voltbricks

DATASHEET

# VDRI Series

## VDRI20, VDRI30

Miniature DC/DC converters
for industrial application


## 1. Description

Universal isolated DC/DC converters of high reliability and extended service life were designed for industrial application.

Waterproof potting securely protects the unit from aggressive external factors and allows this converter to operate in a wide range of environmental conditions.

Each batch of products is tested for compliance to dozens of various electric parameters, and is exposed to special types of peak thermal tests.

### 1.1. Engineered in accordance with

- Safety Std. Approval
  EN 60950-1, RoHS
- EMC Std
  EN55032 Class B

### 1.2. Features

- 3 year warranty
- Form-factor 1×1 inch
- Output current up to 9 A
- Case operating temperature –40...+105 °C
- Low-profile design 10,2 mm
- Short circuit and overvoltage
- Remote on/off
- On-peak efficiency 90 %
- Potting sealing

### 1.3. Additional information

**1.3.1. Description on the manufacturer's website**

https://voltbricks.com/product/vdri

**1.3.2. Order registration**

+65 6950 0011

sales@voltbricks.com

**1.3.3. Technical support**

support@voltbricks.com

**1.3.4. Reliability test**

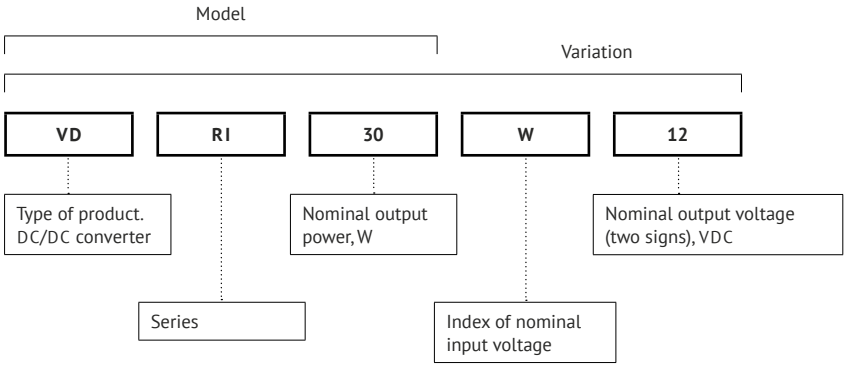
https://support.voltbricks.com/Reliability-Test_ENG.pdf

# 2. Contents



# 3. Part number

For more information please contact our Global Operations Team: +65 6950 0011



# 4. Specifications

All specifications valid for normal climatic conditions (ambient temp. 15…35 °C; relative humidity 45…80 %; air pressure 8,6×10⁴…10,6×10⁴ Pa), $U_{IN.NOM}$, $I_{OUT.NOM}$, unless otherwise stated. It is important to note that the information herein is not full.

## 4.1. General specifications

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Operating case temperature | $T_{CASE}$ | | –40…+105 | °C |
| Operating ambient temperature | $T_{AMB}$ | Case temperature in standard limits | –40…+85 | °C |
| Storage temperature | | | –50…+110 | °C |
| Switching frequency | | | 340–400 | kHz |
| Isolation voltage @ 60 s | | Input/output, input/case, output/case | 1500 | VDC |
| Isolation resistance @ 500 VDC | | Input/output, input/case, output/case | min 1 | GOhm |
| Thermal impedance | | | 15 | °C/W |
| Remote on/off | | | Off.: 0…1 VDC or connection of pins “ON” and “–IN”, I<1 mA | |
| MTBF | | $T_{CASE}$=75 °C, $P_{OUT}$=70 % | 585 000 | hrs |
| Warranty | | | 3 | years |

## 4.2. Input specifications

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Nominal input voltage | $U_{IN.NOM}$ | Index «B» | 24 | VDC |
| | | Index «W» | 48 | VDC |
| Input voltage range | | $U_{IN.NOM}$=24 V | 9…36 | VDC |
| | | $U_{IN.NOM}$=48 V | 18…75 | VDC |
| Transient deviation $U_{IN}$ | | $U_{IN.NOM}$=24 V @ 1 s | 8…40 | VDC |
| | | $U_{IN.NOM}$=48 V @ 1 s | 16…80 | VDC |

## 4.3. Output specifications

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Output power | $P_{OUT}$ | | 20; 30 | W |
| Typical efficiency | EFF | $U_{IN}$=24 V, $U_{OUT}$=12 V | 90 | % |
| | | $U_{IN}$=48 V, $U_{OUT}$=12 V | 90 | % |
| Quantity of output channels | | | 1 | |
| Nominal output voltage | $U_{OUT.NOM}$ | | 3,3; 5; 9; 12; 15; 24; 48 | VDC |
| Output current (min) | $I_{OUT.MIN}$ | | 0 | A |
| Output current (max) | $I_{OUT.MAX}$ | | 9 | A |
| Output voltage adjustment | | | min ±10 | % |
| Steady-state output voltage deviation, $U_{OUT.NOM}$ | | $U_{IN.NOM}$, $I_{OUT.MAX}$, normal climatic conditions | max ±1 | % |



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| Parameter | Symbol | Conditions | Value | | Unit |
|---|---|---|---|---|---|
| Voltage regulation, $U_{OUT.NOM}$ | | Gradual change of $U_{IN}$ within set value range | max ±0,5 | | % |
| | | Gradual change of $I_{OUT}$ within 0,05...1×$I_{OUT.MAX}$ | max ±0,5 | | % |
| | | Thermal instability | max ±2 | | % |
| | | Repeatability | max ±0,5 | | % |
| | | Total voltage regulation within the complete range of output voltage, output current and ambient temperature | max ±4 | | % |
| Ripple and noise (p-p), $U_{OUT.NOM}$ | $U_{P-P}$ | $U_{OUT}$≤5 V | <50 | | mV |
| | | $U_{OUT}$>5 V | <1 | | % |
| Max total capacitance of output capacitors | $C_{OUT.MAX}$ | $U_{OUT}$=3,3 V<br>$U_{OUT}$=5 V<br>$U_{OUT}$=9 V<br>$U_{OUT}$=12 V<br>$U_{OUT}$=15 V<br>$U_{OUT}$=24 V<br>$U_{OUT}$=48 V | 10000<br>7000<br>2000<br>1100<br>750<br>300<br>70<br>$P_{OUT}$=20 W | 10000<br>9000<br>3100<br>1700<br>1100<br>450<br>100<br>$P_{OUT}$=30 W | uF |
| Start up time | $t_{IN}$ | $I_{OUT.MAX}$ + $C_{OUT.MAX}$, $U_{IN.NOM}$ | <0,05 | | s |
| Trancient responce deviation, $U_{OUT.NOM}$ | | On change $U_{IN.NOM}$ to 1,4×$U_{IN.NOM}$;<br>On change within (0,75...1)×$I_{OUT.MAX}$;<br>front time >100 us. | max ±5 | | % |

## 4.4. Protections

Parameters are stated for the information purposes and could not be used for long term operation, over current operation, operation out of stated temperature limits.

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Short circuit protection | | $U_{OUT}$ ≤5 V | <2 $I_{OUT.MAX}$ | |
| | | $U_{OUT}$ >5 V | <2 $I_{OUT.MAX}$ | |
| Overvoltage protection | | | <1,3 $U_{OUT.NOM}$ | |
| Vibration proof | | | 10...2000 Hz, 200 (20) m/s$^2$ (g), 0,3 mm | |
| Dust proof | | | yes | |
| Salt fog resistant | | | yes | |
| Moisture proof | | 98% at $T_{AMB}$= 35°C | yes | |

## 4.5. Physical specifications

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Form-factor | | | 1×1 inch | |
| Case material | | | aluminium | |
| Coating | | | anodic oxide | |
| Pin material | | | bronze | |
| Weight | | | max 20 | g |
| Soldering temperature | | 5 s | 260 | °C |
| Dimensions | | Without output pins | max 25,4×25,4×10,2 | mm |



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# 5. Diagrams

## 5.1. Layout

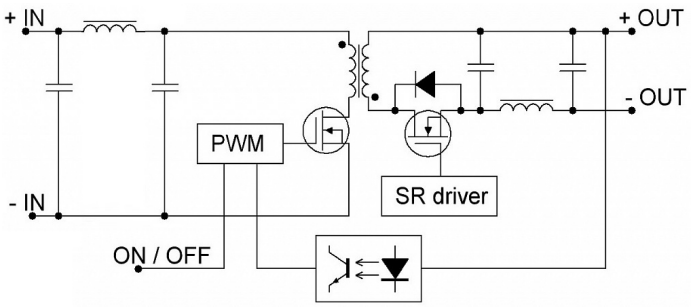


*Figure 1. VDRI20, VDRI30 layout.*

## 5.2. Typical connection diagram

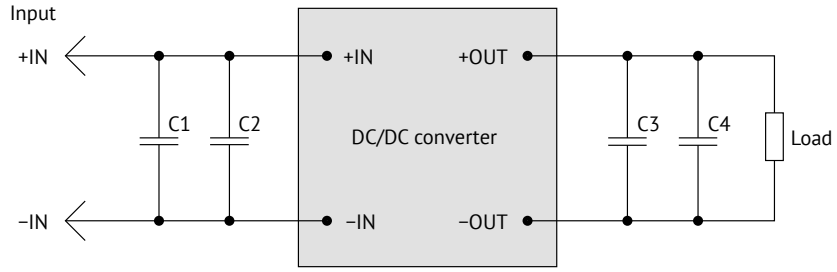


*Figure 2. VDRI20, VDRI30 typical connection diagram.*

| Name | Type | Comment | | VDRI20 | VDRI30 |
|---|---|---|---|---|---|
| C1 | tantalum capasitor | Input voltage | =24 V<br>=48 V | 22 µF<br>22 µF | 47 µF<br>33 µF |
| C2 | ceramic capacitor | | =24 V<br>=48 V | 4,7 µF<br>4,7 µF | 10 µF<br>6,8 µF |
| C3 | ceramic capacitor | Output voltage | 3,3 up to 15 V on<br>=24 V<br>=48 V | | 10 µF<br>4,7 µF<br>2,2 µF |
| C4 | tantalum capasitor | | =3,3 V<br>=5 V<br>9 up to 12 V on<br>=15 V<br>24 up to 48 V on | | 100 µF<br>68 µF<br>47 µF<br>33 µF<br>10 µF |

*Table 1. Description of the elements of a typical VDRI20, VDRI30 connection diagram.*



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### 5.2.1. Wiring diagram for compliance with EN55032 Class A

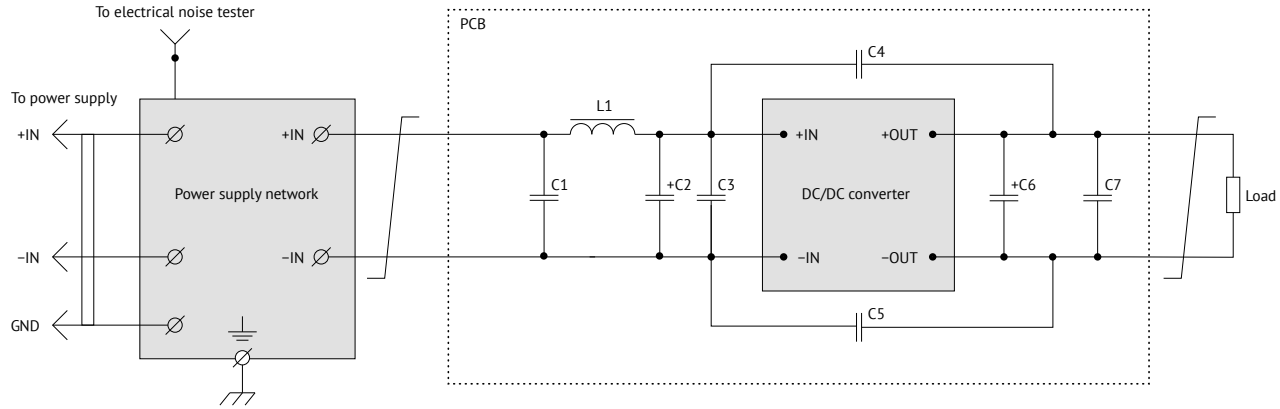


*Figure 3. Connection diagram VDRI20, VDRI30.*

| Name | Type | Comment | | VDRI20 | VDRI30 |
|---|---|---|---|---|---|
| C1 | ceramic capacitor | | | | 4,7 µF |
| C2 | tantalum capasitor | Input voltage | =24 V<br>=48 V | 22 µF<br>22 µF | 47 µF<br>33 µF |
| C3 | ceramic capacitor | | =24 V<br>=48 V | 4,7 µF<br>4,7 µF | 10 µF<br>6,8 µF |
| C4, C5 | ceramic capacitor | | | | 10 nF |
| C6 | tantalum capasitor | Output voltage | =3,3 V<br>=5 V<br>9 up to 12 V on<br>=15 V<br>24 up to 48 V on | | 100 µF<br>68 µF<br>47 µF<br>33 µF<br>10 µF |
| C7 | ceramic capacitor | | =3,3 V<br>5 up to 48 V on | | 10 µF<br>4,7 µF<br>2,2 µF |
| L1 | | | =3,3 V<br>≥3,3 V | | 2,2 µH or more<br>do not install |

*Table 2. Description of the elements VDRI20, VDRI30 for compliance with EN55032 Class A.*

### 5.2.2. Wiring diagram for compliance with EN55032 Class B

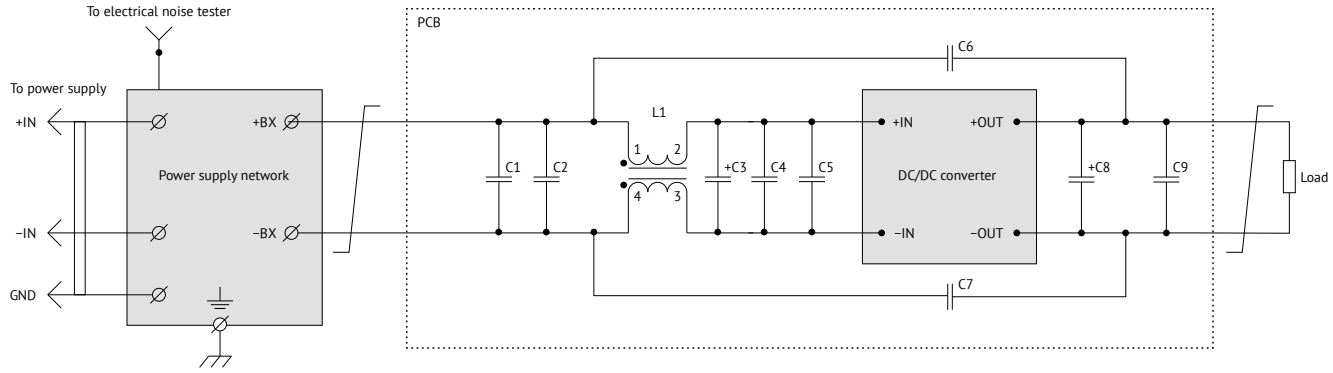


*Figure 4. Connection diagram VDRI20, VDRI30.*

| Name | Type | Comment | | VDRI20 | VDRI30 |
|---|---|---|---|---|---|
| C1, C2, | ceramic capacitor | | | | 4,7 µF |
| C3 | tantalum capasitor | Input voltage | =24 V<br>=48 V | 22 µF<br>22 µF | 47 µF<br>33 µF |
| C4 | ceramic capacitor | | =24 V<br>=48 V | 4,7 µF<br>4,7 µF | 10 µF<br>6,8 µF |
| C5 | ceramic capacitor | | | | 4,7 µF |
| C6, C7 | ceramic capacitor | | | | 10 nF |
| C8 | tantalum capasitor | Output voltage | =3,3 V<br>=5 V<br>9 up to 12 V on<br>=15 V<br>24 up to 48 V on | | 100 µF<br>68 µF<br>47 µF<br>33 µF<br>10 µF |
| C9 | ceramic capacitor | | 3,3 up to 15 V on<br>=24 V<br>=48 V | | 10 µF<br>4,7 µF<br>2,2 µF |
| L1 | common mode choke | | | | min 330 µH |

*Table 3. Description of the elements VDRI20, VDRI30 for compliance with EN55032 Class B.*

### 5.2.3. Wiring diagram for compliance with MIL-STD-461F CE102

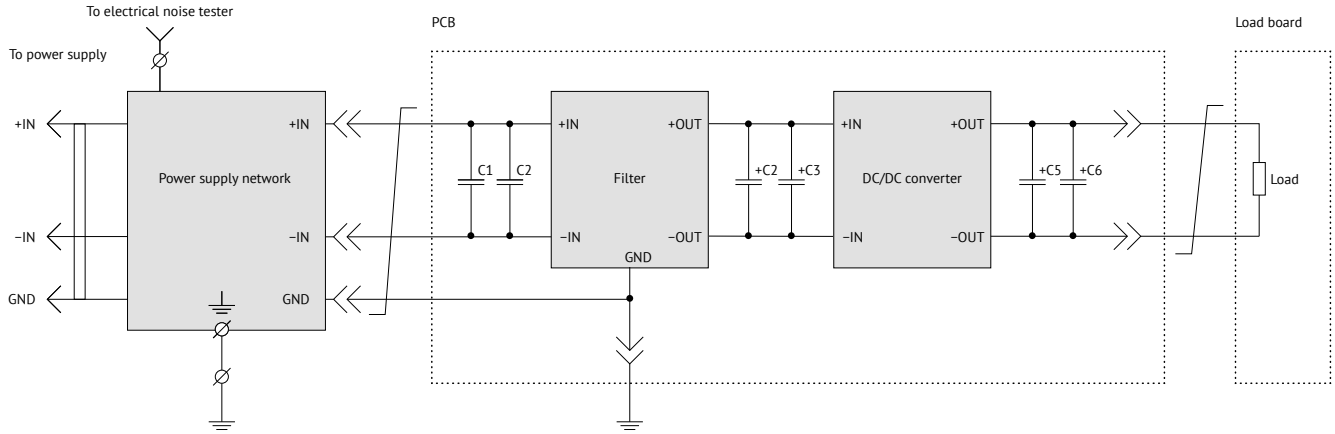


*Figure 5. Connection diagram VDRI20, VDRI30.*

| Name | Type | Comment | | VDRI20 | VDRI30 |
|---|---|---|---|---|---|
| C1 | tantalum capasitor | Input voltage | =24 V<br>=48 V | 22 µF<br>22 µF | 47 µF<br>33 µF |
| C2 | ceramic capacitor | | =24 V<br>=48 V | 4.7 µF<br>4.7 µF | 10 µF<br>6,8 µF |
| C3 | tantalum capasitor | | =24 V<br>=48 V | 22 µF<br>22 µF | 47 µF<br>33 µF |
| C4 | ceramic capacitor | | =24 V<br>=48 V | 4.7 µF<br>4.7 µF | 10 µF<br>6,8 µF |
| C5 | tantalum capasitor | Output voltage | =3,3 V<br>=5 V<br>9 up to 12 V on<br>=15 V<br>=24 V<br>=48 V | | 100 µF<br>68 µF<br>47 µF<br>33 µF<br>10 µF<br>10 µF |
| C6 | ceramic capacitor | | 3,3 up to 15 V on<br>=24 V<br>=48 V | | 10 µF<br>4,7 µF<br>2.2 µF |
| Filter | | Input voltage | =24 V<br>=48 V | | VFD07B<br>VFD07W |

*Table 4. Description of the elements VDRI20, VDRI30 for compliance with MIL-STD-461F CE102.*

# 6. Test reports

## 6.1. Effiency

### 6.1.1. VDRI30 (Index "B")

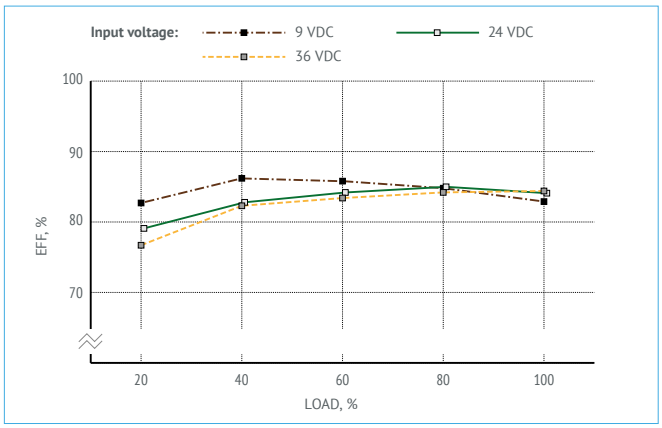


*Figure 6. VDRI30B3,3.*

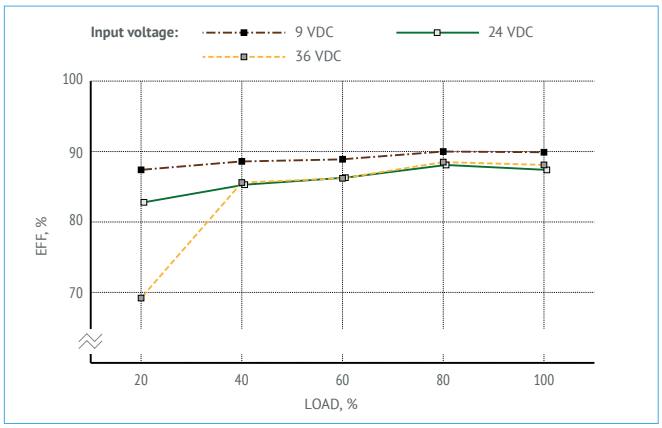


*Figure 7. VDRI30B05.*

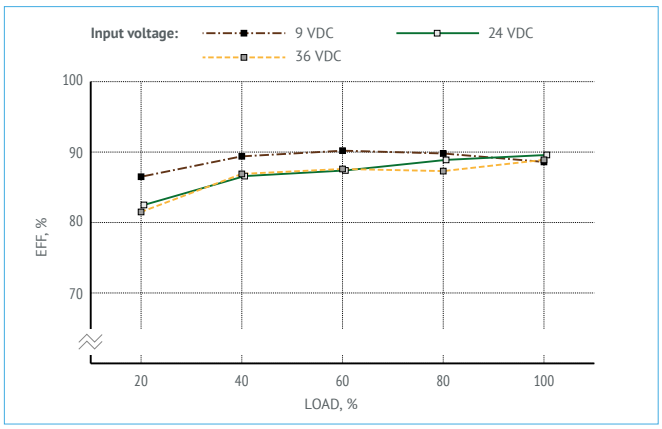


*Figure 8. VDRI30B09.*

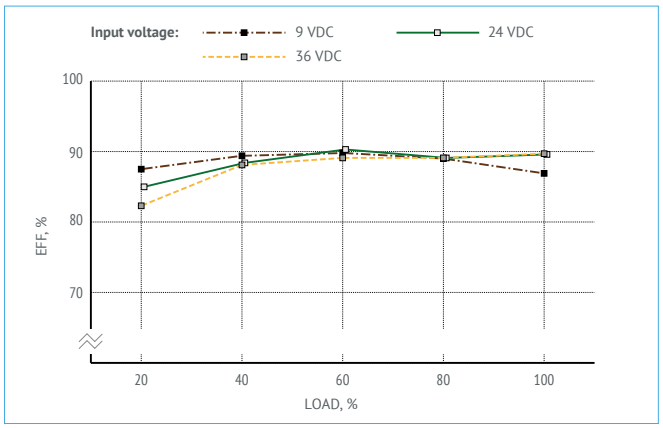


*Figure 9. VDRI30B12.*

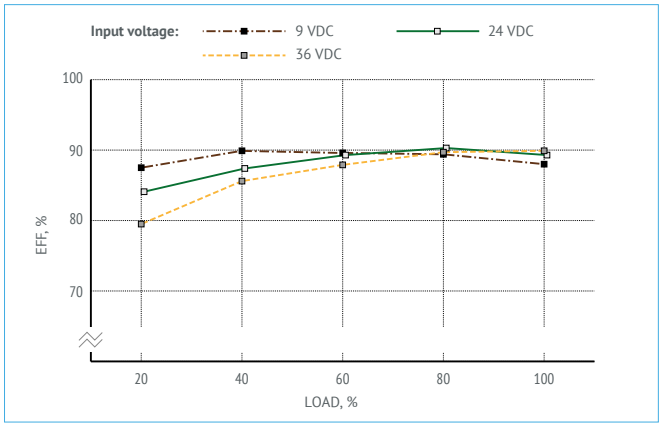


*Figure 10. VDRI30B15.*

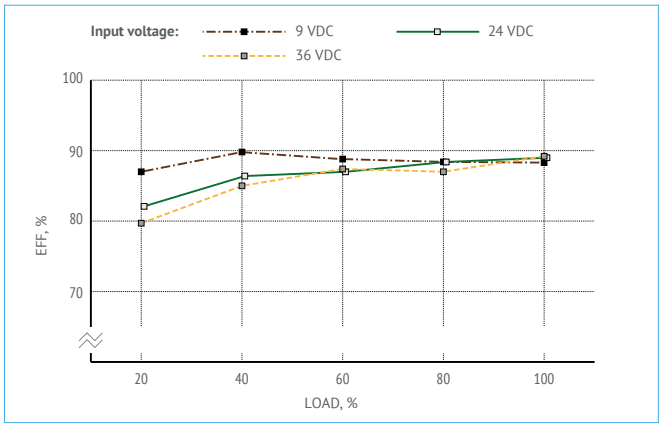


*Figure 11. VDRI30B24.*

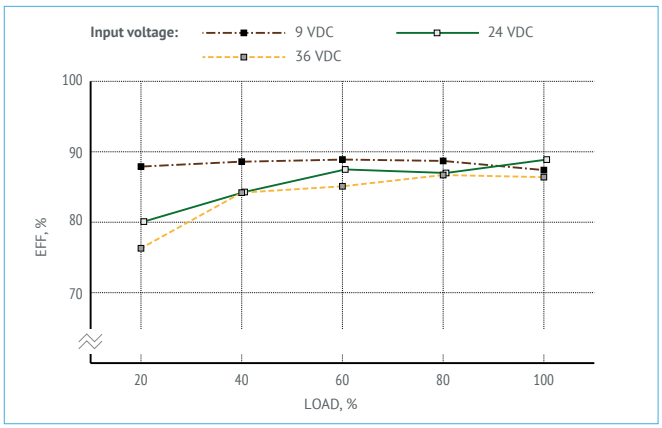


*Figure 12. VDRI30B48.*

### 6.1.2. VDRI30 (Index "W")

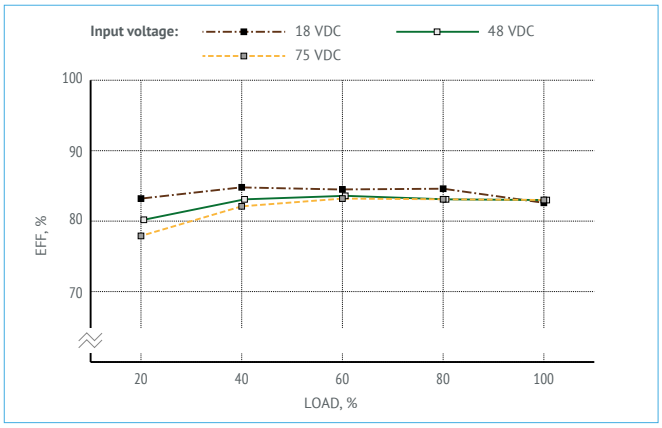


*Figure 13. VDRI30W3,3.*

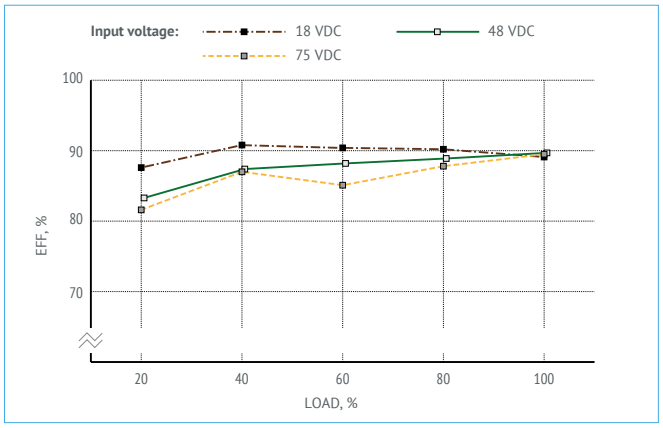


*Figure 15. VDRI30W09.*

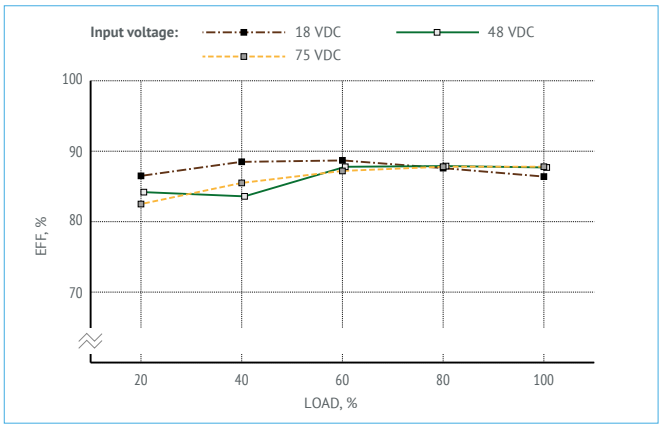


*Figure 14. VDRI30W05.*

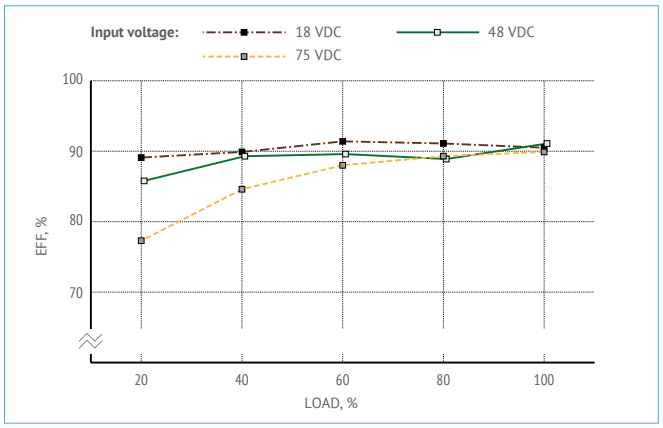


*Figure 16. VDRI30W15.*

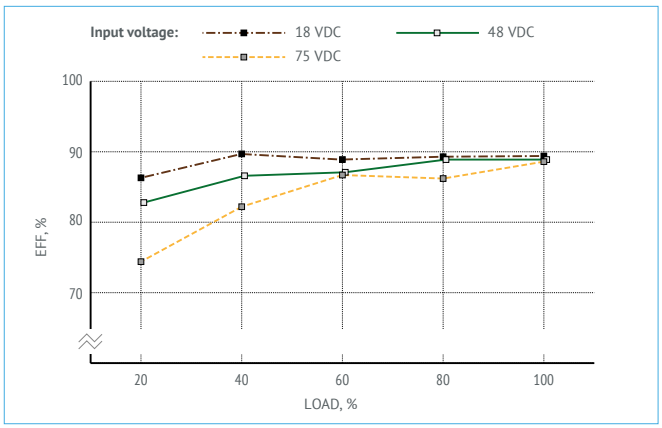


*Figure 17. VDRI30W24.*

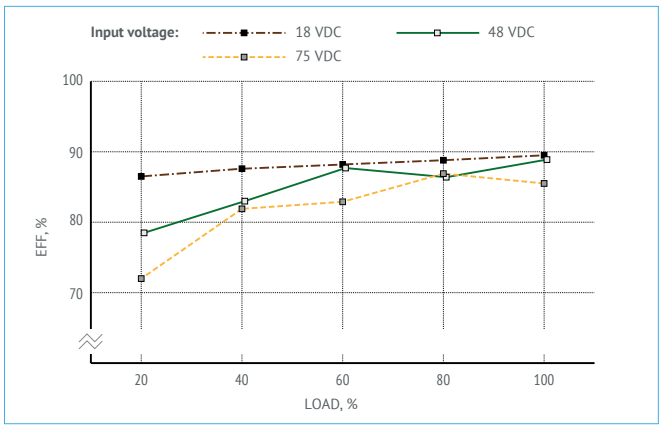


*Figure 18. VDRI30W48.*

## 6.2. Oscillograph charts

### 6.2.1. VDRI30B05

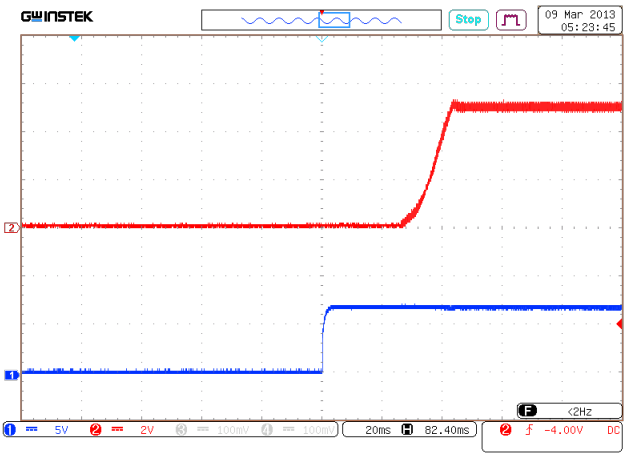


*Figure 19. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).*

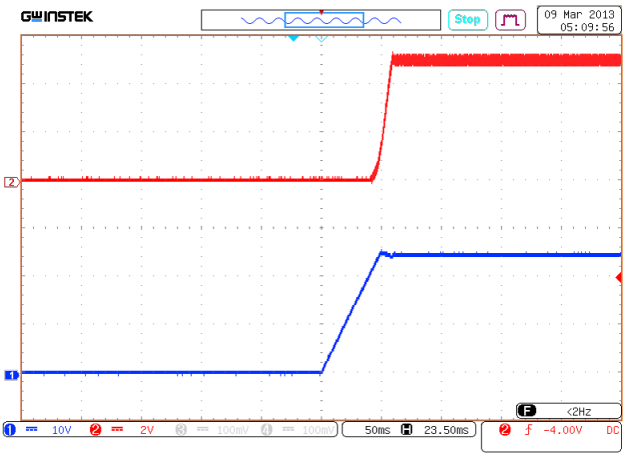


*Figure 21. $U_{OUT.NOM}$ stabilizing with $U_{IN.NOM}$.*

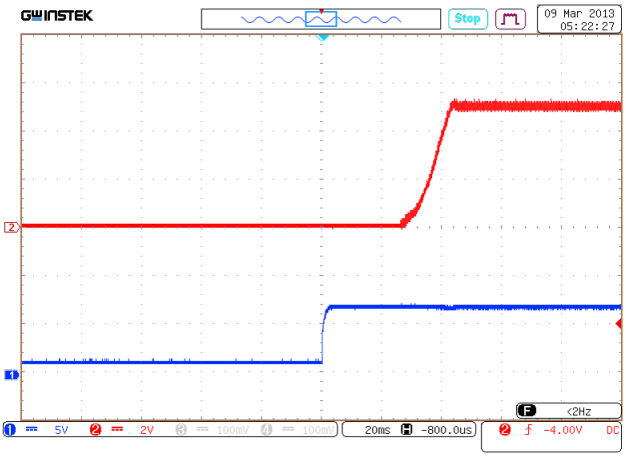


*Figure 20. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (control signal).*

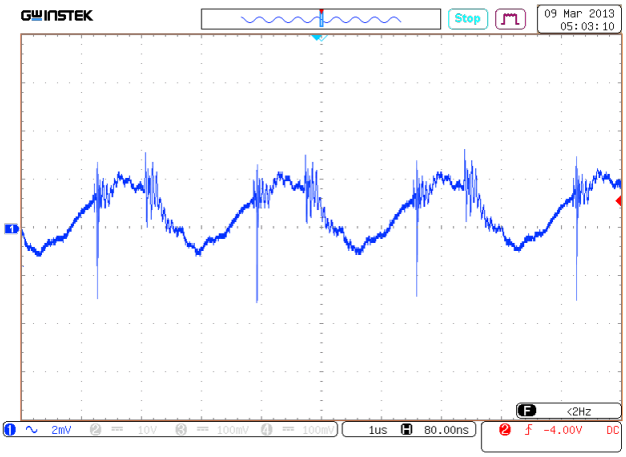


*Figure 22. $U_{OUT.NOM}$ ripple.*

### 6.2.2. VDRI30W05

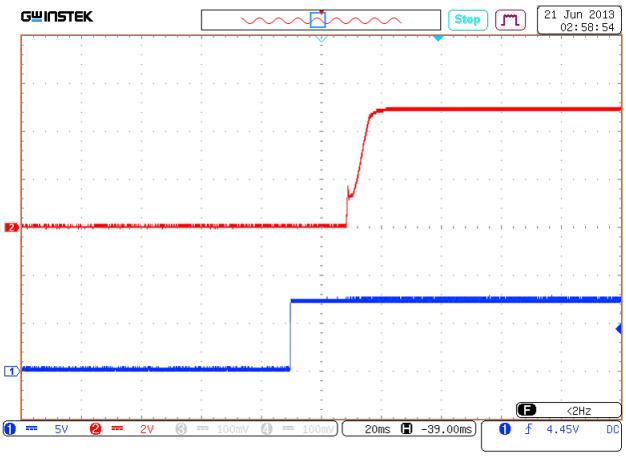


*Figure 23. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).*

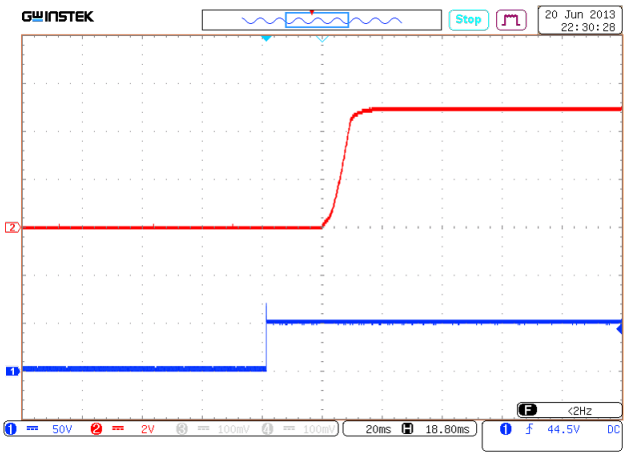


*Figure 25. $U_{OUT.NOM}$ stabilizing with $U_{IN.NOM}$.*

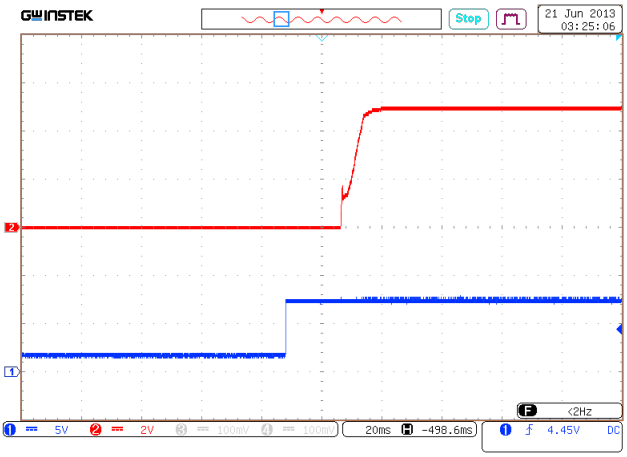


*Figure 24. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (control signal).*

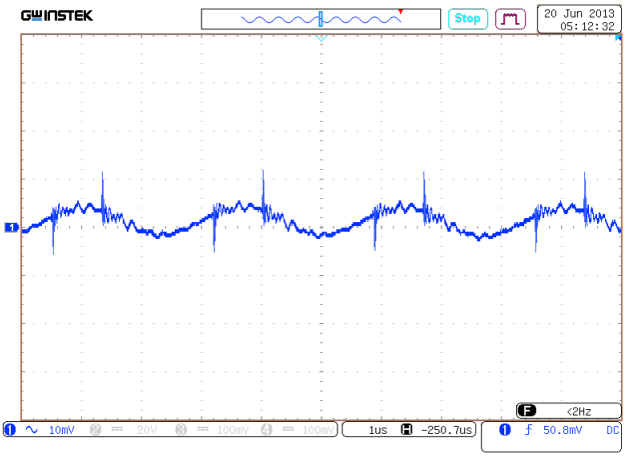


*Figure 26. $U_{OUT.NOM}$ ripple.*

## 6.3. Noise spectrogram

### 6.3.1. VDRI20B24

For testing we used connection circuits to comply EN55032 Class A *[Figure 3] and EN55032 Class B [Figure 4]*.

Test conditions: $U_{IN}$=24 VDC, $T_{AMB}$=25 °C.

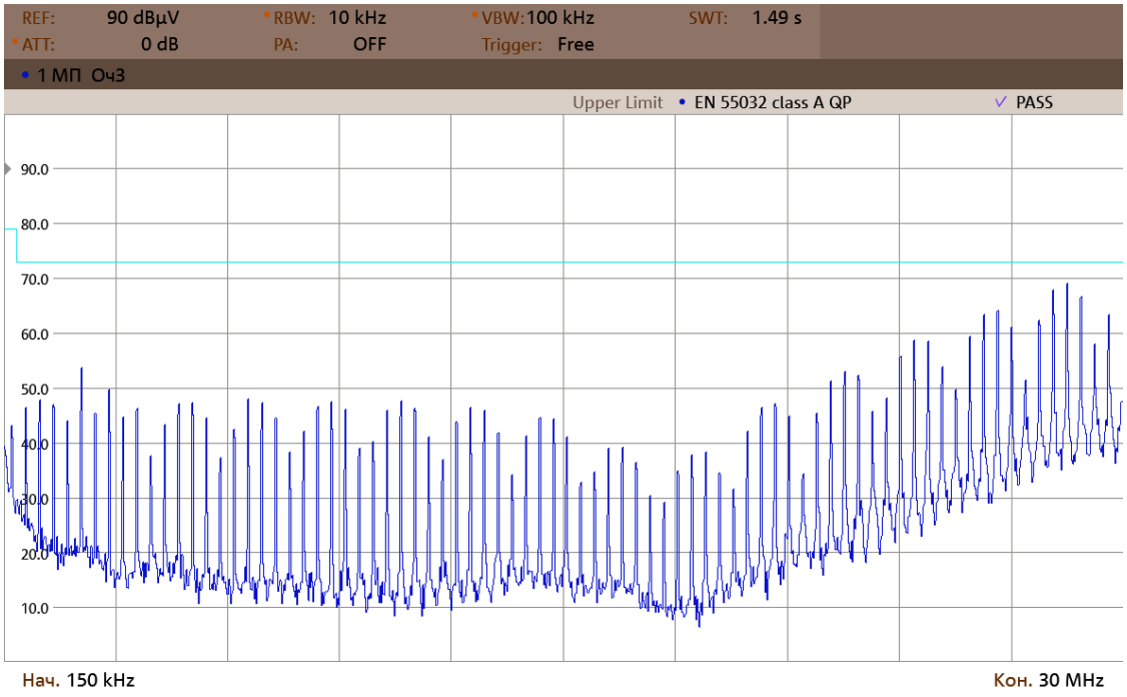


*Figure 27. Compliance spectrogram EN55032 Class A (0,15–30 MHz).*

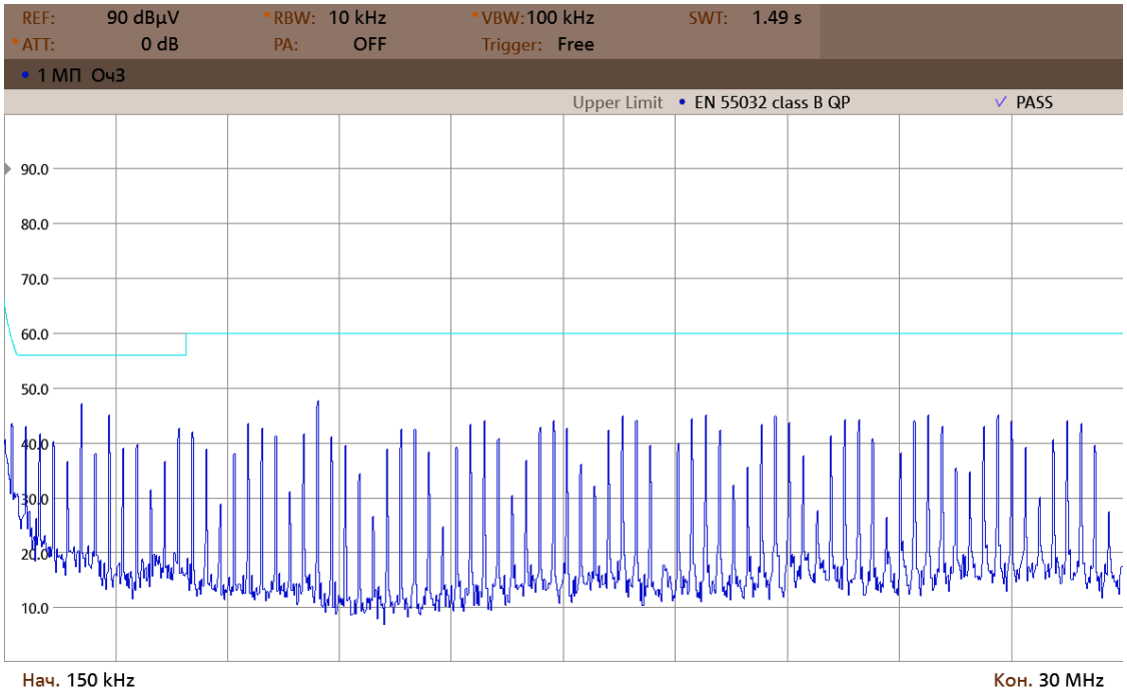


*Figure 28. Compliance spectrogram EN55032 Class B (0,15–30 MHz).*

### 6.3.2. VDRI20W24

For testing we used connection circuits to comply EN55032 Class A *[Figure 3] and EN55032 Class B [Figure 4]*.

Test conditions: $U_{IN}$=48 VDC, $T_{AMB}$=25 °C.

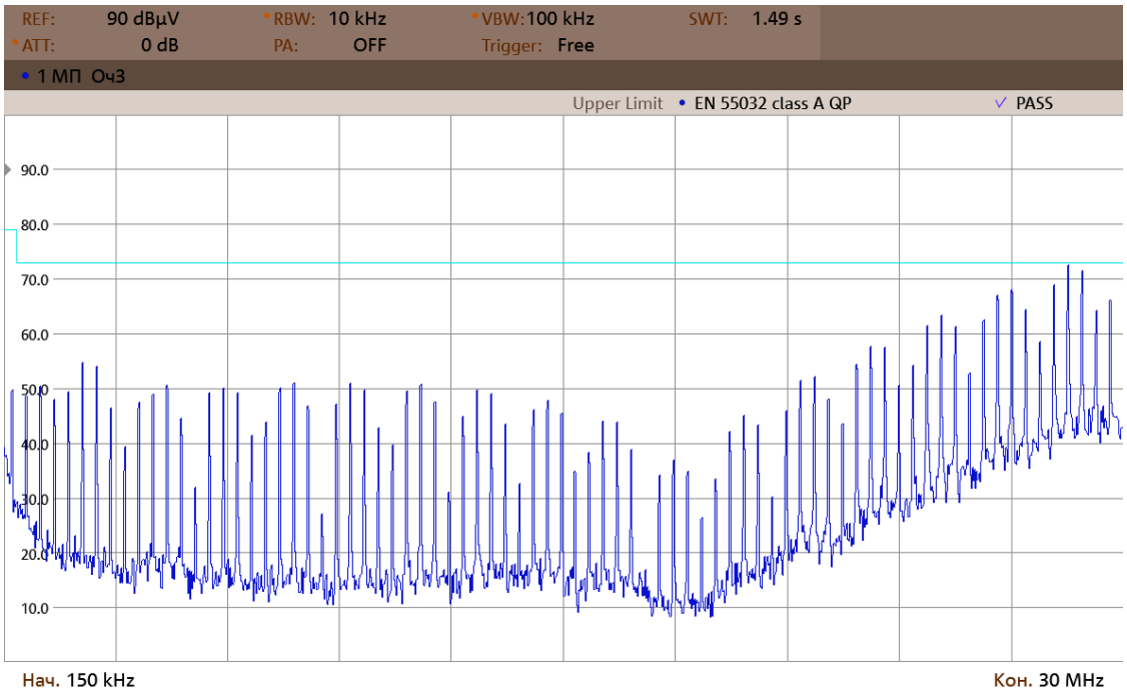


*Figure 29. Compliance spectrogram EN55032 Class A (0,15–30 MHz).*

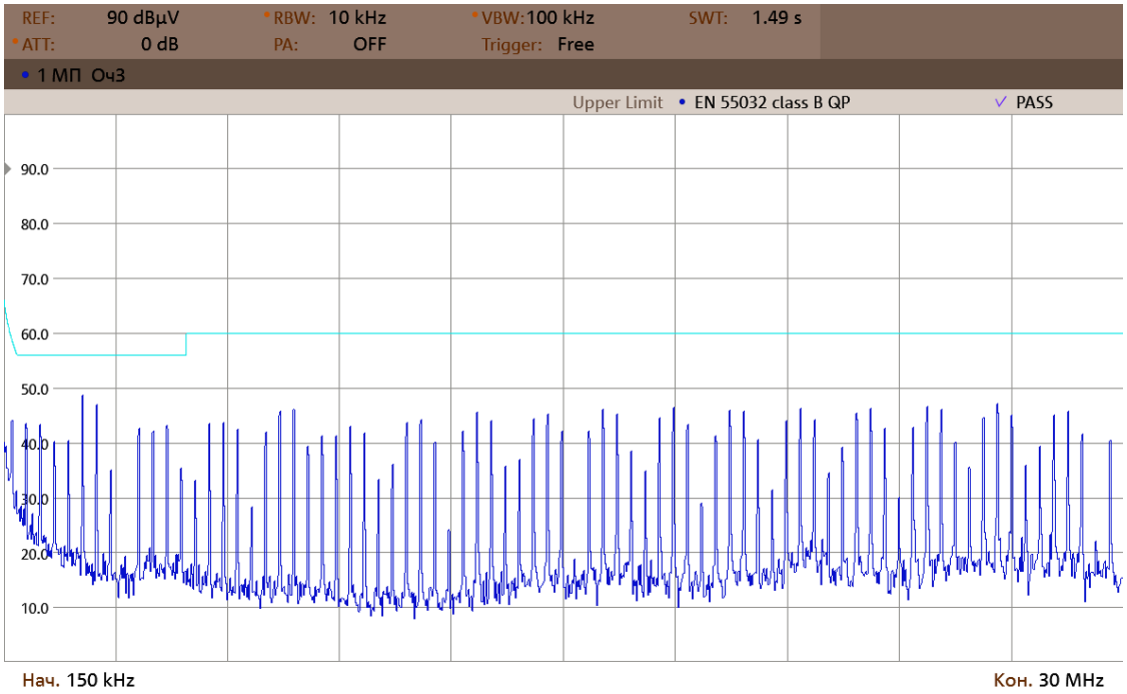


*Figure 30. Compliance spectrogram EN55032 Class B (0,15–30 MHz).*

### 6.3.3. VDRI30B24

For testing we used connection circuits to comply EN55032 Class A *[Figure 3] and EN55032 Class B [Figure 4]*.

Test conditions: $U_{IN}$=24 VDC, $T_{AMB}$=25 °C.

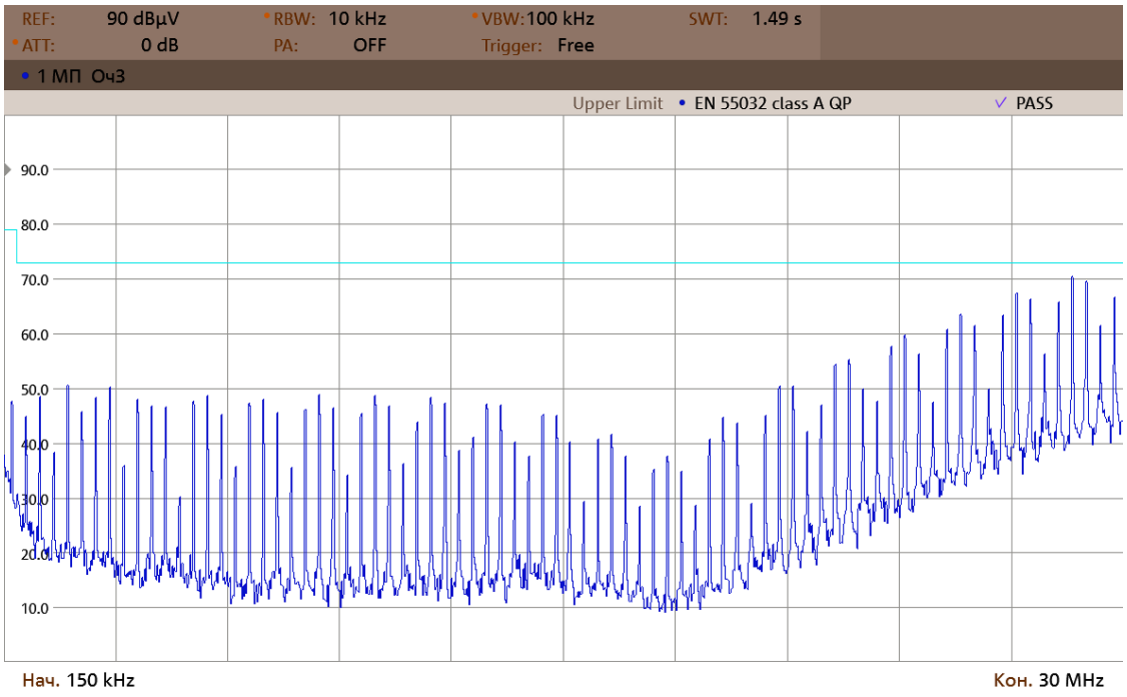


*Figure 31. Compliance spectrogram EN55032 Class A (0,15–30 MHz).*

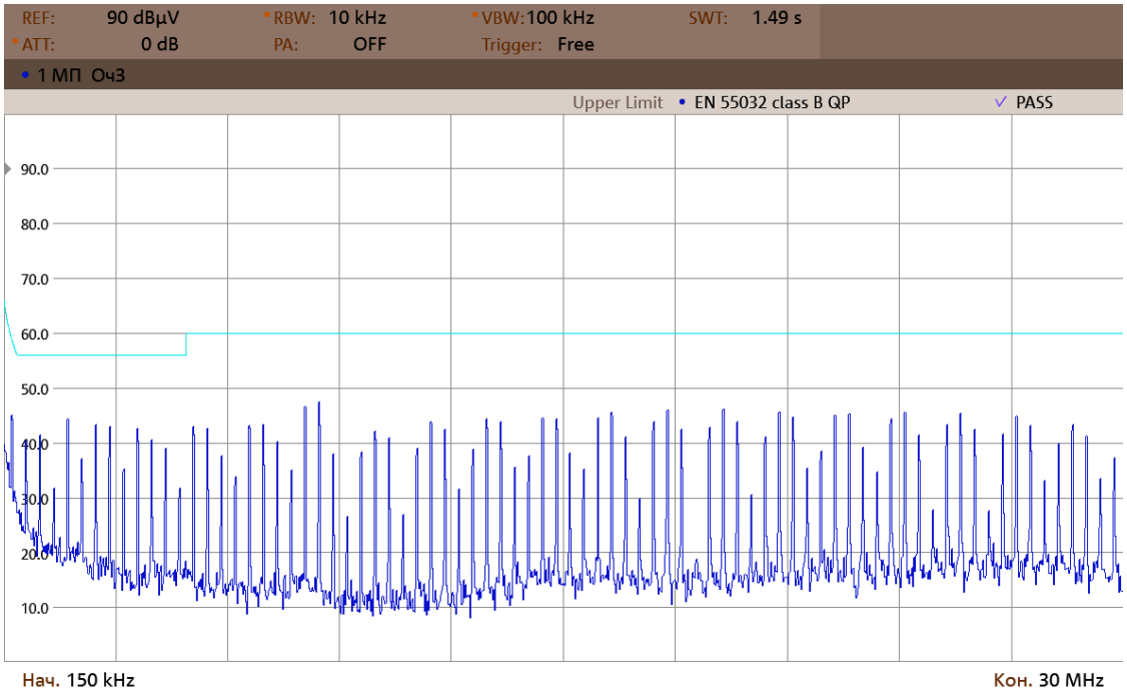


*Figure 32. Compliance spectrogram EN55032 Class B (0,15–30 MHz).*

### 6.3.4. VDRI30W24

For testing we used connection circuits to comply EN55032 Class A *[Figure 3] and EN55032 Class B [Figure 4]*.

Test conditions: $U_{IN}$=48 VDC, $T_{AMB}$=25 °C.

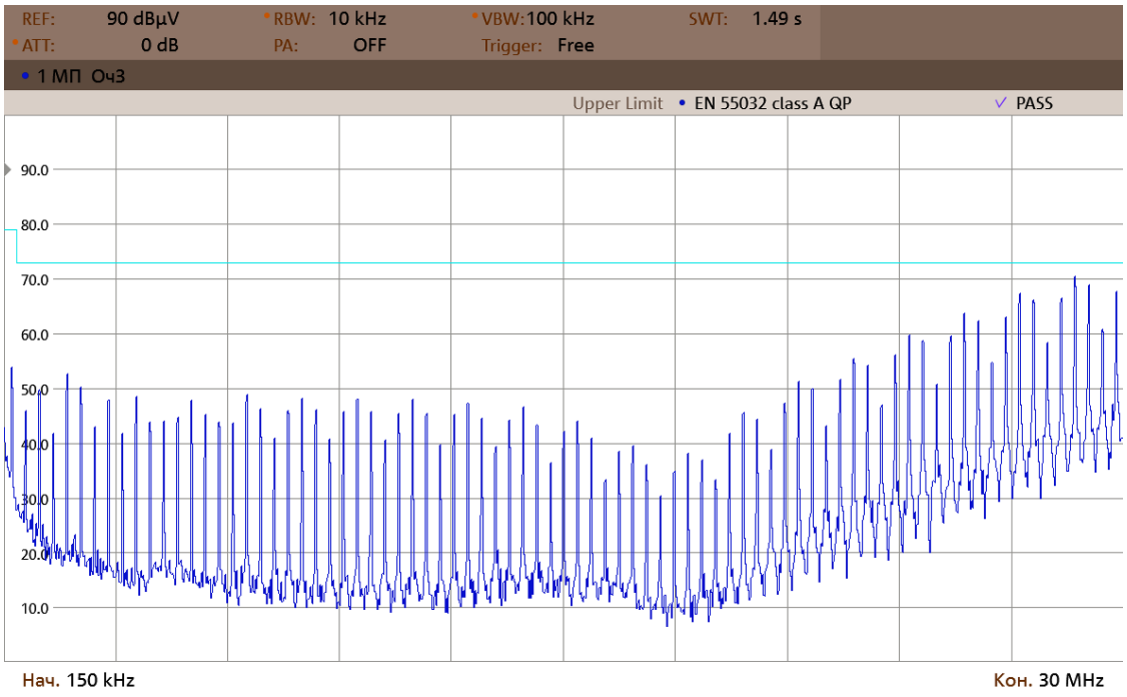


*Figure 33. Compliance spectrogram EN55032 Class A (0,15–30 MHz).*

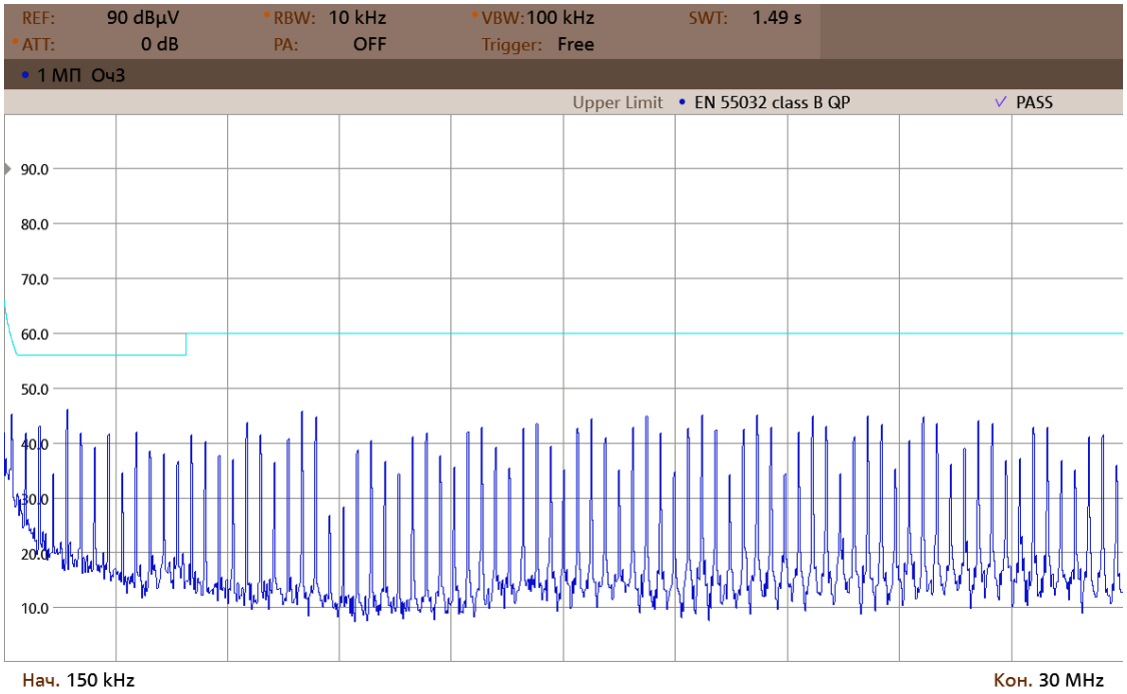


*Figure 34. Compliance spectrogram EN55032 Class B (0,15–30 MHz).*

# 7. Outline dimensions

| Pin # | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Function | +IN | −IN | +OUT | TRIM | −OUT | Remote On/Off |

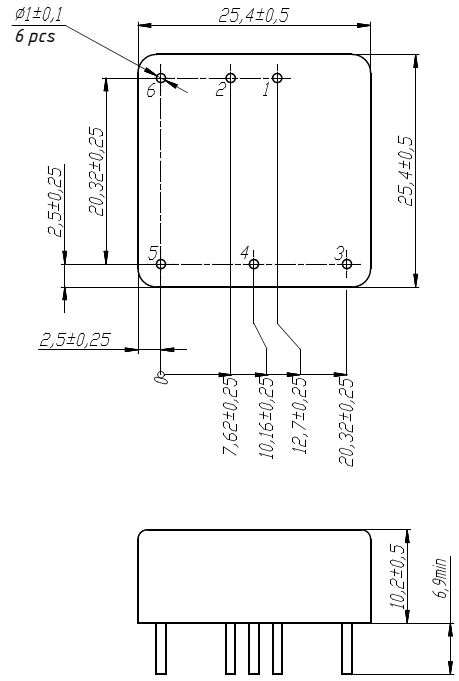


*Figure 35. Valid for VDRI20, VDRI30.*

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**This datasheet is valid for the following units:** VDRI20B3,3; VDRI20B05; VDRI20B09; VDRI20B12; VDRI20B15; VDRI20B24; VDRI20B48; VDRI20W3,3; VDRI20W05; VDRI20W09; VDRI20W12; VDRI20W15; VDRI20W24; VDRI20W48; VDRI30B05; VDRI30B09; VDRI30B12; VDRI30B15; VDRI30B24; VDRI30B48; VDRI30W05; VDRI30W09; VDRI30W12; VDRI30W15; VDRI30W24; VDRI30W48.