Test Report
19-1-0130001T14a-C1

D-PL-12047-01-01
D-PL-12047-01-03
D-PL-12047-01-04

Number of pages:	16	**Date of Report:**	2021-Jul-29
Testing company:	CETECOM GmbH Im Teelbruch 116 45219 Essen Germany Tel. + 49 (0) 20 54 / 95 19-0 Fax: + 49 (0) 20 54 / 95 19-150	**Applicant:**	ORTOVOX Sportartikel GmbH
Product: **Model:**	**Avalanche Transceiver** **DIRACT VOICE**		
FCC ID:	KF5DIR1	**IC:**	26906-DIR1
Testing has been carried out in accordance with:	CFR Title 47, Chapter I, Subchapter A, Part 15, §15.209 RSS-210, Issue 10 (December 2019) + Amendment (April 2020) Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".		
Tested Technology:	SRD		
Test Results:	**☒ The EUT complies with the requirements in respect of all parameters subject to the test.** The test results relate only to devices specified in this document		

This test report CETECOM_TR19-1-0130001T14a_C1 dated on 2021-Jul-23 substitutes the test report CETECOM_TR19-1-0130001T14a dated on 2021-May-11, which herewith gets invalid.

Signatures:

Ninovic Perez 2021.07.29 10:36:45 + 02'00'

Guangcheng Huang 2021.07.29 10:26:56 + 02'00'

Dipl.-Ing. Ninovic Perez	Guangcheng Huang
Test Lab Manager	Test manager
Authorization of test report	Responsible of test report

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1 General information

1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. CETECOM does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

1.2 Attestation

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All of the above requirements are met in accordance with enumerated standards.

1.3 Summary of Test Results

The EUT integrates a Bluetooth transmitter. Other implemented wireless technologies were not considered within this test report.

Test case	Reference Clause FCC ☒	Reference Clause ISED ☒	Page	Remark	Result
Radiated field strength emissions below 30 MHz	§15.209(a)	RSS-Gen: Issue 5 §8.9 Table 6	10	-	PASSED

PASSED	The EUT complies with the essential requirements in the standard.
FAILED	The EUT does not comply with the essential requirements in the standard.
NP	The test was not performed by the CETECOM Laboratory.
NT	Not tested
N/A	Not applicable

*The calculation of the measurement uncertainty shows compliance with the "maximum measurement uncertainties" of the tested standard and therefore for result evaluation the stated uncertainties will not be additionally added to the measured results.

1.4 Summary of Test Methods

Test case	Test method
Duty-Cycle	ANSI 63.10:2013, §11.6(b)
Emission Bandwidth 20 dB	ANSI C63.10:2013
Occupied Channel Bandwidth 99%	ANSI C63.10:2013, §6.9.3
Carrier Frequency Separation	ANSI C63.10:2013
Number of Hopping Channels	ANSI C63.10:2013
Time of Occupancy	ANSI C63.10:2013
Peak output power (Sweep)	ANSI 63.10:2013, §6.101
Power spectral density	ANSI C63.10:2013, §6.9.2, §11.8
Emissions in non-restricted frequency bands	ANSI C63.10:2013, §11.11, §6.10.5
Radiated Band-Edge emissions	ANSI C63.10-2013; “Marker-Delta method”, §6.10.5, §11.13
Transmitter Peak output power radiated	Result calculated with measured conducted RF-power value and stated/measured antenna gain for band of interest
Radiated field strength emissions below 30 MHz	ANSI C63.10-2013 §6.3, §6.4
Radiated field strength emissions 30 MHz- 1 GHz	ANSI C63.4-2014 §8.2.3, ANSI C63.10-2013 §6.3, § 6.5
Radiated field strength emissions above 1 GHz	ANSI C63.4-2014 §8.3, ANSI C63.10-2013 §6.3, § 6.6
AC-Power Lines Conducted Emissions	ANSI C63.4-2014 §7, ANSI C63.10-2013 § 6.2

And reference also to Test methods in KDB558074

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Ninovic Perez
Accreditation scope:	DAkkS Webpage
Test location:	CETECOM GmbH; Im Teelbruch 116; 45219 Essen - Kettwig

2.2 General limits for environmental conditions

Temperature:	22±2 °C
Relative. humidity:	45±15% rH

2.3 Test Laboratories sub-contracted

Company name:

2.4 Organizational Items

Responsible test manager:	Guangcheng Huang
Receipt of EUT:	2021-Feb-10
Date(s) of test:	2021-Apr-26 – 2021-Apr-27
Version of template:	14.7

2.5 Applicant's details

Applicant's name:	ORTOVOX Sportartikel GmbH
Address:	Rotwandweg 5 82024 Taufkirchen Bavaria Germany
Contact Person:	Tobias Schädel
Contact Person's Email:	tschaedel@ortovox.com

2.6 Manufacturer's details

Manufacturer's name:	x-log Elektronik GmbH
Address:	Balanstr. 55 81541 München Germany

2.7 EUT: Type, S/N etc. and short descriptions used in this test report

Short description*)	PMT Sample No.	Product	Model	Type	S/N	HW status	SW status
EUT 1	19-1-01300S08_C01	Avalanche Transceiver	DIRACT VOICE	-	-	160-801B	d0325742733c3952ceed8f7d4f8e80422dcbeb0d

*) EUT short description is used to simplify the identification of the EUT in this test report.

2.8 Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

Short description*)	PMT Sample No.	Auxiliary Equipment	Type	S/N	HW status	SW status
-	-	-	-	-	-	-

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

2.9 Connected cables

Short description*)	PMT Sample No.	Cable type	Connectors	Length
-	-	-	-	-

*) CAB short description is used to simplify the identification of the connected cables in this test report.

2.10 Software

Short description*)	PMT Sample No.	Software	Type	S/N	HW status	SW status
-	-	-	-	-	-	-

*) SW short description is used to simplify the identification of the used software in this test report.

2.11 EUT set-ups

set-up no.*)	Combination of EUT and AE	Description
Set.1	EUT 1	Used for Radiated measurements

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

2.12 EUT operation modes

EUT operating mode no.*1)	Operating modes	Additional information
op. 1	TX mode	The EUT is set to continuous transmission mode

*1) EUT operating mode no. is used to simplify the test report.

*2) Please refer to document CETECOM_test_modes_210208_TOS.xlsx

3 Equipment under test (EUT)

3.1 General Data of Main EUT as Declared by Applicant

Product name	DIRACT VOICE		
Kind of product	Avalanche Transceiver		
Firmware	☐ for normal use	☒ Special version for test execution	
	☐ AC Mains	Wählen Sie ein Element aus.	
	☐ DC Mains	XX V DC via XX Connector	
	☒ Battery	Lithium Ion battery	
Operational conditions	T_{nom} =20 °C	T_{min} =XX °C	T_{max} =XX °C
EUT sample type	**Engineering Samples**		
Weight	-		
Size [LxWxH]	-		
Interfaces/Ports	-		
For further details refer Applicants Declaration & following technical documents CETECOM_test_modes_210208_TOS.xlsx			

3.2 Detailed Technical data of Main EUT as Declared by Applicant

Carrier Freqeuncy	457 kHz		
Measured Bandwidth	99% OBW: 785 Hz 20 dB BW: 276 Hz		
Frequency Band	-		
Number of Channels (USA/Canada -bands)	1		
Type of Modulation | Data Rate	☐ GFSK | 1 Mbit / s ☐ 8DPSK | 3 Mbit / s	☐ π/4 DQPSK | 2 Mbit / s	
Other installed options	☐ a/n/ac mode ☐ b/g/n mode ☒ Bluetooth LE (not tested within this report) ☐ Cellular transceiver (2G/3G/4G/5G/GPS, not tested in this report)		
Antenna Type	Coil		
Antenna Gain	Not reported		
FCC label attached	No		
Test firmware / software and storage location	In EUT		
For further details refer Applicants Declaration & following technical documents			
Description of Reference Document (supplied by applicant)		**Version**	**Total Pages**
-		-	-

3.3 Modifications on Test sample

Additions/deviations or exclusions	

4 Measurements

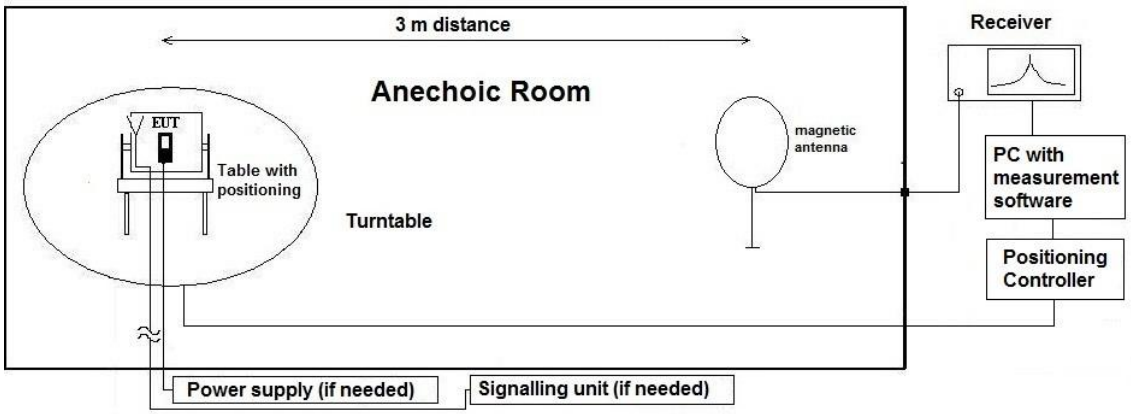
4.1 Radiated field strength emissions below 30 MHz

4.1.1 Description of the general test setup and methodology, see below example:

Evaluating the radiated field emissions are done first by an exploratory emission measurement and a final measurement for most critical frequencies determined.

The loop antenna was placed at 1 m height above ground plane and 8 m measurement distance from set-up for investigations. Because of reduced measurement distance, correction data were applied, as stated in chapter "General Limit - Radiated field strength emissions below 30 MHz". The tests are performed in the semi anechoic room recognized by the regulatory commission.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 6)

Exploratory, preliminary measurements
The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (step 90°, range 0°to 360°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT), the emission spectrum was recorded.

The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a data reduction table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position).

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$E_C = E_R + AF + C_L + D_F - G_A$

$M = L_T - E_C$

AF = Antenna factor
C_L = Cable loss
D_F = Distance correction factor (if used)
E_C = Electrical field – corrected value
E_R = Receiver reading
G_A = Gain of pre-amplifier (if used)
L_T = Limit
M = Margin

All units are dB-units, positive margin means value is below limit.

4.1.2 Measurement Location

Test site	225911 - SAC5 - Radiated Emission <1GHz

Correction factors due to reduced meas. distance (f< 30 MHz):

The used correction factors when the measurement distance is reduced compared to regulatory measurement distance, are calculated according Extrapolation formulas valid for EUT's with maximum dimension of 0.625xLambda. Formula 2+3+4 as presented in ANSI C63.10, Chapter 6.4.4 are used for the calculations of proper extrapolation factors

Frequency -Range	f [kHz/MHz]	Lambda [m]	Far-Field Point [m]	Distance Limit accord. 15.209 [m]		1st Condition (dmeas< Dnear-field)	2'te Condition (Limit distance bigger dnear-field)	Distance Correction accord. Formula
	9.00E+00	33333.33	5305.17			fullfilled	not fullfilled	-62.96
	1.00E+01	30000.00	4774.65			fullfilled	not fullfilled	-62.96
	2.00E+01	15000.00	2387.33			fullfilled	not fullfilled	-62.96
	3.00E+01	10000.00	1591.55			fullfilled	not fullfilled	-62.96
	4.00E+01	7500.00	1193.66			fullfilled	not fullfilled	-62.96
	5.00E+01	6000.00	954.93			fullfilled	not fullfilled	-62.96
	6.00E+01	5000.00	795.78			fullfilled	not fullfilled	-62.96
	7.00E+01	4285.71	682.09			fullfilled	not fullfilled	-62.96
	8.00E+01	3750.00	596.83	**300**		fullfilled	not fullfilled	-62.96
	9.00E+01	3333.33	530.52			fullfilled	not fullfilled	-62.96
kHz	1.00E+02	3000.00	477.47			fullfilled	not fullfilled	-62.96
	1.25E+02	2400.00	381.97			fullfilled	not fullfilled	-62.96
	2.00E+02	1500.00	238.73			fullfilled	fullfilled	-60.98
	3.00E+02	1000.00	159.16			fullfilled	fullfilled	-57.46
	4.00E+02	750.00	119.37			fullfilled	fullfilled	-53.20
	4.90E+02	612.24	97.44			fullfilled	fullfilled	-54.69
	5.00E+02	600.00	95.49			fullfilled	not fullfilled	-22.69
	6.00E+02	500.00	79.58			fullfilled	not fullfilled	-22.69
	7.00E+02	428.57	68.21			fullfilled	not fullfilled	-22.69
	8.00E+02	375.00	59.68			fullfilled	not fullfilled	-22.69
	9.00E+02	333.33	53.05			fullfilled	not fullfilled	-22.69
	1.00	300.00	47.75			fullfilled	not fullfilled	-22.69
	1.59	188.50	**30.00**			fullfilled	not fullfilled	-22.69
	2.00	150.00	23.87			fullfilled	fullfilled	-20.98
	3.00	100.00	15.92			fullfilled	fullfilled	-17.46
	4.00	75.00	11.94			fullfilled	fullfilled	-14.96
	5.00	60.00	9.55			fullfilled	fullfilled	-13.02
	6.00	50.00	7.96			fullfilled	fullfilled	-11.48
	7.00	42.86	6.82			fullfilled	fullfilled	-11.48
	8.00	37.50	5.97			fullfilled	fullfilled	-11.48
	9.00	33.33	5.31			fullfilled	fullfilled	-11.48
	10.00	30.00	4.77	**30**		fullfilled	fullfilled	-11.48
	10.60	28.30	4.50			fullfilled	fullfilled	-11.48
MHz	11.00	27.27	4.34			fullfilled	fullfilled	-11.48
	12.00	25.00	3.98			fullfilled	fullfilled	-11.48
	13.56	22.12	3.52			fullfilled	fullfilled	-11.48
	15.00	20.00	3.18			fullfilled	fullfilled	-11.48
	15.92	18.85	**3.00**			fullfilled	fullfilled	-11.48
	17.00	17.65	2.81			not fullfilled	fullfilled	-11.48
	18.00	16.67	2.65			not fullfilled	fullfilled	-11.48
	20.00	15.00	2.39			not fullfilled	fullfilled	-11.48
	21.00	14.29	2.27			not fullfilled	fullfilled	-11.48
	23.00	13.04	2.08			not fullfilled	fullfilled	-11.48
	25.00	12.00	1.91			not fullfilled	fullfilled	-11.48
	27.00	11.11	1.77			not fullfilled	fullfilled	-11.48
	29.00	10.34	1.65			not fullfilled	fullfilled	-11.48
	30.00	10.00	1.59			not fullfilled	fullfilled	-11.48

4.1.3 Limit

Radiated emissions limits, (3 meters)					
Frequency Range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Distance [m]	Detector	RBW [kHz]
0.009 – 0.09	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	0.2
0.09 – 0.11	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Quasi peak	0.2
0.11 – 0.15	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	0.2
0.15 – 0.49	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	9
0.49 – 1.705	24000 / f [kHz]	87.6 – 20Log(f) (kHz)	30	Quasi peak	9
1.705 - 30	30	29.5	30	Quasi peak	9

*Remark: In Canada same limits apply, just unit reference is different

4.1.4 Result

Diagram	Channel	Mode	Maximum Level [dBµV/m] Frequency Range 0.009 – 5 MHz	Result
2.08	1	Op.1	21.33 (noise level)	PASSED
2.09	1	Op.1	21.90 (noise level)	PASSED

Remark1: for more information and graphical plot see annex A1**CETECOM_TR19-1-0130001T14a_A1_C1**
Remark2: Radited emission is measured up to either 30 MHz or 10th harmonic, which ever is smaller. Thus the measured frequency range ends at 5 MHz, which is the 10th harmonic.

4.2 Results from external laboratory

None	-

4.3 Opinions and interpretations

None	-

4.4 List of abbreviations

None	-

5 Equipment lists

ID	Description	Manufacturer	SerNo	Cal due date
	120901 - SAC - Radiated Emission <1GHz			**2025-Jul-21**
25038	Loop Antenna HFH2-Z2	Rohde & Schwarz Messgerätebau GmbH	879824/13	2022-Apr-07
	120911 - Radio Laboratory 2			
20457	DC-Power supply, 0-5A EA-3013 S	EA Elektro-Automatik GmbH & Co. KG	9624680	
20468	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	90090455	2021-May-16
20431	Model 7405 Near-Field Probe Set	EMCO Elektronik GmbH	9305-2457	
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	2021-May-23
	225911 - SAC5 - Radiated Emission <1GHz			**2026-Apr-05**
25360	Antennenmast BAM 4.5-P	maturo GmbH	BAM 4.5-P/091/17791115	
25361	Controller NCD	maturo GmbH	NCD/202/17791115	
25348	EMI Test Receiver ESR7	Rohde & Schwarz Messgerätebau GmbH	101600	2021-May-21
25352	Open Switch and control Platform OSP120	Rohde & Schwarz Messgerätebau GmbH	101542-rV	
25358	Semi Anechoic Chamber SAC5	Albatross Projects GmbH	P27281-016	2026-Jun-30
25357	Ultrabroadband Antenna HL562E	Rohde & Schwarz Messgerätebau GmbH	100824	2023-Oct-09

6 Measurement Uncertainty valid for conducted/radiated measurements

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved. For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it contribution to the overall uncertainty according its statistical distribution calculated.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%						Remarks
Conducted emissions (U_{CISPR})	-	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB						-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB						Substitution method
Power Output conducted	-	Set-up No.	Cel-C1	Cel-C2	BT1	W1	W2	--	
		9 kHz - 12.75 GHz	N/A	0.60	0.7	0.25	N/A	--	-
		12.75 GHz - 26.5 GHz	N/A	0.82	--	N/A	N/A	--	
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	0.70	N/A	0.69	--	N/A - not applicable
		2.8 GHz - 12.75 GHz	1.48	N/A	1.51	N/A	1.43	--	
		12.75 GHz – 18 GHz	1.81	N/A	1.83	N/A	1.77	--	
		18 GHz - 26.5 GHz	1.83	N/A	1.85	N/A	1.79	--	
Occupied bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
			1.0 dB						Power
Emission bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
	-		See above: 0.70 dB						Power
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm						-
Radiated emissions Enclosure	-	150 kHz - 30 MHz	5.01dB						Magnetic field strength
		30 MHz - 1 GHz 1 GHz - 18 GHz 18-26.5 GHz	5.83 dB 4.91 dB 5.06 dB						Electrical Field strength

7 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2021-May-11
C1	Update bandwidth measurement in Annex 1	2021-Jul-29
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End of Test Report