



Operational Amplifier

Manufacturer

DUT Name

*Immunity test - DPI
(IEC EN 62132-4)*

Date: month / day / year

Author: XXXXX XXXXXXXXX

Langer EMV-Technik GmbH
D-01728 Bannewitz
Rosentitzer Str. 73

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1 GENERAL

1.1 Scope

The Direct RF power injection method on the basis of IEC EN 62132-4 has been performed on operational amplifiers in MSOP-8 package.

1.2 Devices under test (DUT):

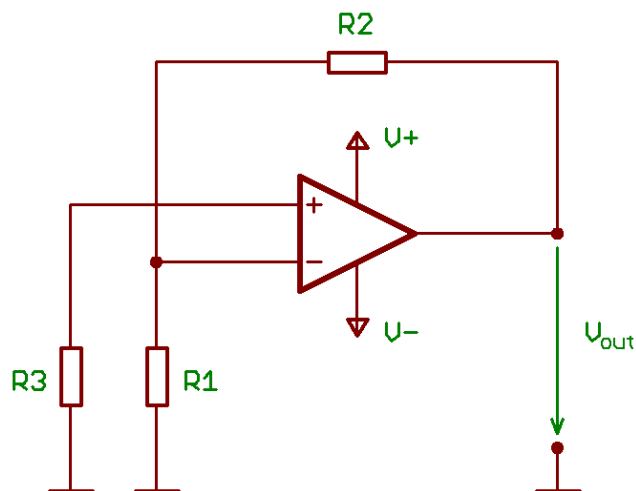
DUT_1:	XXXXXX
Manufacturer:	XXXXXXXXXXXXX
Package Marking:	XXXX
Current consumption:	31 μ A
DUT_2:	XXXXXX
Manufacturer:	XXXXXXXXXXXXX
Package Marking:	XXXX
Current consumption:	18 μ A
Package:	MSOP-8
Supply voltage level:	V+ = + 1.5 V V- = - 1.5 V

2 HARDWARE SETTINGS

2.1 Test configuration

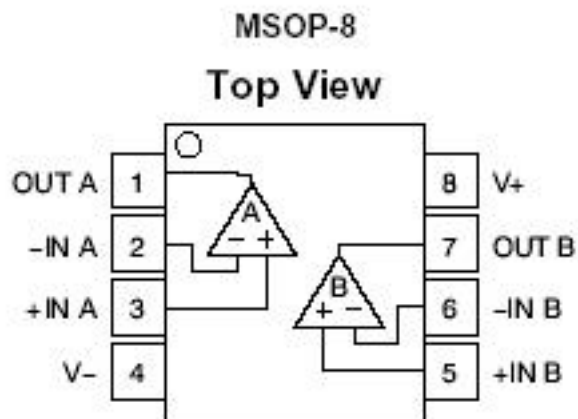
Operating mode: non inverting
symmetrical supply

Gain: 100

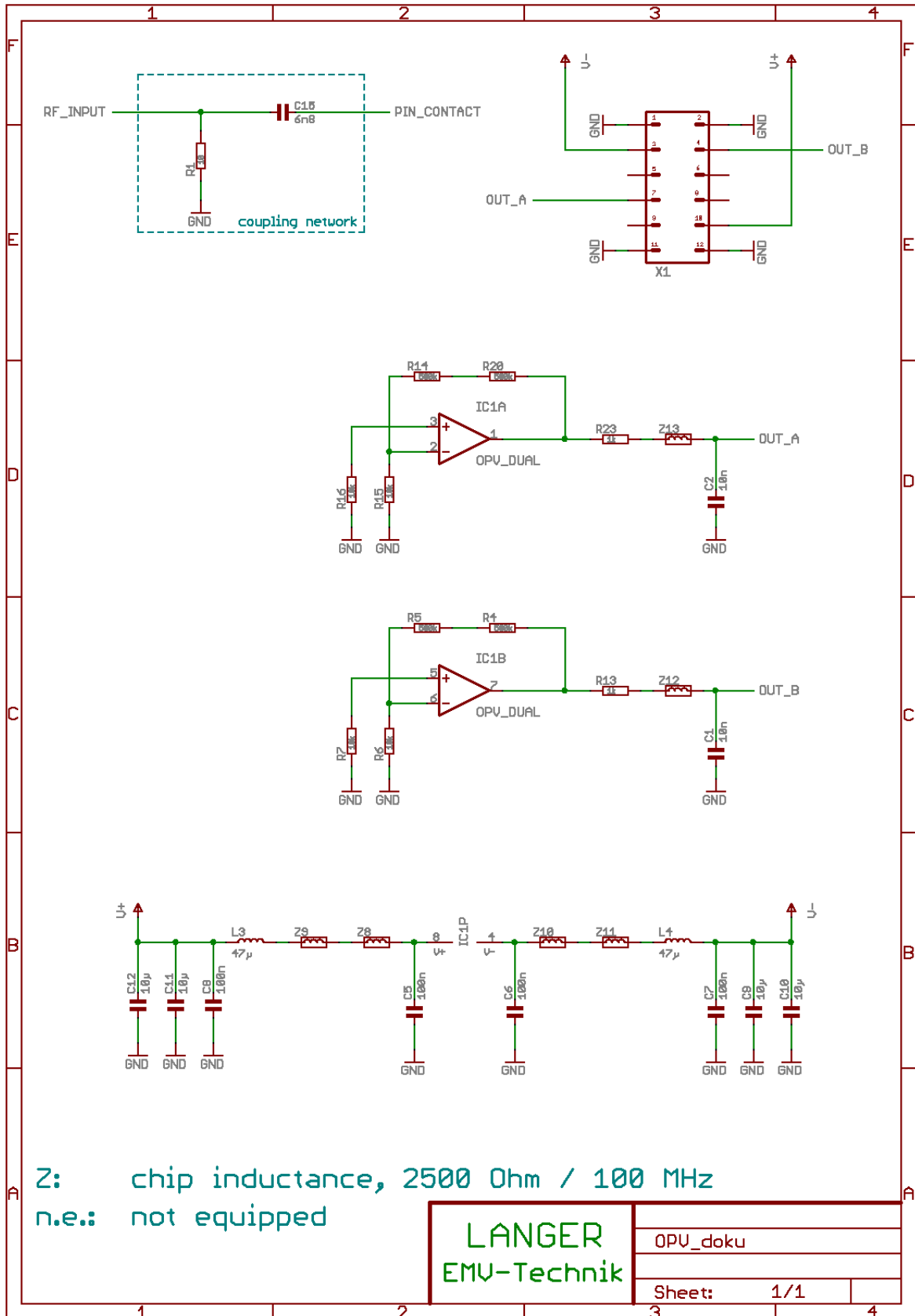


R1: 10 k Ω
R2: 1 M Ω
R3: 10 k Ω

2.2 Pinout



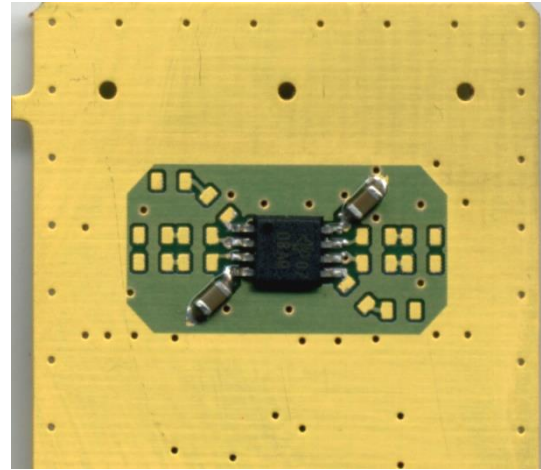
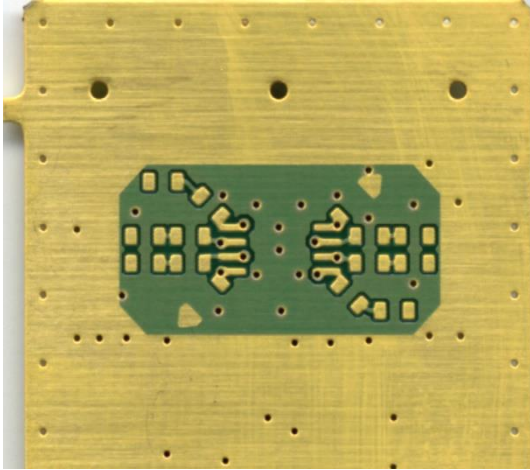
2.3 Test board schematic



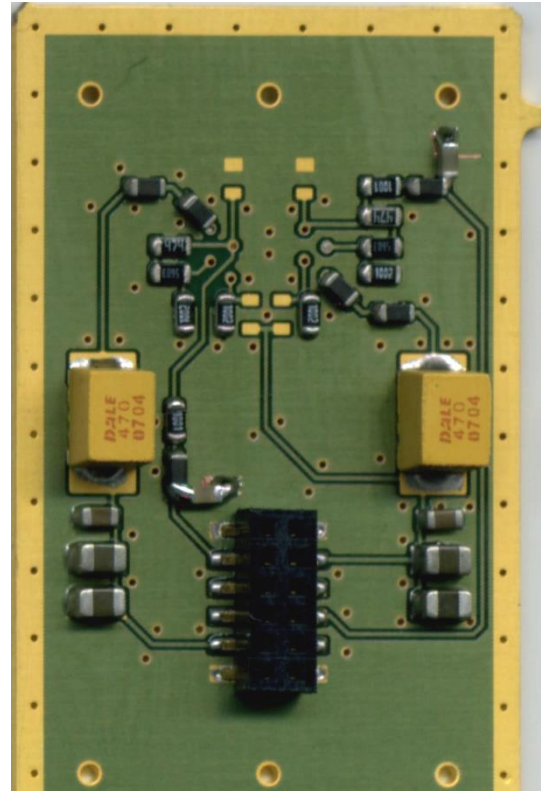
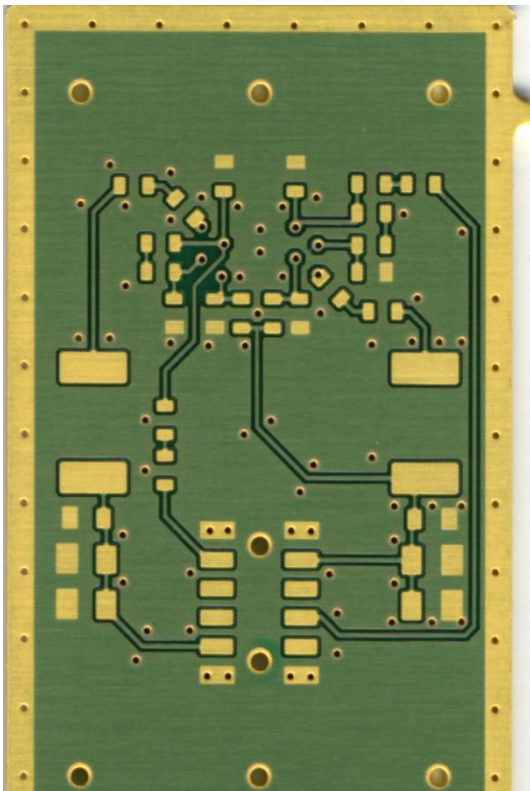
2.4 Test board

4 layers, 22 mm x 64 mm x 1.0 mm dimensions

Test board top:

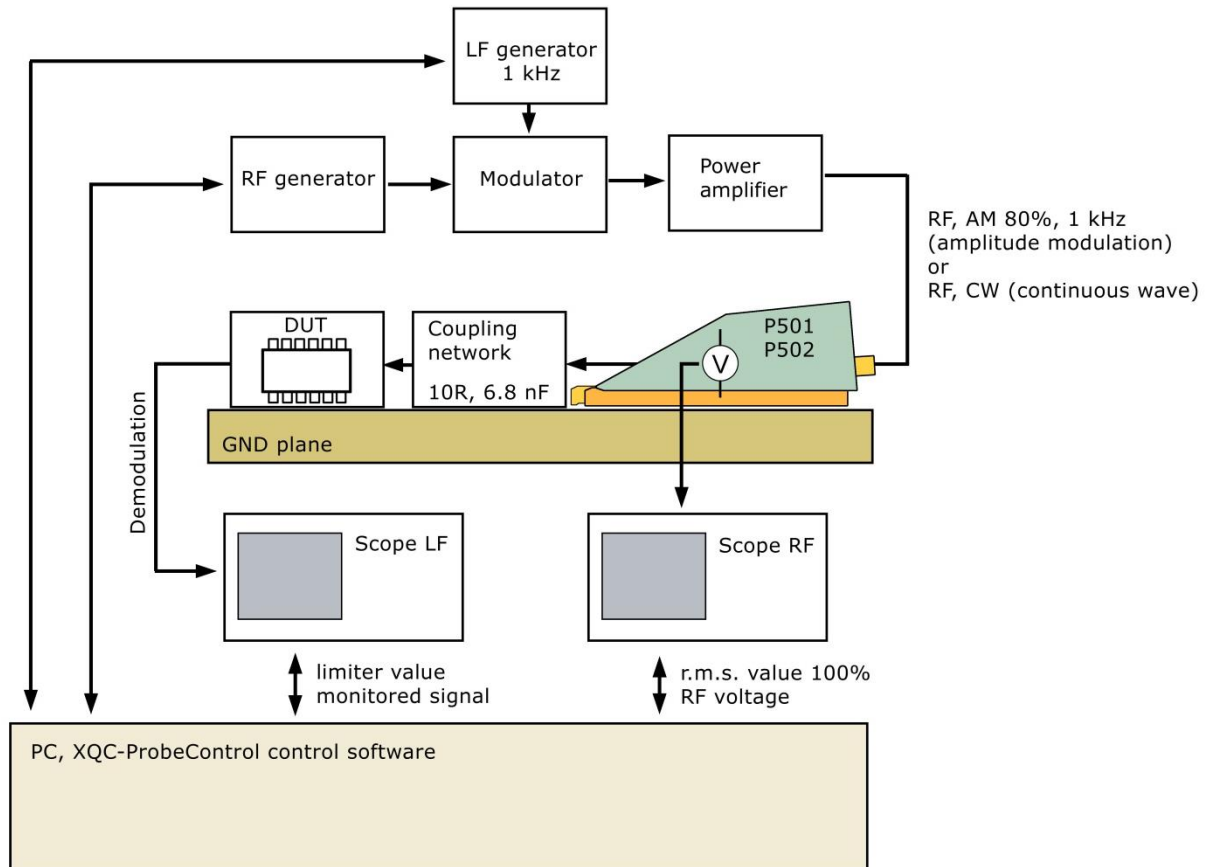


Test board bottom:



3 TEST CONDITIONS

3.1 Test Set-up



3.2 Test equipment

Instrument	Vendor	Model	Comment
Power supply	STATRON	Type 2229	2 x 0-40 V / 0-2.5 A
RF generator	HAMEG	HM8134-3	RF generator + Modulator and LF generator
RF power amplifier	AMPLIFIER RESEARCH	30W1000B	30 Watt
Directional Coupler	RHODE & SCHWARZ	NAP-Z7	0,4 – 80 MHz
		NRT-Z14	25 – 1000 MHz
Oscilloscope RF	Tektronix	TDS7404B	4 GHz digital phosphor oscilloscope
Oscilloscope LF	Tektronix	TDS3054	Limiter module
IC-Test system	Langer	Set P500	RF injection set for IC
	Langer	Set 200/300	EFT injection set for IC
Connection Board	Langer	CB02	
Oscilloscope Adapter	Langer	OA4005	4 Channel
Control Unit	Langer	CU 22	
Ground Plane	Langer	GND 20-02	

3.3 Fault criteria for failure evaluation

For the immunity evaluation the output signal of the operational amplifiers is compared under influence of the disturbance with the undisturbed signal by using the limiter function of an oscilloscope.

Immunity evaluation signal: OUT A

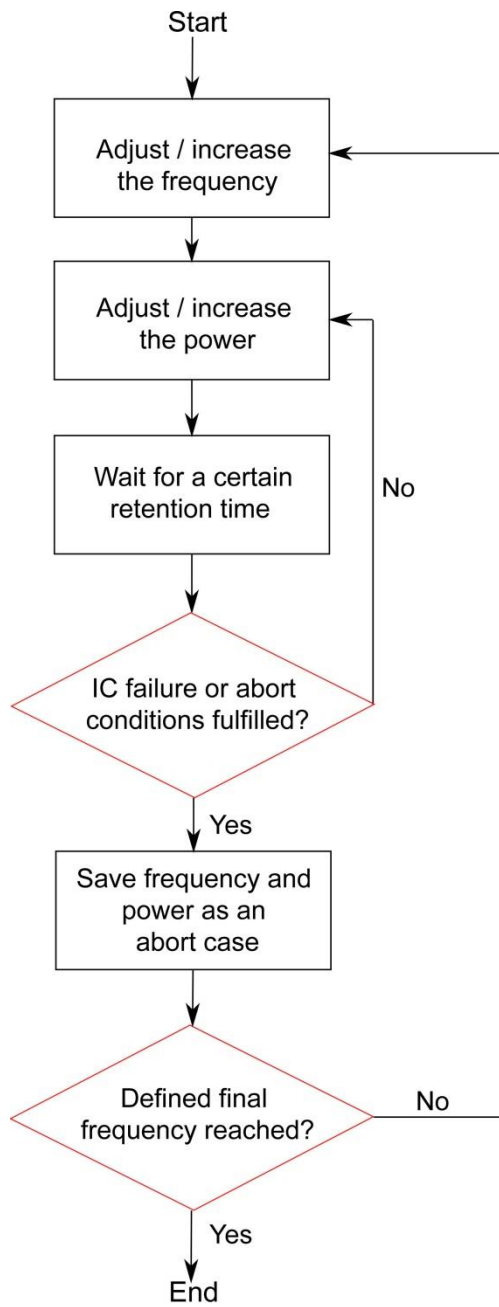
Maximum voltage variations: ± 100 mV

Maximum time variations: ± 200 μ s

3.4 Measurement Settings

Frequency [MHz]:	<table border="1"> <thead> <tr> <th>Range</th> <th>Step size</th> </tr> </thead> <tbody> <tr> <td>1 to 10</td> <td>1</td> </tr> <tr> <td>10 to 100</td> <td>10</td> </tr> <tr> <td>100 to 1000</td> <td>50</td> </tr> </tbody> </table>	Range	Step size	1 to 10	1	10 to 100	10	100 to 1000	50
Range	Step size								
1 to 10	1								
10 to 100	10								
100 to 1000	50								
Presentation of immunity:	Immunity threshold curve with the voltage on a resistor of 10 Ω as the parameter.								
P _{min} : V _{min} (resistor):	- 23 dBm 0.01 V								
P _{max} : V _{max} (resistor):	27 dBm 3.0 V								
Power step size	0,5 dB								
Power control procedure:	Normal mode set frequency power reduction (20 %) 200 ms stay set controlled power start validation mask test 1 s dwell time stop validation mask test control next power and / or frequency								
Modulation:	Continuous wave (CW) or Amplitude modulation (AM)								
Test signal:	Output of the operational amplifiers.								

Flowchart test procedure:



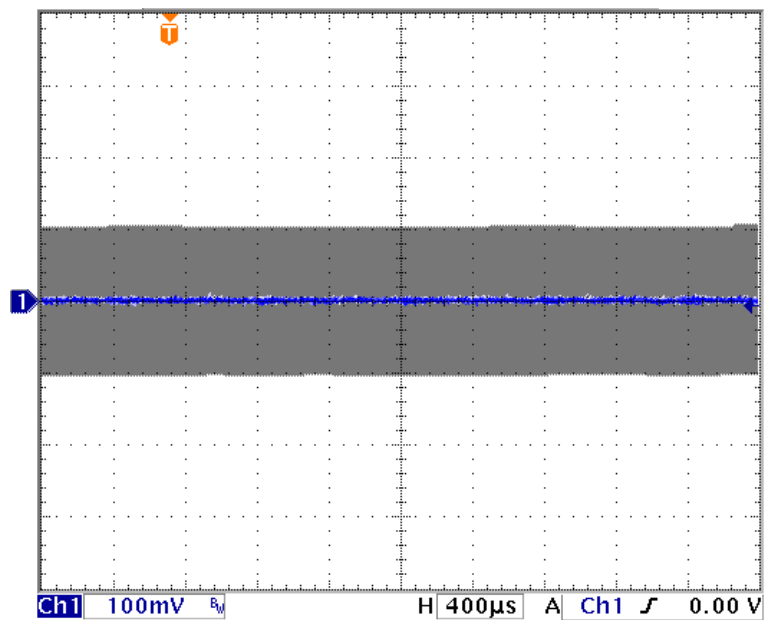
4 RESULTS

4.1 Normal operation mode

Legend:

Oscilloscope Channel:	Colour:	Signal name:
1	Blue	OUT
Ref 1	Grey	Limiter range of OUT

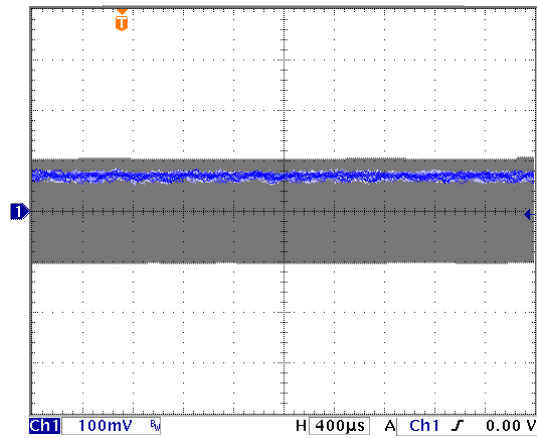
Normal operation mode:



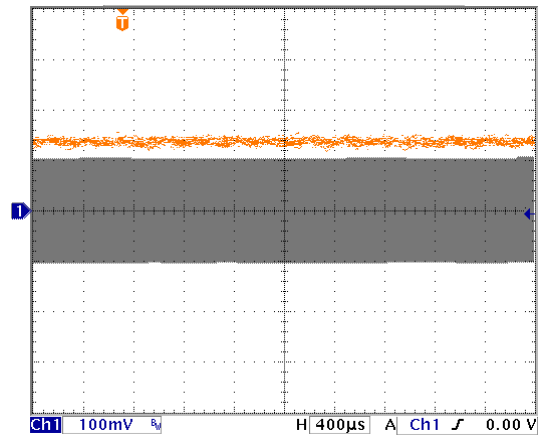
4.2 Fault description

Positive out of limit with continuous wave (CW):

No fault:

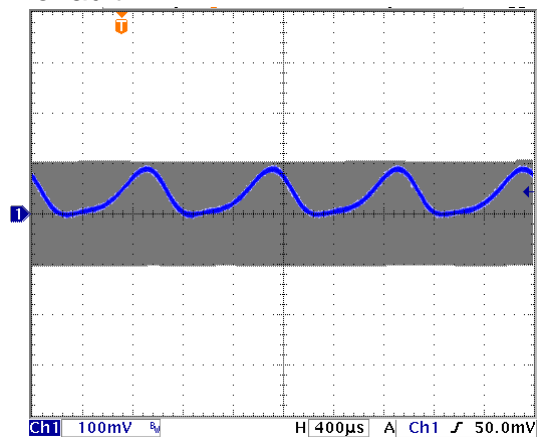


Fault:

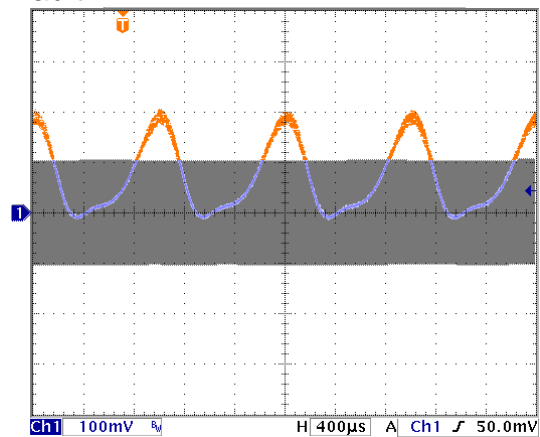


Positive out of limit with amplitude modulation (AM):

No fault:

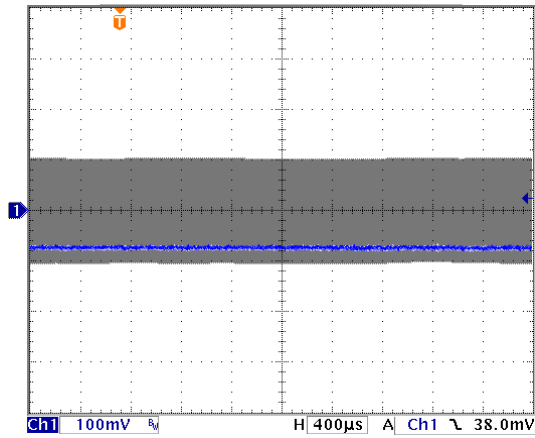


Fault:

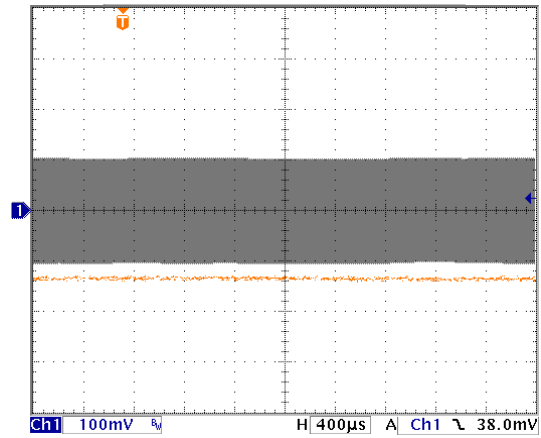


Negative out of limit with continuous wave (CW):

No fault:

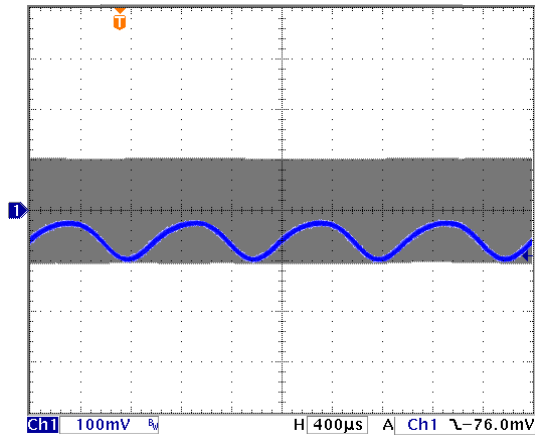


Fault:

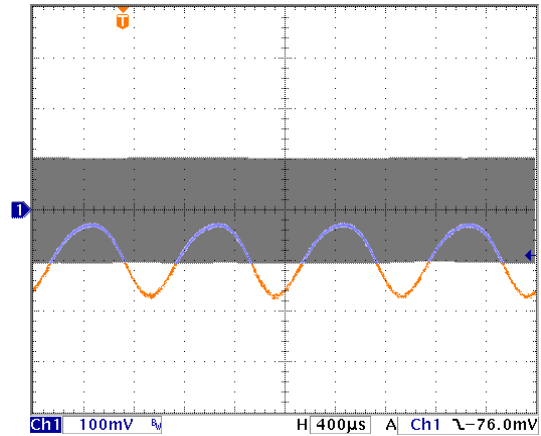


Negative out of limit with amplitude modulation (AM):

No fault:

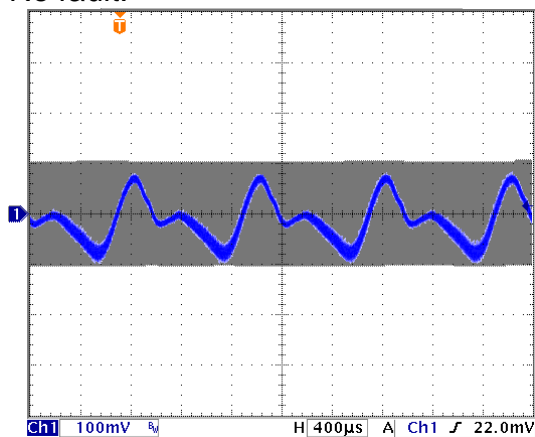


Fault:

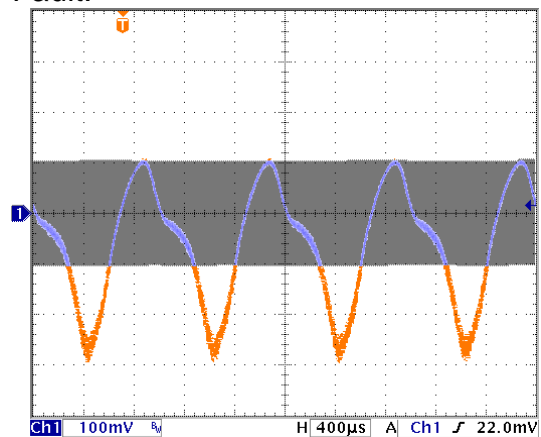


Other out of limit with amplitude modulation (AM):

No fault:



Fault:



4.3 Test result diagrams

The detailed test results are located in the attached Excel-file
 "OPV - DPI test results.xls".

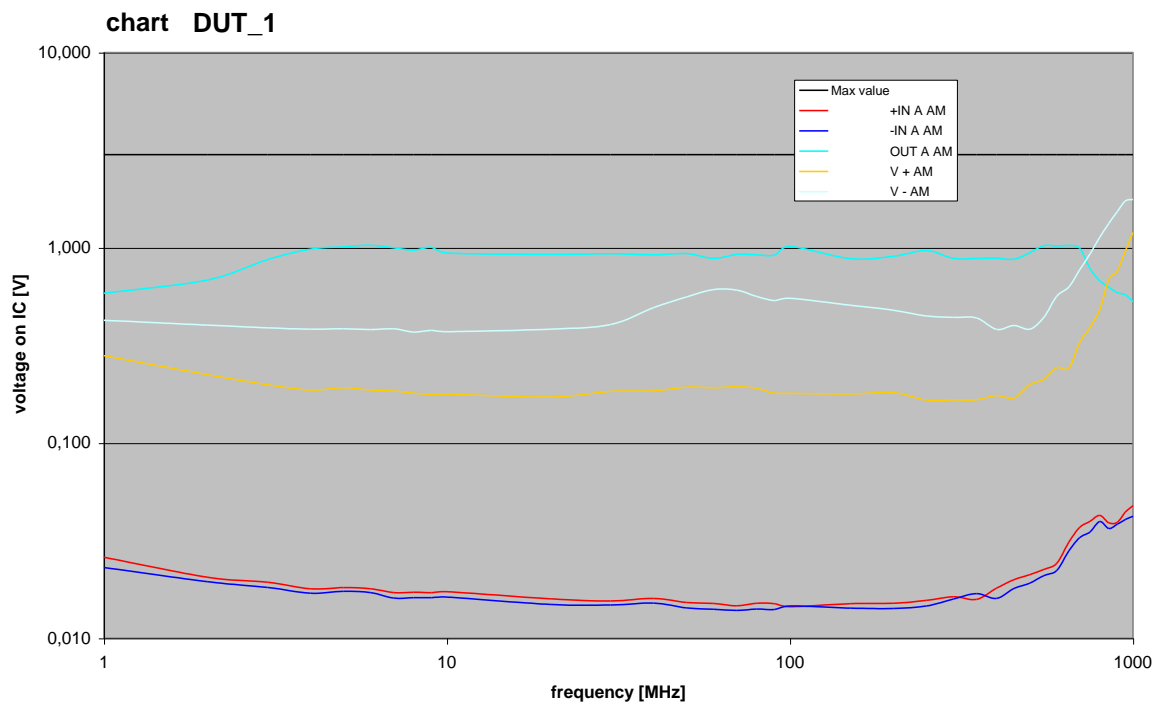
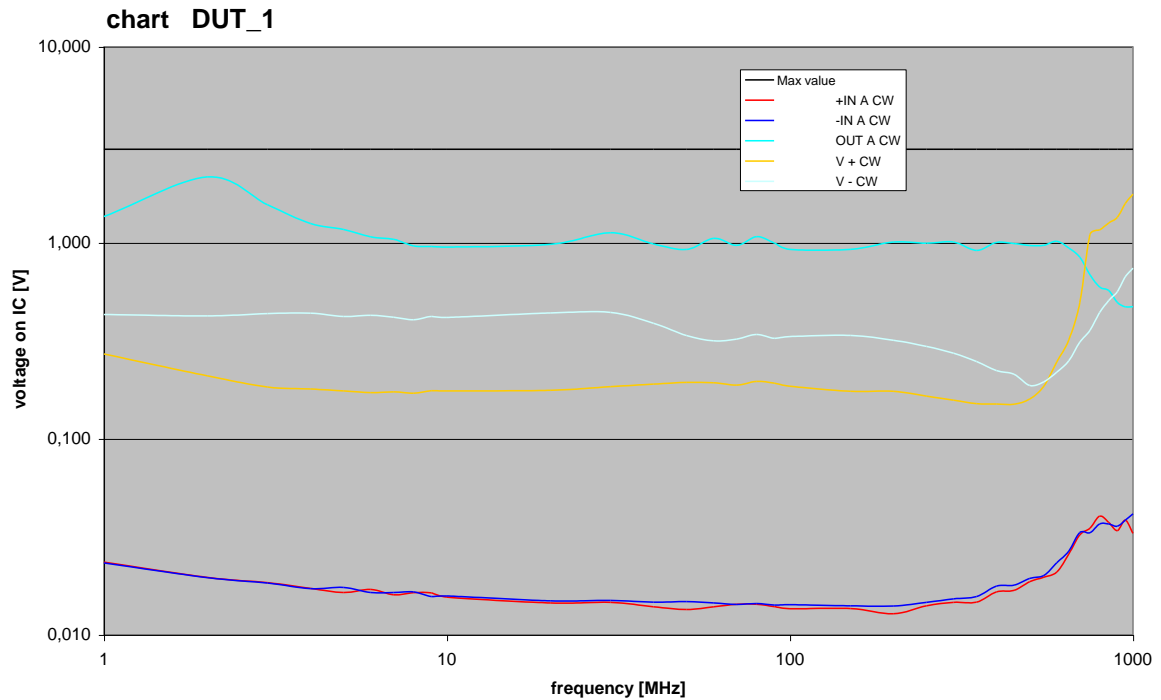


chart DUT_2

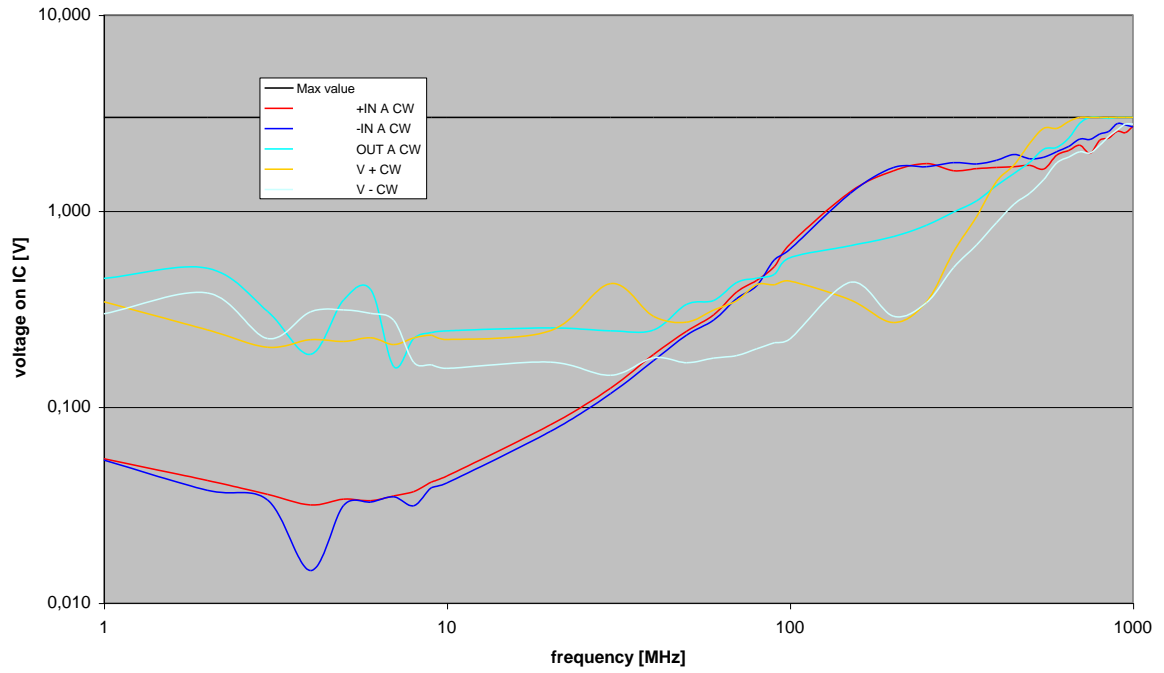


chart DUT_2

