

NO. 04787-16-0492

TÜV SÜD Rail GmbH Barthstr. 16 80339 Munich Germany	CLIENT
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Panorama Antennas Ltd. 61 Frogmore London SW18 1HF United Kingdom	MANUFACTURER
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Railway antenna for vehicle roof mounting	TEST OBJECT
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TRNM(G) MiMo TRANSIT ANTENNA	TYPE
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Test sample 1 (insulation test) Test sample 2 (short-circuit withstand test)	SERIAL NO.
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Nominal voltage of railway networks U_n	15/25 kV	RATED
Rated insulation voltage U_{Nm}	17.25/27.5 kV	CHARACTERISTICS
Nominal short-circuit current of railway networks	25 kA, 0.1 s	GIVEN BY THE
Nominal frequency of railway networks	16.7 and 50, resp. Hz	CLIENT

As required by the client and on the basis of EN 50124-1: 2001 + A1: 2003 + A2: 2005	NORMATIVE DOCUMENT
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<ul style="list-style-type: none"> • Insulation test • Short-circuit withstand test at 50 Hz 	RANGE OF TESTS PERFORMED
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20 May and 04 August 2016	DATE OF TEST
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See Sub-clauses 4.6 and 5.6	TEST RESULT
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RONALD BOCHERT
Senior engineer
Berlin, 19 August 2016



p.p. JENS HARING
Test engineer in charge



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This test document comprises 22 sheets.

Distribution

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TÜV SÜD Rail GmbH

1. Present at the test

Mr. Heise IPH test engineer in charge
 Mr. Schröder-Heske IPH test engineer (insulation test)

2. Test performed

- Insulation test
- Short-circuit withstand test at 50 Hz

3. Identity of the test object

3.1 Technical data and characteristics

Test object: Railway antenna for vehicle roof mounting
 Type: TRNM(G) MiMo TRANSIT ANTENNA
 Manufacturer: Panorama Antennas Ltd.
 Serial No.: Test sample 1 (insulation test)
 Test sample 2 (short-circuit withstand test)
 Year of manufacture: 2016

Rated characteristics: Nominal voltage of railway networks U_n 15/25 kV
 Rated insulation voltage U_{Nm} 17.25/27.5 kV
 Nominal short-circuit current (eff.) of railway networks 25 kA, 0.1 s
 Nominal frequency of railway networks 16.7 and 50, resp. Hz

Characteristics: Material Radome made of synthetic material
 Outputs 2 x Cellular Elements 698-960 MHz & 1710-6000 MHz
 1 x GPS/GNSS module 1562-1610 MHz

3.2 Identity documents

The manufacturer confirms that the test object has been manufactured in compliance with the drawings given in this document. IPH did not verify this compliance in every detail.

The identity of this test object is fixed by the following drawings and data submitted by the client:

Name of drawing	Drawing No.	Date of drawing	Author	Notes
MiMo TRANSIT ANTENNA 2x698-960/1710-6000 MHz + GPS/GNSS	TRNMG-7-60-NJ	-	Panorama Antennas	Sheet 17
Installation Instructions – SW3-679 TRNM[G] Range	-	-	Panorama Antennas	Sheets 18 to 22

Notes:

Entry of test objects at IPH: 21 April 2016

4. Insulation test

4.1 Test laboratory

High-voltage test laboratory, high-voltage hall 2

4.2 Normative document

As required by the client and in accordance to EN 50124-1: 2001 + A1: 2003 + A2: 2005

4.3 Required test parameters

AC withstand voltage 50 Hz, 1 min	17.25 kV	for railway networks at 15 kV nominal voltage
AC withstand voltage 50 Hz, 1 min	27.5 kV	for railway networks at 25 kV nominal voltage

4.4 Test arrangement

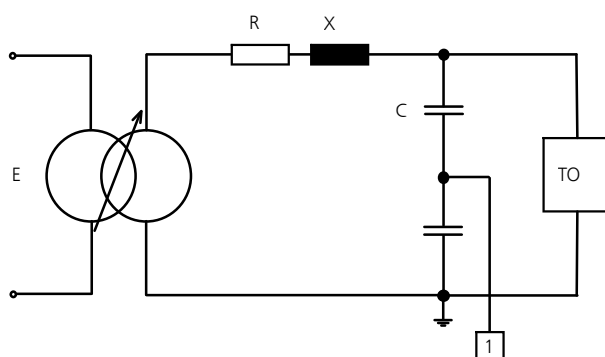
The test object was horizontally arranged with the insulating cover upwards. On the top of the radome, an electrode of 20 mm diameter was centrally fixed. The test electrode was connected to the test voltage supply and the metal ground plate of the test object to the test earth.

4.5 Test and measuring circuits

Power-frequency voltage test

Technical test circuit data for 50 Hz

Test transformer:	Rated voltage	125	kV
	Rated power	20	kVA
	Rated current (5 h)	160	mA
	Rated frequency	50	Hz
	Damping resistance	0.67	kOhm



- E Supply test voltage
- R Damping resistance
- X Blocking impedance
- C Capacitive divider
- 1 Measuring point
- TO Test object

Figure 1: Test and measuring circuits for the 50-Hz power-frequency test

Technical data of measuring circuit

Measuring point	Measured quantity	Measuring sensor/device	Technical parameters
1	Test voltage	Capacitive divider with MU18 peak voltmeter (made by HighVolt)	U = 200 kV C = 120 pF Ratio 582

4.6 Test results

Power-frequency voltage test

Date of test:	20 May 2016
Test frequency:	50 Hz
Testing time after having reached full amplitude:	1 min
Air temperature:	23.7 °C
Air pressure:	1010 hPa
Air humidity (relative):	44 %
Atmospheric correction of test voltage:	Without

Every voltage is related to an air pressure of 101.3 kPa, an air temperature of 20 °C and an air humidity of 11 g/m³. The test voltage applied was not corrected.

Test arrangement			Rated insulation voltage kV	Test voltage kV	Disruptive discharge
Test object	Voltage applied to	Earthed			
TRNM	Electrode	Ground plate	17.25	17.3	no
TRNM	Electrode	Ground plate	27.5	27.5	no

Notes: -

Condition of test object after test:

During the tests at 17.3 kV and 27.5 kV, no visible damage on the radome occurred.

For information only:

At 17.3 kV and 27.5 kV there was no measurable 50-Hz touch voltage at all outputs. Only pre-discharge pulses with maximal voltage $U_{ss} = 1.66$ V were detected.

5. Short-circuit withstand test

5.1 Test laboratory

Low-voltage test laboratory, test room 10

5.2 Normative document

The test was carried out as agreed with the client.

5.3 Required test parameters

Step 1:

Peak short-circuit current	- 1)
Short-time current	10 kA
Duration of short-circuit	0.1 s
Frequency	50 Hz

Step 2:

Peak short-circuit current	- 1)
Short-time current	25 kA
Duration of short-circuit	0.1 s
Frequency	50 Hz

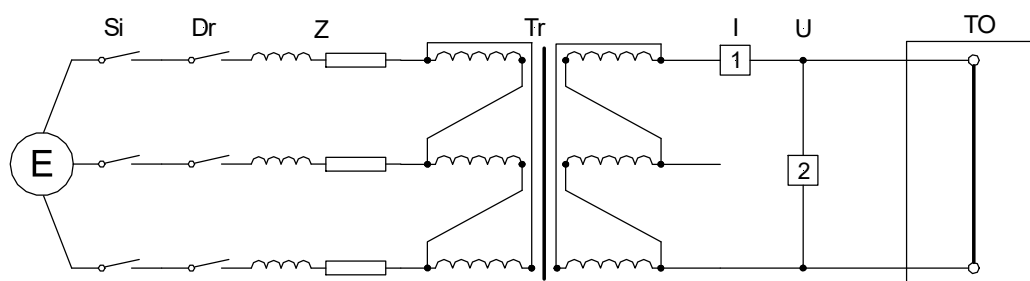
1) Symmetrical making at the maximum voltage according to the client's request

5.4 Test arrangement

The antenna base plate was mounted on a metal plate, to simulate the roof of the train with holes for the external connectors. One pole of the test supply was connected by 100 mm x 10 mm copper bar to the metal plate.

The other pole was connected by copper bar of 30 mm x 10 mm direct to the cellular radiating element. For this bolted connection, the manufacturer made a bore at the radiator and a cutout on the radome (see Photo 3, Sheet 12).

5.5 Test and measuring circuits



- | | | | |
|----|---------------------------|------|---------------------|
| E | Supply | U | Voltage measurement |
| Si | Master breaker | I | Current measurement |
| Dr | Making switch | TO | Test object |
| Z | Test circuit impedance | 1, 2 | Measuring points |
| Tr | Short-circuit transformer | | |

Figure 2: Test and measuring circuits for single-pole short-circuit test

Technical data of measuring circuits

Measuring point	Measured quantity	Measuring sensor/device
1	Current	Rogowski measuring device
2	Voltage	RC divider

5.6 Test results

Condition of test object before test: New
 Test sample No.: 2
 Date of test: 04 August 2016

Test parameters:

Test No.		1016 1180
Test voltage	V	420
Symmetrical short-circuit current	kA	16.1
Duration of short-circuit	ms	110
Joule integral	10 ⁶ A ² s	12.0
Symmetrical short-circuit current 0.1 s	kA	11.0
Notes		-
Evaluation		OK

Notes:

-

Condition of test object after test:

The test object shows no visible damage.

See Photos 2 and 3, Sheets 11 and 12

Test results (continued)

Condition of test object before test: Prestressed
 Test sample No.: 2
 Date of test: 04 August 2016

Test parameters:

Test No.		1016 1181
Test voltage	V	420
Symmetrical short-circuit current	kA	25.6
Duration of short-circuit	ms	90.5
Joule integral	10 ⁶ A ² s	63.2
Symmetrical short-circuit current 0.1 s	kA	25.1
Notes		1)
Evaluation		OK

Notes:

1) Some sparks during the test

Condition of test object after test:

The test object shows no visible damage.

See Photos 4 to 7, Sheets 12 to 14