

Assigned Power

The NCP1081REF12VC4GEVB will request Class 4 during Physical Layer classification. PDs need to consider that they can be underpowered and eventually be assigned to Class 3.

The state of the nCLASS_AT output provides information about the power level that the PSE has assigned to the NCP1081REF12VC4GEVB during classification. See Table 1 to determine the assigned power based on the status of the orange NCL led.

Table 1. CLASSIFICATION RESULT

NCL Led	Assigned Class	Assigned Power
off	3	13 W
on	4	25.5 W

Figure 2 shows that the load on the 12 V output should be limited to **1.82 A** to meet the maximum input average power for **Class 4** over the complete input DC voltage range. Likewise, Figure 3 shows that the load on the 12 V output should be limited to **0.92 A** to meet the maximum input average power for **Class 3** over the complete input DC voltage range.

The application should always operate at or below the assigned power limit. Failure to do so will result in the PSE disconnecting the PD !

Maintain Power Signature (MPS)

A PD should draw a minimum amount of current in order to prevent the PSE from removing power. The load resistor R15 was added on the bottom side of the board to be able to make sure the load current is always sufficient and the NCP1081REF12VC4GEVB remains powered. This load resistor R15 is enabled when a **jumper** is placed on header P3 labeled “MPS”. As can be seen on Figure 4, the input

current remains well above 10 mA over the complete PSE output voltage range when the jumper is mounted on the “MPS” header P3.

Depending on the minimum current the system may draw, the resistance value of R15 should be increased for the final design in order not to waste power unnecessarily.

For some systems, the load resistor can even be omitted.

Earth Connection

A Powered Device (PD) can operate without an earth connection.

In case NCP1081REF12VGEVB would need to be earthed, it should be the frame ground “Frame” that is connected to earth. This could be implemented in one of the following ways:

- Soldering an earthed wire in the 1.6 mm hole (labeled “E”)
- Connecting an earthed wire with alligator clip on the SMT Test Point on the top (TP12) or the SMT Test Point on the bottom (TP17)
- Connecting a shielded Ethernet cable of which the shield is earthed to the PoE-enabled Ethernet port J2 (labeled “PoE IN”)

If NCP1081REF12VGEVB is earthed, the internal system ground “GND” should not be driven more than 15V above or below earth potential in order not to overstress TVS diode D21.

Requested Power

As mentioned before, the NCP1081REF12VC4GEVB will request Class 4 during Physical Layer classification. If a lower Class or power level is preferred, resistor R26 labeled “CLASS” should be changed. See the NCP1081 datasheet for the nominal resistance values.

NCP1081REF12VC4GEVB

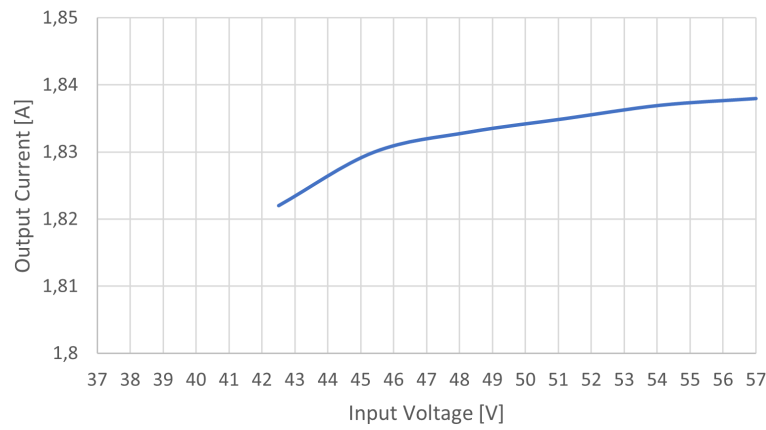


Figure 2. Output Current vs. PoE Input Voltage – Full Input Power Load (Class 4)

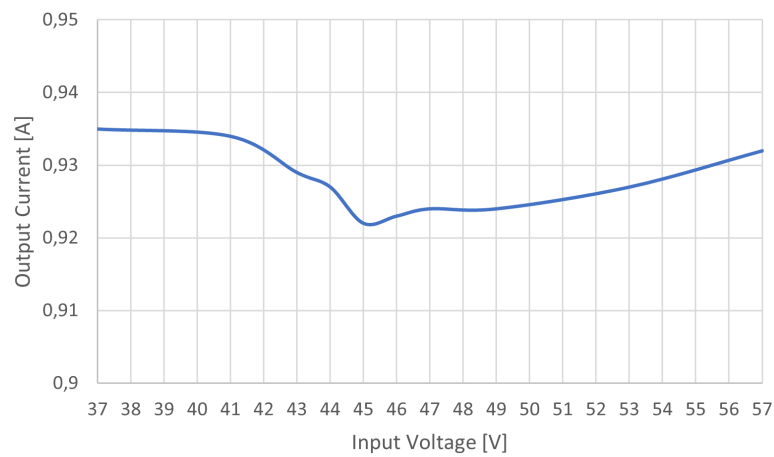


Figure 3. Output Current vs. PoE Input Voltage – Full Input Power Load (Class 3)

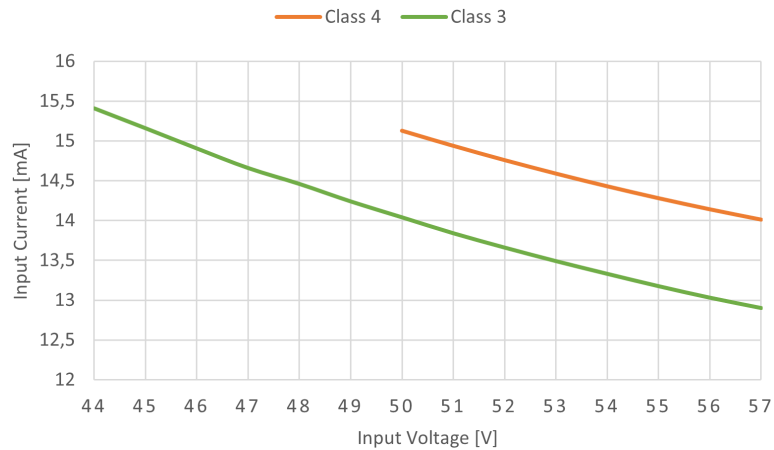


Figure 4. PoE Input Current vs PoE Input Voltage – No Output Load except R15

NCP1081REF12VC4GEVB

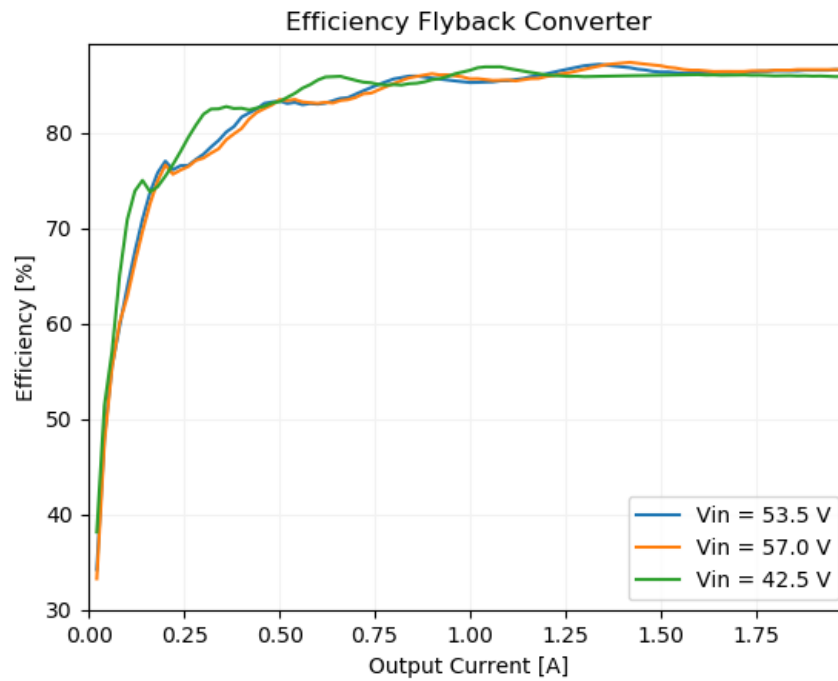


Figure 5. Efficiency vs. Output Current

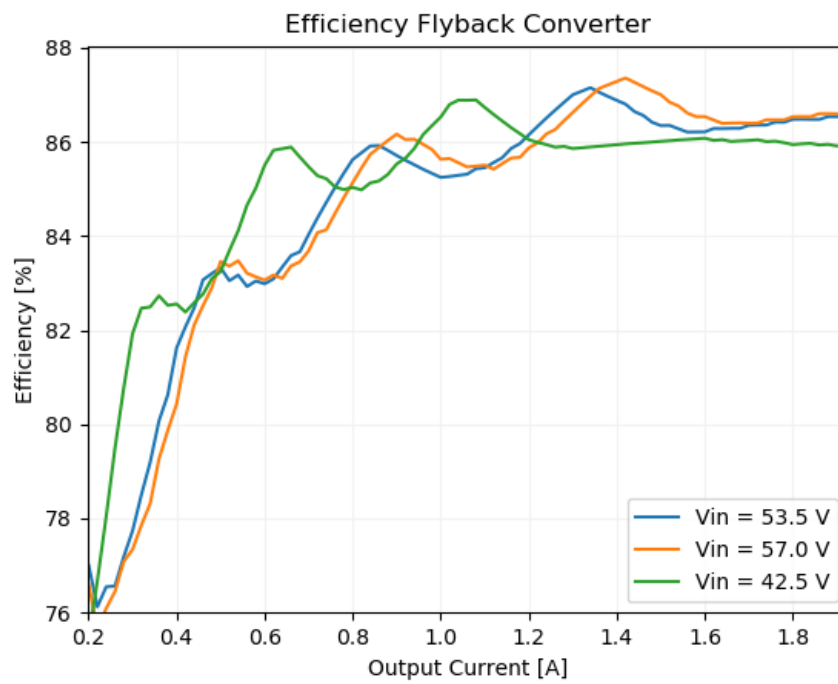


Figure 6. Efficiency vs. Output Current – Zoom In

NCP1081REF12VC4GEVB

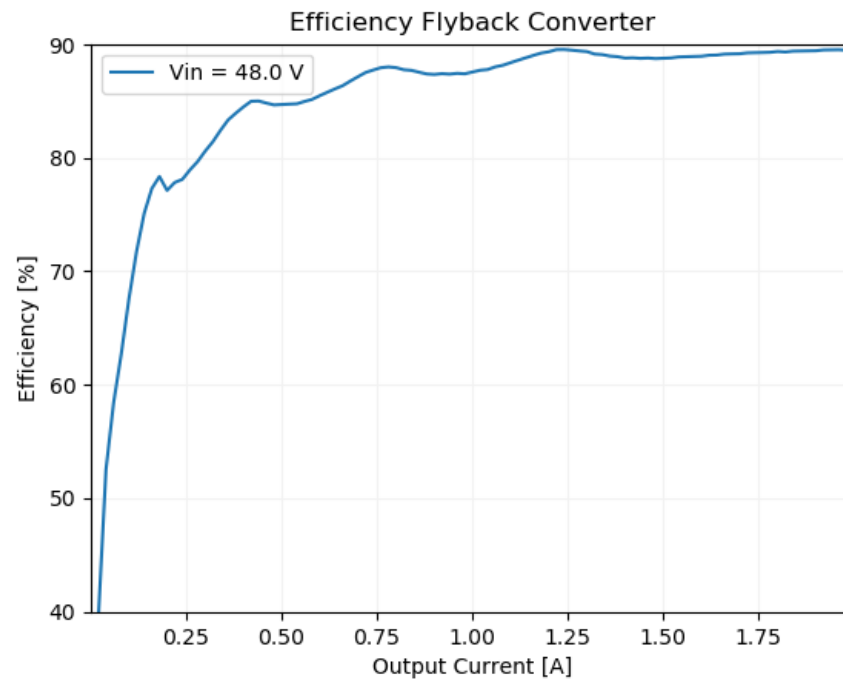


Figure 7. Efficiency vs. Output Current – from (VPP,RTN) to (12V,GND)

NCP1081REF12VC4GEVB

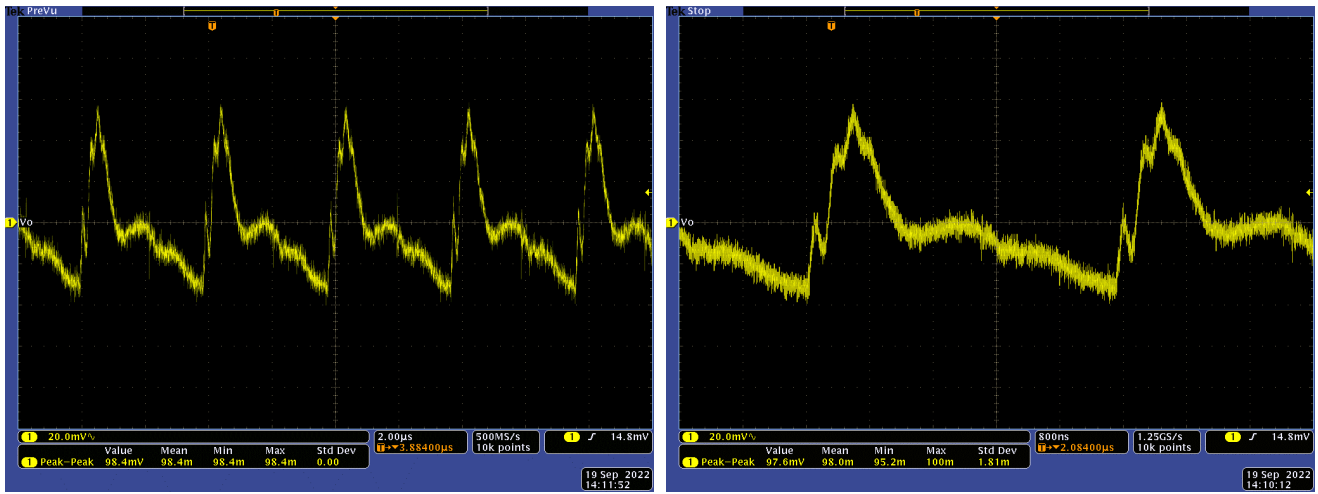


Figure 8. 12 V Output Ripple and Noise

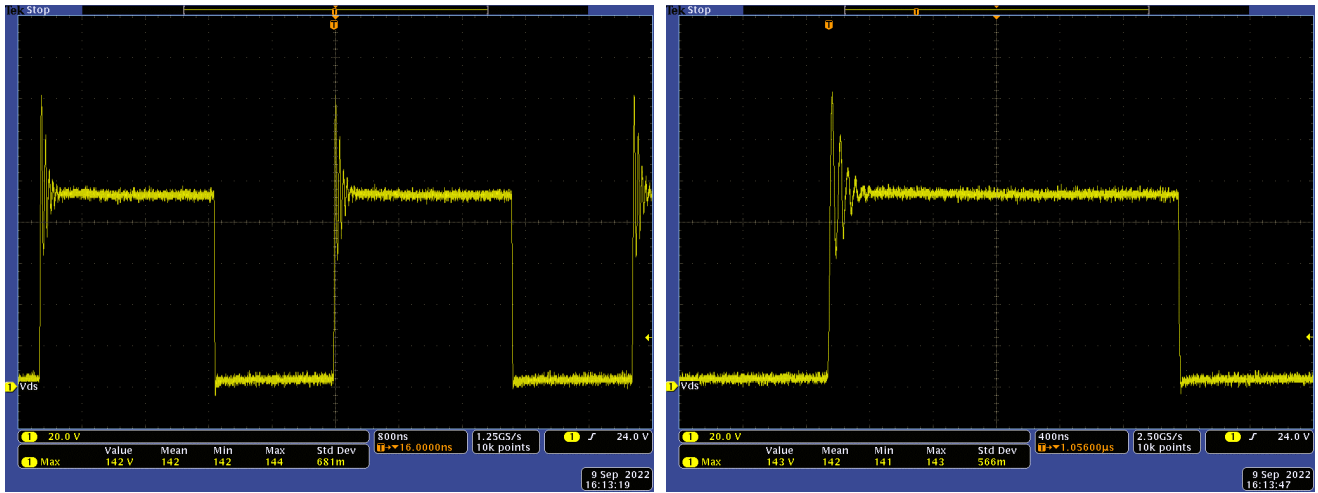


Figure 9. $V_{\text{DrainSource}}$ Primary Mosfet Q2 ($V_{\text{PD}} = 57 \text{ V}$)

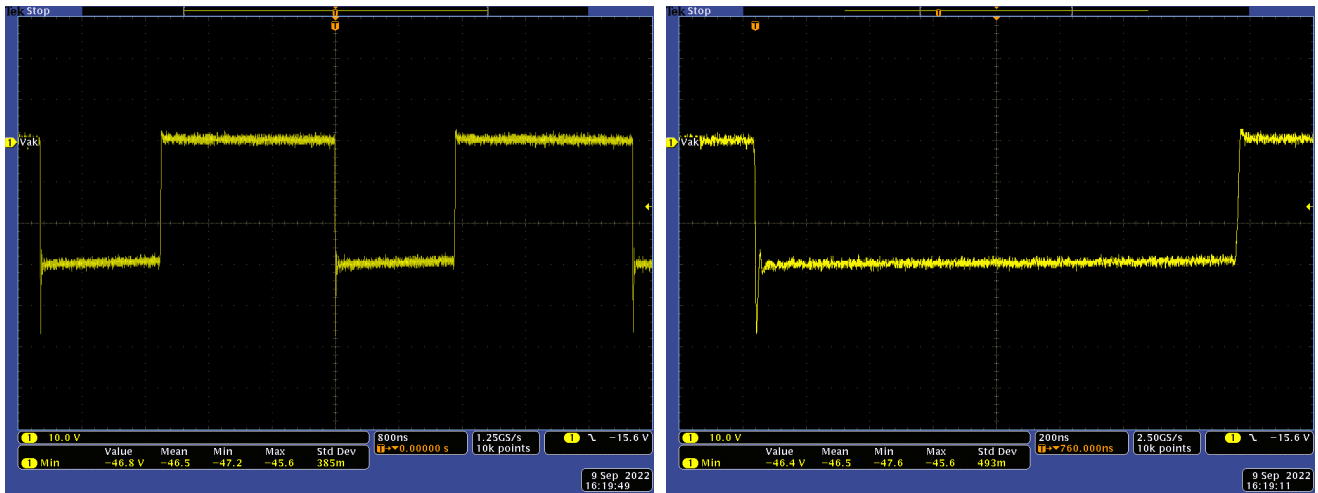


Figure 10. $V_{\text{CathodeAnode}}$ Secondary Diode D17 ($V_{\text{PD}} = 57 \text{ V}$)



Figure 11. Thermal Image – Top

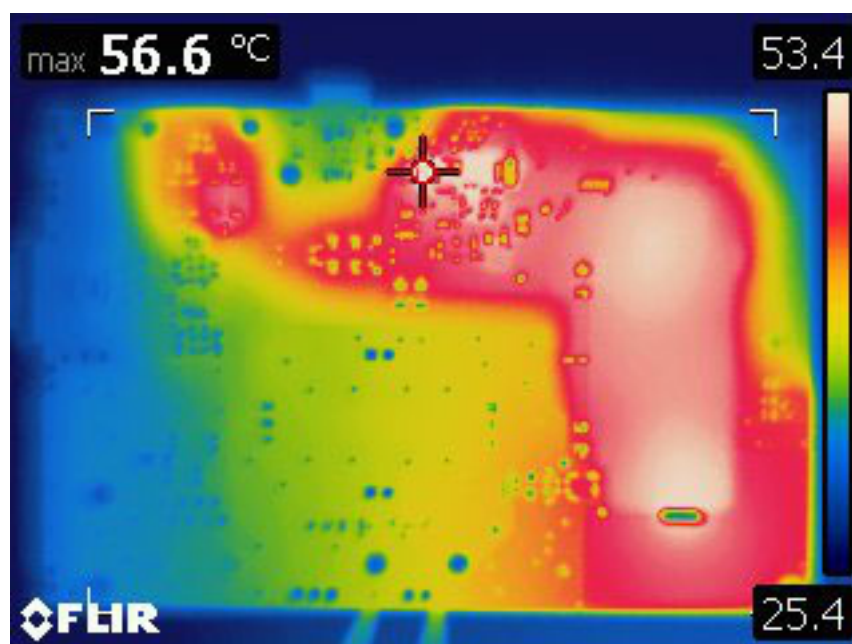


Figure 12. Thermal Image – Bottom

NCP1081REF12VC4GEVB



Figure 13. Emission Test DUT: NCP1081REF12VGEVB with 7.3 Ω Load

NCP1081REF12VC4GEVB

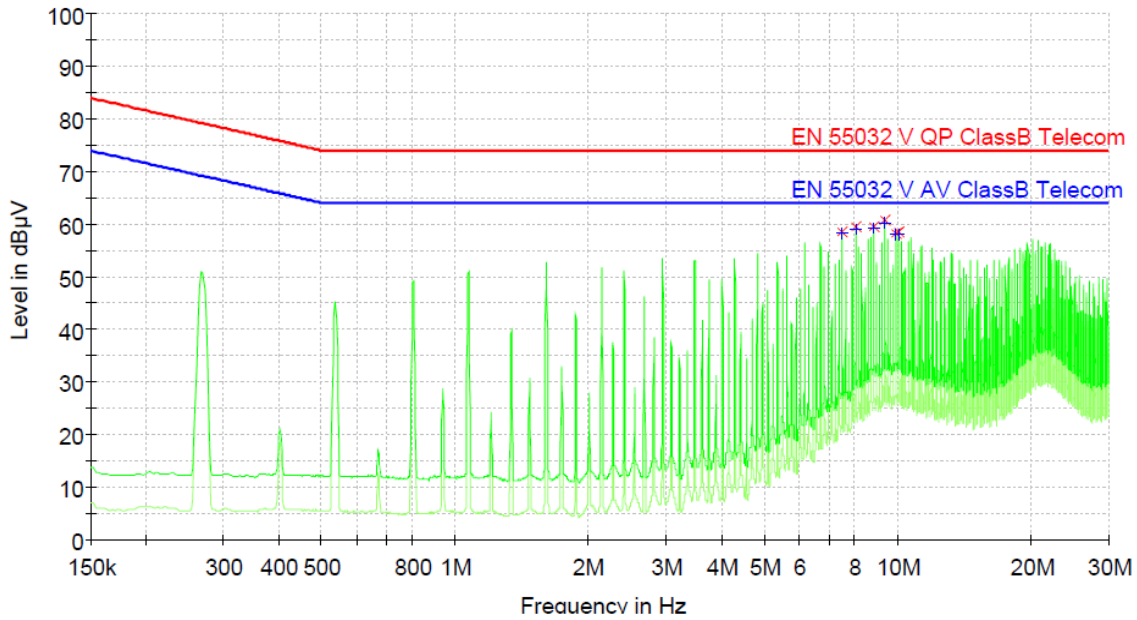


Figure 14. Conducted Emission – Preview Result and Final Result

Table 2. CONDUCTED EMISSION – FINAL RESULT QPK

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Corr. (dB)
7.503000	58.48	74.00	15.52	9.6
8.038500	59.38	74.00	14.62	9.7
8.841750	59.61	74.00	14.39	9.7
9.379500	60.63	74.00	13.37	9.7
9.915000	58.32	74.00	15.68	9.7
10.047750	58.47	74.00	15.53	9.7

Table 3. CONDUCTED EMISSION – FINAL RESULT CAV

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Corr. (dB)
7.503000	58.25	64.00	5.76	9.6
8.038500	59.12	64.00	4.88	9.7
8.844000	59.30	64.00	4.70	9.7
9.379500	60.29	64.00	3.71	9.7
9.915000	57.94	64.00	6.06	9.7
10.047750	58.08	64.00	5.92	9.7

NCP1081REF12VC4GEVB

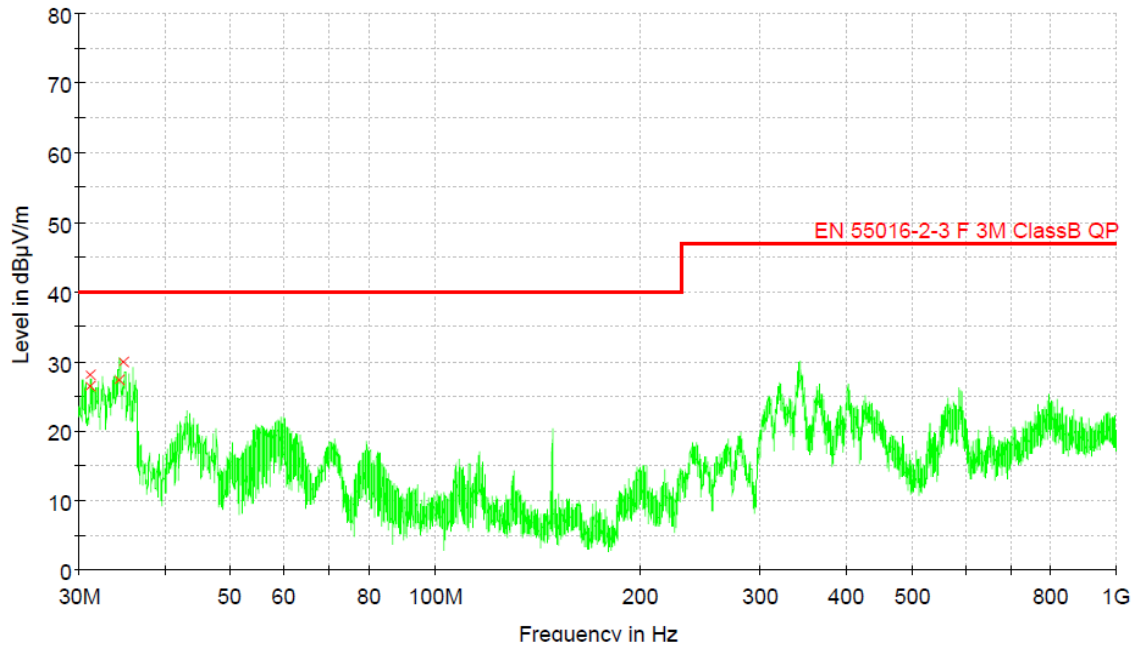


Figure 15. Radiated Emission – Preview Result and Final Result

Table 4. RADIATED EMISSION – FINAL RESULT QPK

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
31.160000	28.15	40.00	11.85	1000.0	120.000	98.0	V	173.0	-9.9
31.180000	26.45	40.00	13.55	1000.0	120.000	122.0	V	253.0	-9.9
34.360000	27.29	40.00	12.71	1000.0	120.000	103.0	V	138.0	-11.8
34.900000	29.86	40.00	10.14	1000.0	120.000	98.0	V	309.0	-12.1

NCP1081REF12VC4GEVB

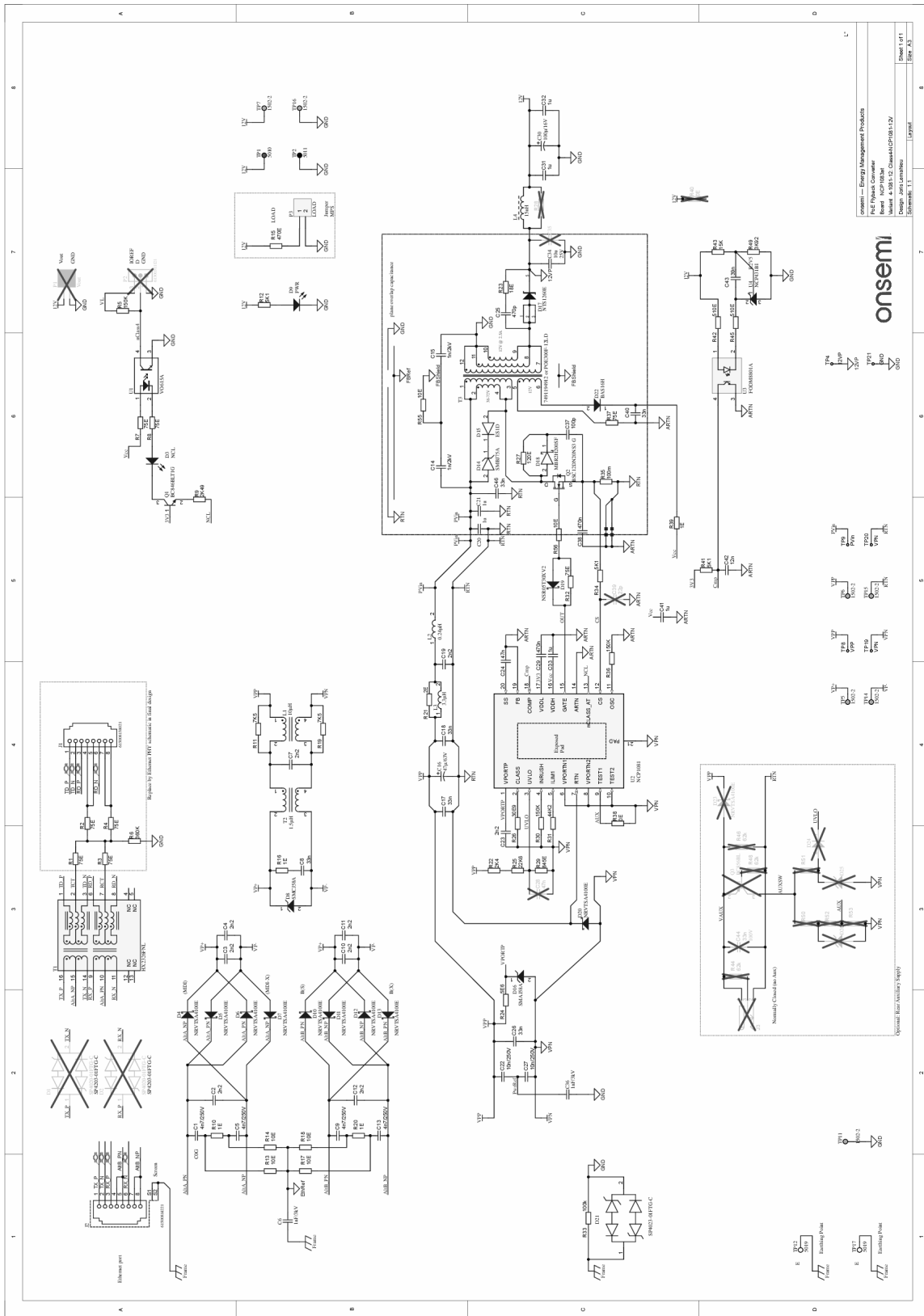


Figure 16. Schematic Diagram NCP1081REF12VC4GEVB

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