

Report on the Radio Testing of the PRÜFTECHNIK Condition Monitoring GmbH Model: ALI 21.901

In accordance with ETSI EN 300 328 (partly)

Prepared for: PRÜFTECHNIK Condition Monitoring GmbH
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COMMERCIAL-IN-CONFIDENCE

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EXECUTIVE SUMMARY

A sample of this product was partly tested and tested parts were found to be in compliance with ETSI EN 300 328:V2.1.1 (2016-11).

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2019-11-06

Table 1

1.2 Introduction

Applicant	PRÜFTECHNIK Condition Monitoring GmbH
Manufacturer	PRÜFTECHNIK Condition Monitoring GmbH
Model Number(s)	ALI 21.901
Serial Number(s)	21910012
Hardware Version(s)	1.00
Software Version(s)	1.05
Number of Samples Tested	1
Test Specification/Issue/Date	ETSI EN 300 328:V2.1.1 (2016-11)
Test Plan/Issue/Date	---
Order Number	4500068632
Date	2019-07-01
Date of Receipt of EUT	2019-10-29
Start of Test	2019-10-29
Finish of Test	2019-10-29
Name of Engineer(s)	Alex Fink
Related Document(s)	---



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with ETSI EN 300 328 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Test Mode - Continuous Transmission				
2.1	4.3.2.2	RF Output Power	Pass	---
2.2	4.3.2.9	Transmitter Unwanted Emissions in the Spurious Domain	Pass	---

On applicant's request, no more tests have been performed.

Table 2



1.4 Product Information

1.4.1 EUT Configuration Record

ALI 21.901 was configured as follows during testing:

Radio Interface: Bluetooth
Band: 2,4 GHz
Channel Bandwidth: 1 MHz
Channel under Test: Bluetooth: 0, 39, 78
Transmit Power Setting: Max. Available

1.5 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer, S/N: 21910012	Not Applicable	Not Applicable

Table 3

1.6 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing Test Laboratory.

Test Name	Name of Engineer(s)
Configuration and Mode: Test Mode - Continuous Transmission	
RF Output Power	Alex Fink
Transmitter Unwanted Emissions in the Spurious Domain	Alex Fink

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany



2 Test Details

2.1 RF Output Power

2.1.1 Specification Reference

ETSI EN 300 328, Clause 4.3.2.2

2.1.2 Equipment Under Test and Modification State

ALI 21.901, S/N: 21910012 - Modification State 0

2.1.3 Date of Test

2019-10-29

2.1.4 Test Method

This test was performed in accordance with ETSI EN 300 328, clause 5.4.2.2.

2.1.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	50,0 %



2.1.6 Test Results

Test Mode - Continuous Transmission, Bluetooth

Measurements were performed as radiated test.

Temperature	Voltage	EIRP (dBm)	
		Ch00 2402 MHz	Ch78 2480 MHz
+21°C	3,7 V DC	-6,56	-13,06

Table 5 - Bluetooth RF Output Power Results, radiated

ETSI EN 300 328, Limit Clause 4.3.2.2.3

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be declared by the manufacturer and not exceed 20 dBm.

The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the supplier.

This limit shall apply for any combination of power level and intended antenna assembly.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Fully anechoic room - cabin no. 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Horn Antenna	Rohde & Schwarz	HF907	19933	24	2021-07-31
TRILOG broadband antenna	Schwarzbeck	VULB 9163	19589	36	2020-10-31
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02-29

Table 6

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.2 Transmitter Unwanted Emissions in the Spurious Domain

2.2.1 Specification Reference

ETSI EN 300 328, Clause 4.3.2.9

2.2.2 Equipment Under Test and Modification State

ALI 21.901, S/N: 21910012 - Modification State 0

2.2.3 Date of Test

2019-10-29

2.2.4 Test Method

This test was performed in accordance with ETSI EN 300 328, clause 5.4.9.2.

2.2.5 Environmental Conditions

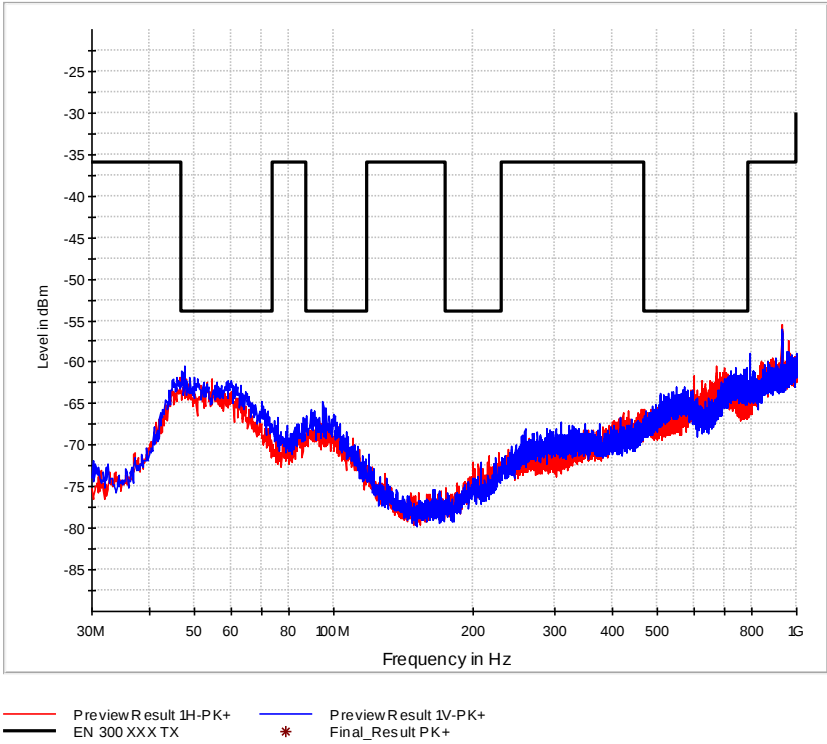
Ambient Temperature	21,0 °C
Relative Humidity	50,0 %

2.2.6 Test Results

Measurements were performed as radiated test including antenna.

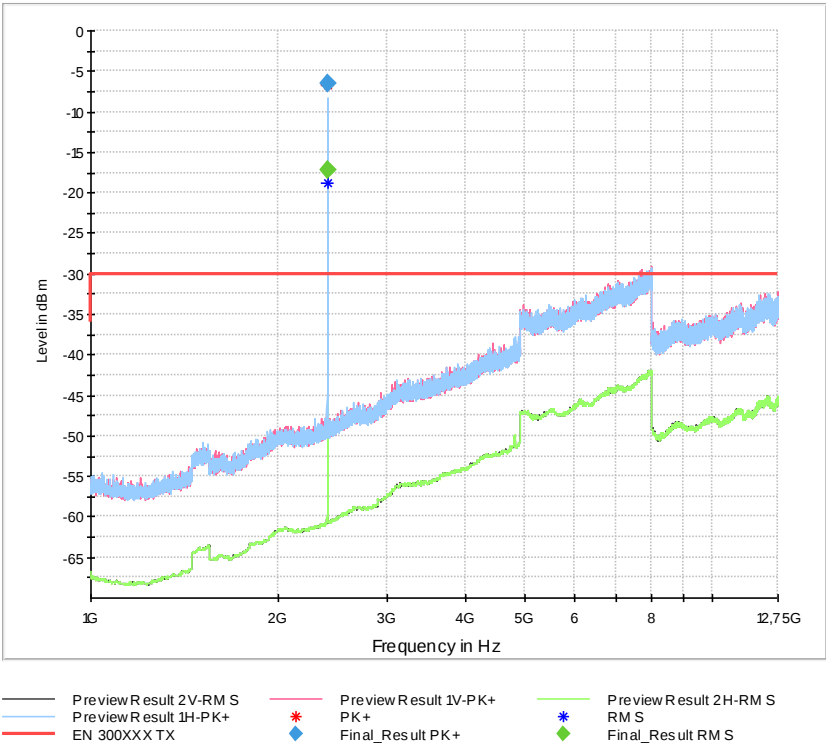


Test Mode - Continuous Transmission Bluetooth, Channel 0





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Final Results:

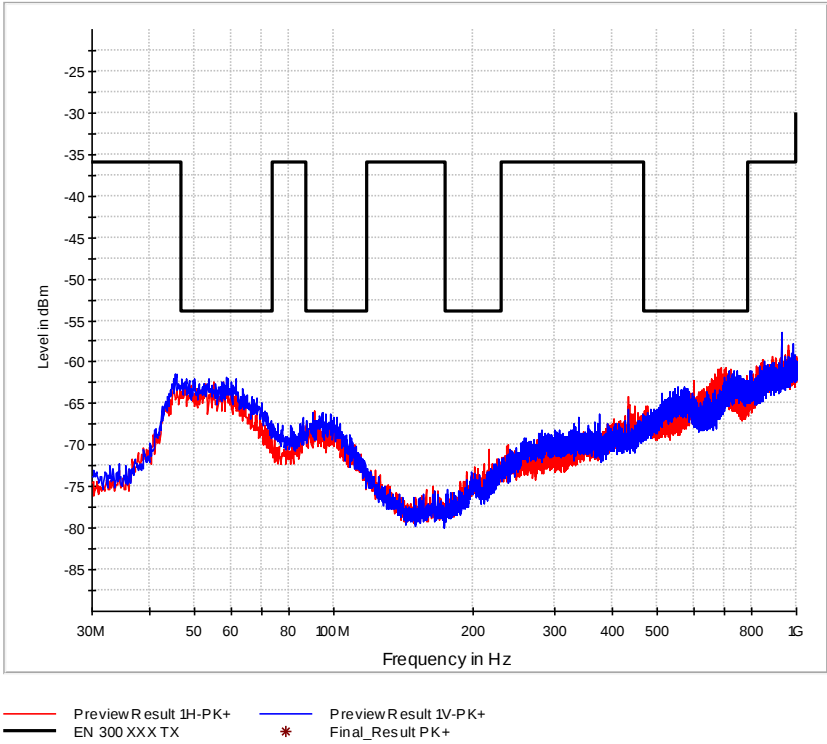
Frequency	MaxPeak	RMS	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBm	dBm	dBm	dB	ms	kHz	cm		deg	dB
2401,990000	---	-17,28	#1	#1	1000,0	1000,000	129,0	H	111,0	-62,9
2401,990000	-6,56	---	#1	#1	1000,0	1000,000	129,0	H	111,0	-62,9

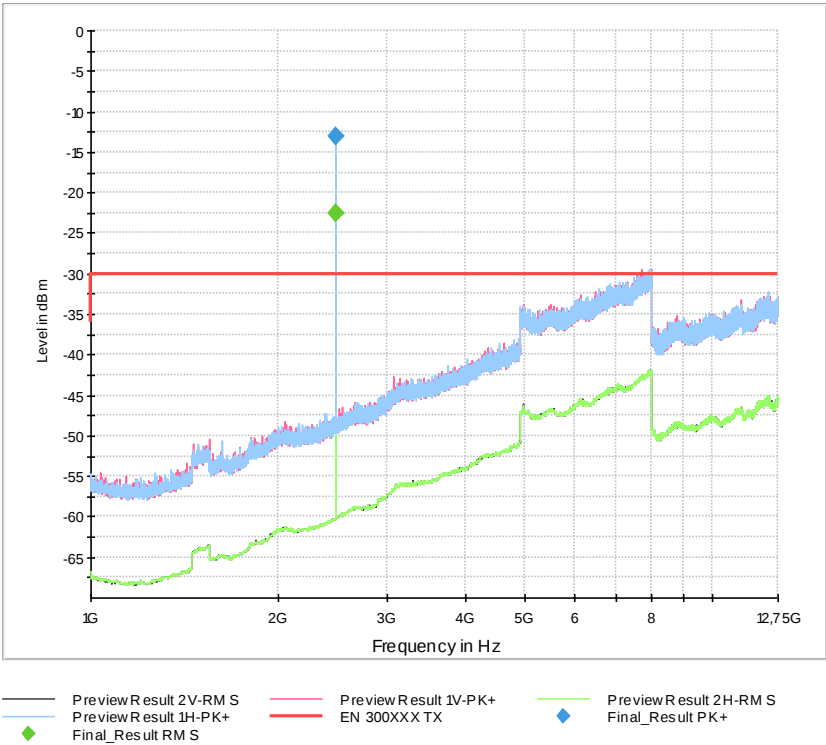
Note: #1: intentional radiation



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Test Mode - Continuous Transmission Bluetooth, Channel 78





Final Results:

Frequency	MaxPeak	RMS	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBm	dBm	dBm	dB	ms	kHz	cm		deg	dB
2479,850000	---	-22,56	#1	#1	1000,0	1000,000	151,0	V	-59,0	-62,3
2479,850000	-13,06	---	#1	#1	1000,0	1000,000	151,0	V	-59,0	-62,3

Note: #1: intentional radiation



ETSI EN 300 328, Limit Clause 4.3.2.9.3

Frequency Range	Maximum power e.r.p (≤ 1 GHz) e.i.r.p (> 1 GHz)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87.5 MHz	-36 dBm	100 kHz
87.5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

Table 7 - Transmitter Spurious Emissions Limit

2.2.7 Test Location and Test Equipment Used

This test was carried out in Fully anechoic room - cabin no. 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Horn Antenna	Rohde & Schwarz	HF907	19933	24	2021-07-31
TRILOG broadband antenna	Schwarzbeck	VULB 9163	19589	36	2020-10-31
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02-29

Table 8

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable

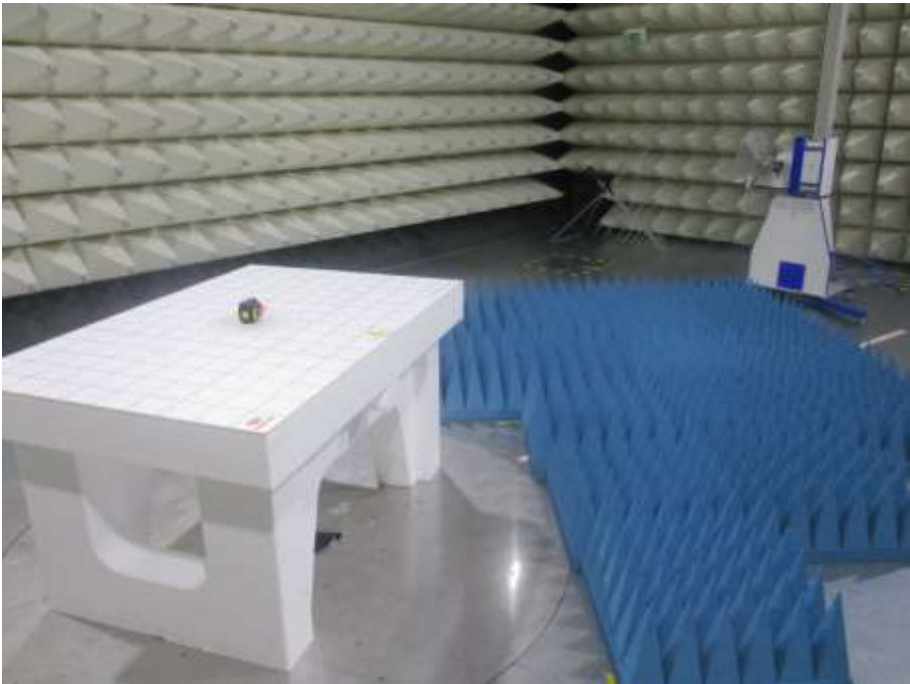
3 Photographs

3.1 Equipment Under Test (EUT)





Product Service





4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	$\pm 1.14 \%$	2
RF-Frequency error	1.96	$\pm 1 \cdot 10^{-7}$	7
RF-Power, conducted carrier	2	$\pm 0.079 \text{ dB}$	2
RF-Power uncertainty for given BER	1.96	$+0.94 \text{ dB} / -1.05$	7
RF power, conducted, spurious emissions	1.96	$+1.4 \text{ dB} / -1.6 \text{ dB}$	7
RF power, radiated			
25 MHz – 4 GHz	1.96	$+3.6 \text{ dB} / -5.2 \text{ dB}$	8
1 GHz – 18 GHz	1.96	$+3.8 \text{ dB} / -5.6 \text{ dB}$	8
18 GHz – 26.5 GHz	1.96	$+3.4 \text{ dB} / -4.5 \text{ dB}$	8
40 GHz – 170 GHz	1.96	$+4.2 \text{ dB} / -7.1 \text{ dB}$	8
Spectral Power Density, conducted	2.0	$\pm 0.53 \text{ dB}$	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	$\pm 2.89 \%$	2
6 kHz – 25 kHz	2	$\pm 0.2 \text{ dB}$	2
Maximum frequency deviation for FM	2	$\pm 2.89 \%$	2
Adjacent channel power 25 MHz – 1 GHz	2	$\pm 2.31 \%$	2
Temperature	2	$\pm 0.39 \text{ K}$	4
(Relative) Humidity	2	$\pm 2.28 \%$	2
DC- and low frequency AC voltage			
DC voltage	2	$\pm 0.01 \%$	2
AC voltage up to 1 kHz	2	$\pm 1.2 \%$	2
Time	2	$\pm 0.6 \%$	2

Table 9



Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50μH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50μH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5μH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50μH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50μH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes, Voltage Fluctuations and Flicker			4

Table 10



Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Table 11

Note 1:

The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 2:

The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 3:

The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2.05$, providing a level of confidence of $p = 95.45\%$

Note 4:

It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95%confidence.

Note 5:

The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 6:

The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 7:

The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of $k_p = 1.96$, providing a level of confidence of $p = 95.45\%$

Note 8:

The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 1.96$, providing a level of confidence of $p = 95.45\%$