Introduction

This application note introduces a new "all-primary sensing" switching regulator ALTAIR04-900, used to build an innovative solution to supply a power line communication.

A demonstration board, implementing a wide-range double-output power supply, has been developed and the results of its bench evaluation are reported in this document.

The board uses the new ALTAIR04-900, a quasi-resonant (QR) current-mode controller IC specifically designed for QR ZVS (zero voltage switching at switch turn-on) flyback converters, which combines a high-performance low-voltage PWM controller chip and a typical 16 $R_{DSon}$, 900 V, avalanche-rugged power MOSFET in the same package.

The device is capable of providing constant output voltage regulation using primary-sensing constant voltage loop (CV loop). This eliminates the need for the optocoupler and the secondary voltage reference while still maintaining quite accurate regulation.

Also, using the primary constant current loop (CC loop), it is possible to set the maximum deliverable output current without any secondary components or current sensor.
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1 Test board design and evaluation

As a reference design, a 7.48 W nameplate output power SMPS has been specifically designed and developed according to the specifications for a complete power line communication based on ST7580 (by STMicroelectronics).

The power supply provides a 13 V output voltage to supply the power line modem (PLM) and the analog circuitry, and a post-regulated 3.3 V to supply digital circuitry and an optional external microcontroller.

Table 1 summarizes the electrical specifications of the power supply, Table 2 provides the bill of material and Table 3 lists the transformer specifications. The electrical schematic is shown in Figure 2 and the PCB layout in Figure 3 and 4.

Table 1. ALTAIR04-900 power supply: electrical specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Note</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC main input voltage</td>
<td></td>
<td>85</td>
<td>265</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Mains frequency (fL)</td>
<td></td>
<td>50</td>
<td>60</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>Output voltage 1</td>
<td>Analog supply voltage</td>
<td>11.7</td>
<td>13</td>
<td>14.3</td>
<td>V</td>
</tr>
<tr>
<td>Output current 1</td>
<td>Rx mode</td>
<td>12</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tx mode</td>
<td>35</td>
<td>550</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Output voltage 2</td>
<td>Digital supply voltage</td>
<td>3.3</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output current 2</td>
<td>No external microcontroller connection</td>
<td>40</td>
<td>50</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>External microcontroller connection</td>
<td>100</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total rated output power</td>
<td></td>
<td></td>
<td></td>
<td>7.48</td>
<td>W</td>
</tr>
<tr>
<td>Maximum output power</td>
<td>In TX mode</td>
<td>4.2</td>
<td>W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The input stage, consists of an NTC (NTC1) which limits the inrush current produced by the capacitor charging at plug-in and a varistor (RV1) that protects the power supply against temporary line overvoltage transients. The input EMI filter is a classic Pi-filter, 1-cell for common and differential mode noise. The clamping network (D2-D3) limits the peak of the leakage inductance voltage spike at turn-off, assuring reliable operation of the ALTAIR04-900.

The sense resistor R2 and the transformer primary-to-secondary turn ratio fix the maximum output current limitation, whereas the voltage divider made up of R6, R7, and R8 is used to set the output voltage setpoint, in order to ensure the desired output voltage regulation. The network connected on the COMP pin is used to compensate the loop, ensuring the right gain and phase margin to the system, whereas the voltage across the capacitor C10 is used to fix the voltage level for the CC loop; the value of this capacitor is not critical and a few nF are enough to ensure correct operation. The secondary side is provided by two output voltages; a nameplate 13 V output voltage is directly used to supply the analog circuitry of the PLM, whereas the lower voltage is achieved by a 3V3 LDO and is intended to supply the digital parts.
Figure 1. Electrical schematic

![Electrical schematic diagram]

Figure 2. PCB: component side (not to scale)

![PCB component side diagram]
Figure 3. Demonstration board image: power supply board
Figure 4. Demonstration board image: complete (power supply and PLM boards)

Table 2. ALTAIR04-900 power supply - bill of material

<table>
<thead>
<tr>
<th>Reference</th>
<th>Part</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>1.8 kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>1.3 Ω</td>
<td>1% tolerance</td>
<td></td>
</tr>
<tr>
<td>R3, R5</td>
<td>N.C.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>8.2 kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>8.2 kΩ</td>
<td>1% tolerance</td>
<td></td>
</tr>
<tr>
<td>R7</td>
<td>27 kΩ</td>
<td>1% tolerance</td>
<td></td>
</tr>
<tr>
<td>R8</td>
<td>5.1 kΩ</td>
<td>1% tolerance</td>
<td></td>
</tr>
<tr>
<td>R9</td>
<td>0Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>B41044A4108M</td>
<td>1000 μF - 16 V electrolytic</td>
<td>EPCOS</td>
</tr>
<tr>
<td>C2</td>
<td>B41858C4477M</td>
<td>470 μF - 16 V electrolytic</td>
<td>EPCOS</td>
</tr>
<tr>
<td>C3</td>
<td>B43851F9226M</td>
<td>22 μF - 400 V electrolytic</td>
<td>EPCOS</td>
</tr>
<tr>
<td>C4, C9</td>
<td></td>
<td>100 nF ceramic – 35 V</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>B41851A3477M</td>
<td>470 μF - 10 V electrolytic</td>
<td>EPCOS</td>
</tr>
</tbody>
</table>
### Table 2. ALTAIR04-900 power supply - bill of material (continued)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Part</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>C6</td>
<td>B32922C3224M</td>
<td>220 nF - X2</td>
<td>EPCOS</td>
</tr>
<tr>
<td>C7</td>
<td></td>
<td>2.2 nF - Y-CAP</td>
<td></td>
</tr>
<tr>
<td>C8</td>
<td></td>
<td>470 nF ceramic - 25 V</td>
<td></td>
</tr>
<tr>
<td>C10</td>
<td></td>
<td>4.7 nF ceramic - 25 V</td>
<td></td>
</tr>
<tr>
<td>C11</td>
<td></td>
<td>1 nF ceramic - 25 V</td>
<td></td>
</tr>
<tr>
<td>C12</td>
<td></td>
<td>3.3 μF - 35 V electrolytic</td>
<td>Rubycon</td>
</tr>
<tr>
<td>C13</td>
<td></td>
<td>100 μF - 16 V electrolytic</td>
<td>Rubycon</td>
</tr>
<tr>
<td>D1</td>
<td>STPS2150A</td>
<td>Power Schottky diode</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>D2</td>
<td>P6KE200A</td>
<td>Transil™</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>D3</td>
<td>STTH1L06A</td>
<td>Ultra-fast high voltage diode</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>D4</td>
<td>STPS1L30A</td>
<td>Power Schottky diode</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>D5</td>
<td>BAT41</td>
<td>Small signal Schottky</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>PD1</td>
<td>DF06S</td>
<td>Input bridge rectifier</td>
<td></td>
</tr>
<tr>
<td>L1</td>
<td>B82462G4472M</td>
<td>4.7 μH power inductor</td>
<td>EPCOS</td>
</tr>
<tr>
<td>L2</td>
<td>B82422H1105K</td>
<td>1 mH SMT inductor</td>
<td>EPCOS</td>
</tr>
<tr>
<td>IC1</td>
<td>ALTAIR04-900</td>
<td>Primary switching regulator</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>Q1</td>
<td>LF33AB</td>
<td>3.3 V LDO voltage regulator</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>CM</td>
<td>B82721K2701</td>
<td>CM Choke</td>
<td>EPCOS</td>
</tr>
<tr>
<td></td>
<td>744612101</td>
<td></td>
<td>Wurth</td>
</tr>
<tr>
<td>TF1</td>
<td>ECO2017SEO-X05V015</td>
<td>Flyback transformer</td>
<td>TDK</td>
</tr>
<tr>
<td></td>
<td>760-871-431</td>
<td></td>
<td>Wurth</td>
</tr>
<tr>
<td>NTC1</td>
<td>B57236S0160M</td>
<td>NTC inrush current limiter</td>
<td>EPCOS</td>
</tr>
<tr>
<td>RV1</td>
<td>B72214S0321K</td>
<td>320 V Varistor</td>
<td>EPCOS</td>
</tr>
<tr>
<td>F1</td>
<td></td>
<td>2 A fuse</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** If not otherwise specified, all resistors are 5%, ¼ W.
Table 3. **ALTAIR04-900 power supply: transformer characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>E16</td>
</tr>
<tr>
<td>Primary inductance</td>
<td>2 mH</td>
</tr>
<tr>
<td>Leakage inductance</td>
<td>1.42% nom.</td>
</tr>
<tr>
<td>Primary winding</td>
<td>7.68 ± 5%</td>
</tr>
<tr>
<td>Np1</td>
<td>111 turns</td>
</tr>
<tr>
<td>Np2</td>
<td>55 turns</td>
</tr>
<tr>
<td>Ns1</td>
<td>13 turns</td>
</tr>
<tr>
<td>Ns2</td>
<td>6 turns</td>
</tr>
<tr>
<td>Naux</td>
<td>17 turns</td>
</tr>
<tr>
<td>Primary to auxiliary turn ratio</td>
<td>5.59 ± 5%</td>
</tr>
<tr>
<td>Primary saturation current</td>
<td>550 mA (@ 100 °C)</td>
</tr>
<tr>
<td>Insulation primary-secondary</td>
<td>AC 3 kV (1 s – 2 mA)</td>
</tr>
</tbody>
</table>

Figure 5. **ALTAIR04-900 power supply: transformer characteristics**
2 Output voltage characteristics

Figure 6 and 7 show the load and the line regulation of the output 1 when the other output is charged with 40 mA and 80 mA respectively.

All output voltages have been measured on the output connector of the board.

When the output 2 is heavy loaded and the output 1 is light loaded, $V_{OUT1}$ increases due to the cross regulation. In any case, the voltages are within the tolerance given in the specifications.

Figure 6. Output voltage characteristics with 3V3 @ 40 mA

![Graph of output voltage characteristics with 3V3 @ 40 mA]

Figure 7. Output voltage characteristics with 3V3 @ 80 mA

![Graph of output voltage characteristics with 3V3 @ 80 mA]
3 Efficiency and no load measurements

In this section the converter efficiency has been measured at different output current levels on \( V_{\text{OUT1}} \) and \( V_{\text{OUT2}} \) fixed at 40 mA and 80 mA.

The figures below show the results.

**Figure 8.** Efficiency vs. output power with 3V3 @ 40 mA

**Figure 9.** Efficiency vs. output power with 3V3 @ 80 mA
4 Typical board waveforms

Typical waveforms during TX mode and different input voltages are shown in this section. In this condition the load on output 1 changes from 35 to 550 mA with 1 Hz of repetition rate and 60% duty cycle. Output 2 is loaded at 100 mA.

Figures Figure 10, 11, 12 and 13 show the drain voltage and drain current waveforms at different input voltage values.

Note that the maximum drain peak voltage at maximum input voltage is 576 V (Figure 13), ensuring a reliable operation of the MOSFET with good margin against its maximum BVDSS.

During PLM operations it is important that the output voltage remains regulated within specification limits, to ensure correct operations for the PLM power amplifier. In order to test such conditions, output 1 has been submitted to a dynamic step load according to the specifications of Table 1 and output 2 has been loaded with different output currents, in order to simulate the widest possible operative conditions.

Results are shown in figures 13 to 21; the output voltage is quite stable and clean with no abnormal oscillation during load changes and the steady-state values are within specification with very good margin.

Figure 10. Normal operations in TX mode at 85 V$_{AC}$
Typical board waveforms

Figure 11. Normal operations in TX mode at 115 V\(_{AC}\)

Ch1 (Freq_average): 92.81 kHz
Ch1 (Max): 360.0 V
Ch2 (Max): 308.8 mA
M: 10.0 us/div

Figure 12. Normal operations in TX mode at 230 V\(_{AC}\)

Ch1 (Freq_average): 139.41 kHz
Ch1 (Max): 524.0 V
Ch2 (Max): 244.0 mA
M: 4.0 us/div
Figure 13. Normal operations in TX mode at 264 V<sub>AC</sub>

Ch1 (Freq, high): 145.1 kHz
Ch1 (Freq, low): 112.1 kHz
Ch1 (Max): 576.0 V
Ch2 (Max): 225.0 mA
M: 4.0 us/div

Figure 14. Normal operation in TX mode at 85 V<sub>AC</sub> and I<sub>OUT</sub>=40 mA

Ch1 (Max): 13.4 V
Ch1 (Min): 12.71 V
Ch4 (High): 550.0 mA
Ch4 (Low): 35.0 mA
M: 100.0 ms/div
Figure 15. Normal operation in TX mode at 85 V\textsubscript{AC} and $I_{\text{OUT2}}$=80 mA

Ch2 (Max): 13.62 V  
Ch2 (Min): 12.73 V  
Ch3 (High): 550.0 mA  
Ch3 (Low): 35.0 mA  
M: 100.0 ms/div

Figure 16. Normal operation in TX mode at 115 V\textsubscript{AC} and $I_{\text{OUT2}}$=40 mA

Ch1 (Max): 13.37 V  
Ch1 (Min): 12.73 V  
Ch4 (High): 550.0 mA  
Ch4 (Low): 35.0 mA  
M: 100.0 ms/div
Figure 17. Normal operation in TX mode at 115 V\textsubscript{AC} and I\textsubscript{OUT2}=80 mA

- Ch2 (Max): 13.56 V
- Ch2 (Min): 12.75 V
- Ch3 (High): 550.0 mA
- Ch3 (Low): 35.0 mA
- M: 100.0 ms/div

Figure 18. Normal operation in TX mode at 230 V\textsubscript{AC} and I\textsubscript{OUT2}=40 mA

- Ch1 (Max): 13.31 V
- Ch1 (Min): 12.75 V
- Ch4 (High): 550.0 mA
- Ch4 (Low): 35.0 mA
- M: 100.0 ms/div
Figure 19. Normal operation in TX mode at 230 V\textsubscript{AC} and I\textsubscript{OUT2}=80 mA

Ch2 (Max): 13.61 V
Ch2 (Min): 12.78 V
Ch3 (High): 550.0 mA
Ch3 (Low): 35.0 mA
M: 100.0 ms/div

Figure 20. Normal operation in TX mode at 264 V\textsubscript{AC} and I\textsubscript{OUT2}=40 mA

Ch1 (Max): 13.32 V
Ch1 (Min): 12.75 V
Ch4 (High): 550.0 mA
Ch4 (Low): 35.0 mA
M: 100.0 ms/div
Figure 21. Normal operation in TX mode at 264 V_{AC} and I_{OUT2}=80 mA

Ch2 (Max): 13.62 V
Ch2 (Min): 12.77 V
Ch3 (High): 550.0 mA
Ch3 (Low): 35.0 mA
M: 100.0 ms/div
5 Protection features

The ALTAIR04-900 has several protection features that considerably increase end-product safety and reliability: auxiliary winding disconnection (or brownout) detection, shorted secondary rectifier detection, and transformer saturation protection.

Moreover, using the primary CC loop it is possible to set the maximum deliverable output current without any secondary extra component, therefore providing a best-in-class protection against overload and short-circuit.

In the following paragraphs all protections are tested and the results are presented.

5.1 Overload and short-circuit protection

The CC mode circuitry is able to regulate the maximum deliverable output current also when the output is shorted with good precision.

This means that during short-circuit protection, the output voltage is close to zero, while the output current is fixed to a constant value close to the maximum operative output current, resulting in an extremely safe mode of operation, with no overcurrent stress on the secondary components.

At the same time, the overload also coincides with the maximum operative output current.

Figures 22 and 23 show the drain voltage and the output current waveforms at different input voltage values and output 1 shorted.

Figure 22. Short-circuit mode: 13 V shorted at 115 V\textsubscript{AC}

\begin{center}
\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure22.png}
\caption{Short-circuit mode: 13 V shorted at 115 V\textsubscript{AC}}
\end{figure}
\end{center}
Figure 23. Short-circuit mode: 13 V shorted at 230 V_{AC}

- Ch2 (Mean): 630.1 mA
- Ch2 (Pk-Pk): 34.5 mA
- M: 40.0 us/div
5.2 **Auxiliary winding disconnection (brownout)**

At any switching cycle, the current sourced from the ZCD pin during turn-on is sensed and compared with an internal reference, IZCDON (50 µA).

When the auxiliary winding is accidentally disconnected, no more current is sourced from the pin and the IC enters brownout, therefore, immediately stopping switching. After restart, once $V_{CC}$ reaches the $V_{CCon}$ threshold, the device restarts again and, if the fault is still present, the protection is maintained active.

This feature has been tested and the results are shown in Figure 24.

**Figure 24. Brownout protection activation**
5.3 Secondary winding short-circuit and transformer saturation protection

The ALTAIR04-900 is equipped with a hiccup mode overcurrent protection level.

If the voltage on the SOURCE pin exceeds the $V_{CSds}$ level (1 V typ.), it means the primary drain current exceeds the value $1/R_{SENSE}$ (where $R_{SENSE}$ is set according to the total output power requirement), the device enters a warning state. If, at the next switching cycle, the hiccup mode level is exceeded again, the device assumes that a secondary winding short-circuit or a hard saturation of the transformer has occurred, so the device stops operating and the MOSFET is no longer allowed to switch on.

In order to enable the MOSFET to switch on again, the $V_{CC}$ voltage must be recycled. That is, $V_{CC}$ must go down to $V_{CCrestart}$, then rise up to $V_{CCon}$ and the MOSFET switching can restart.

Of course, if the cause of the hiccup mode overcurrent protection activation is not removed, the device again enters auto-restart mode.

Thanks to the extremely low fault quiescent current value, the restart repetition rate is extremely low, resulting in very safe and reliable protection.

This protection was tested on the demonstration board. The secondary winding of the transformer was shorted in different operating conditions. Figures 25 to 28 show the behavior of the system during fault.

**Figure 25.** Hiccup mode OCP: protection tripping at $V_{IN}=115$ VAC and full load

Ch2 (Max): 1.24 V
Ch (Max): 1.03 A
M: 40.0 us/div
Figure 26. Hiccup mode OCP: protection tripping at $V_{IN}=230\ \text{V}_{\text{AC}}$ and full load

Ch2 (Max): 3.07 V
Ch (Max): 2.44 A
M: 40.0 μs/div

Figure 27. Hiccup mode OCP: operating condition at $V_{IN}=115\ \text{V}_{\text{AC}}$

Ch2 (Max): 2.93 V
Ch (Max): 2.23 A
Ch4 (Max): 13.96 V
Ch4 (Max): 4.96 V
Ch4 (Freq): 7.64 Hz
M: 20.0 μs/div
Figure 28. Hiccup mode OCP: operating condition at $V_{IN}=230\ V_{AC}$

- Ch2 (Max): 3.64 V
- Ch (Max): 2.94 A
- Ch4 (Max): 14.01 V
- Ch4 (Max): 4.95 V
- Ch4 (Freq): 7.62 Hz
- M: 20.0 ms/div
6 Conducted noise measurements

One of the main benefits of the quasi-resonant mode of operation concerns conducted EMI emissions. In mains operated applications, due to the ripple appearing across the input bulk capacitor, the switching frequency is modulated at twice the mains frequency with a depth depending on the ripple amplitude. This causes the spectrum to be spread over frequency bands, rather than being concentrated on single frequency values. Especially when measuring conducted emissions with the average detection method, the level reduction can be several dBµV.

A pre-compliance test for EN55022 (Class B) European normative was also performed and the average measurements of the conducted noise emissions at full load and nominal mains voltages (both line and neutral) are shown in figures 29 to 32. As seen in the diagrams, in all test conditions there is a good margin for the measurements with respect to the limits.

Figure 29. CE average measurement at 115 V<sub>AC</sub> and full load: line
Figure 30. CE average measurement at $115\ \text{V}_{\text{AC}}$ and full load: neutral

Figure 31. CE average measurement at $230\ \text{V}_{\text{AC}}$ and full load: line
Figure 32. CE average measurement at 230 V$_{AC}$ and full load: neutral
7 Modifications for ultra wide-range operations

Although the board has been developed in wide-range up to 264 V\textsubscript{AC}, it can be easily modified in order to sustain ultra wide-range operation, up to 440 V\textsubscript{AC}, with minimum parts modification, thanks to the 900 V rated power section \( B_{\text{VDSS}} \) of the ALTAIR04-900.

In Figure 33 the modified schematic is shown; the modifications mainly involve the input stage, which must be designed in order to meet the 440 V\textsubscript{AC} operations. Also the diodes D3, D4, and D5 must be replaced in order to sustain the higher peak reverse voltage. No modifications are needed for the transformer and the IC.

The modified components are listed in the bill of material in Table 4; for other parts not specified in this table, the bill of material in Table 2 is still valid.

Figure 33. Electrical schematic for 440 V\textsubscript{AC} input voltage option
Table 4. **ALTAIR04-900 power supply: bill of material for 440 V_{AC} input voltage option**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Part</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>R10, R11</td>
<td>R10, R11</td>
<td>6.8 MΩ</td>
<td></td>
</tr>
<tr>
<td>C3, C18</td>
<td>C3, C18</td>
<td>47 µF 350 V electrolytic</td>
<td></td>
</tr>
<tr>
<td>C16, C17</td>
<td>C16, C17</td>
<td>22 nF - X2</td>
<td></td>
</tr>
<tr>
<td>D3</td>
<td>STTH108</td>
<td>Ultra-fast high voltage diode</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>D4</td>
<td>STPS1L60A</td>
<td>Power Schottky diode</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>D5</td>
<td>STPS1150</td>
<td>Power Schottky diode</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>PD</td>
<td>DBLS208G RD</td>
<td>Input bridge rectifier</td>
<td>Taiwan Semiconductor</td>
</tr>
<tr>
<td>NTC1, NTC2</td>
<td>B57236S0100M</td>
<td>10 Ω NTC inrush current limiter</td>
<td>EPCOS</td>
</tr>
<tr>
<td>RV1</td>
<td>B7Z224S0461K</td>
<td>460 V Varistor</td>
<td>EPCOS</td>
</tr>
</tbody>
</table>

**Note:** If not otherwise specified, all resistors are 5%, ¼ W.
8 Conclusions

A double-output flyback converter using the new ALTAIR04-900, specifically designed for power line modem systems based on ST7580 (by STMicroelectronics), has been introduced and the results are presented.

The demonstration board shows good performances in terms of load and line regulation and the overall efficiency is very good also at light load conditions.

The pre-compliant tests on conducted noise show that the QR mode of operation of the IC helps to meet the standards, therefore it is possible to reduce the size and the cost of the EMI filter compared to a fixed frequency IC.

The all-primary sensing control loop circuitry makes this device very competitive in terms of performance and price thanks of the absence of the optocoupler and any specific secondary circuitry for CV regulation and overload protection, including a secondary voltage reference and sense resistor.

Moreover, the 900 V avalanche-rugged power section, and the several protections that this device has onboard, makes this IC the device of choice for energy metering, 3-phase auxiliary power supplies and for all applications where the ultra wide-range is required.
9 Demonstration tools and documentation

The ALTAIR04-900 demonstration board order code is: EVLALTAIR900-M1.

In order to get a complete PLM system, the power supply can be connected with the EVALKITST7580-1.

Further information about these products are available in the ALTAIR04-900 datasheet at www.st.com.
### 10 Revision history

Table 5. Document revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>26-Apr-2011</td>
<td>1</td>
<td>Initial release</td>
</tr>
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