

TEST REPORT

No. AR19-0045638-05

performed in accordance with

FCC Rules: Code of Federal Regulations (CFR) no. 47
Part 15 Subpart B Section 15.107 and 15.109

PRODUCT	Electronic position indicator system
MODEL(s) TESTED	DD52R-E-RF
FCC ID	2AVRQ-DD52R-E-RF
TRADE MARK(s)	

APPLICANT	ELESA S.p.A. - Via Pompei, 29 – 20900 Monza (MB)
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Tested by	Alessandro Macri <i>[Laboratory technician]</i>	
Approved by	Roberto Colombo <i>[Laboratory manager]</i>	

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2021-12-16	First edition Digital signed - AR19-0045638-05_TR_FCC 15.107/109 _ Elesa_DD52R-E-RF

The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself.
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The authenticity of this Test Report and its contents can be verified by contacting IMQ S.p.A., responsible for this Test Report.

1. GENERAL DATA

SAMPLE		
Samples received on	2020-12-15	(Item(s) sampled and sent by applicant)
IMQ reference samples	BEM	102171
Samples tested No.	1	
Object under analysis recognition	Not carried out Except where stated, characteristics of products were taken from client description and were not verified by the laboratory	
Date of acceptance of test item	2021-01-29	
TEST LOCATION		
Testing dates	2021-01-29 ÷ 2021-02-01	
Testing laboratory.	IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano	
Testing site	Via Quintiliano, 43 – I-20138 Milano	
ENVIRONMENTAL CONDITIONING		
<i>Parameter</i>	<i>Measured</i>	
Ambient Temperature	20.5 ÷ 22.7 °C	
Relative Humidity	43 ÷ 48 %	
Atmospheric Pressure	994 ÷ 1003 mbar	
The laboratory is monitored by a continuous environmental conditions measurements system. Temperature, humidity and pressure data are recorded on a weekly basis and stored in local archive.		
REMARKS		
Throughout this report a point is used as the decimal separator. The ability or reliability of this product to perform its intended function in a particular application has not been investigated. IMQ declines any responsibility derived from missing or wrong information provided aside by the applicant		

2. REFERENCE DOCUMENT

	DOCUMENT	DATE	TITLE
<input checked="" type="checkbox"/>	47 CFR Part 15	2015	Radio Frequency Device
<input checked="" type="checkbox"/>	ANSI C63.4	2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
<input checked="" type="checkbox"/>	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices

3. UNIT UNDER TEST (EUT) DETAILS

GENERAL DATA

MODEL (basic)	Description
DD52R-E-RF	Electronic position indicator system
VARIANTS (derived)	Description
/	/

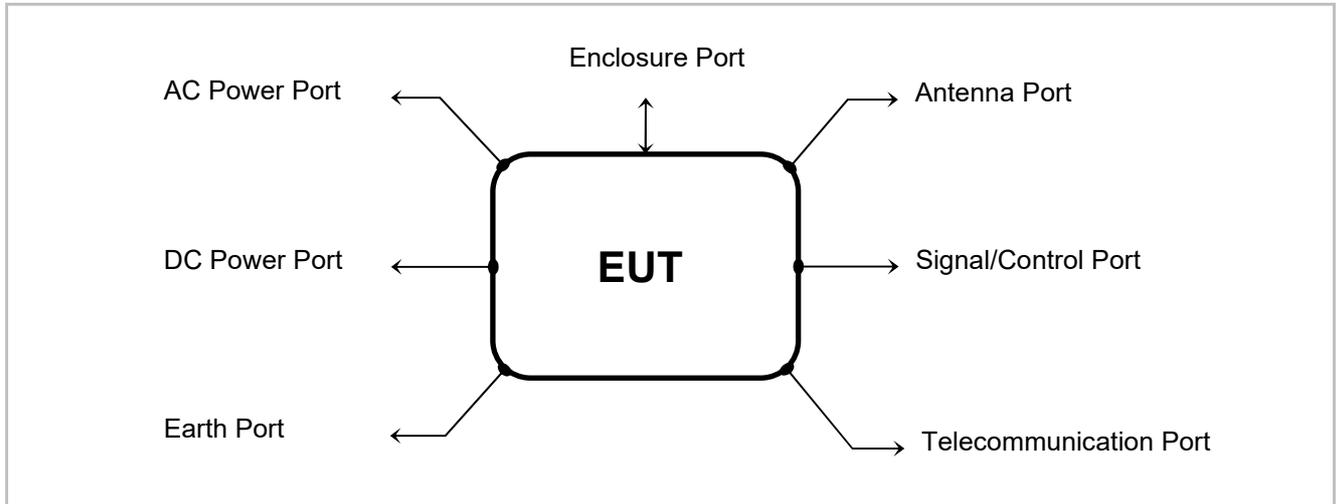
FCC ID	2AVRQ-DD52R-E-RF
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Manufacturer	ELESA S.p.A. - Via Pompei, 29 – 20900 Monza (MB)
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Type of equipment	Electronic position indicator system with 2.4 GHz module integrated
Operating frequency:	2400 ÷ 2483.5 MHz
Maximum RF radiated power:	92.64 dBuV/m
Modulation:	MSK modulation
Channel Spacing:	200 kHz
Antenna:	Integral on PCB

4. TEST CONFIGURATION OF UNIT UNDER TEST

EUT PORTS



Port	Description	Max length
Enclosure	Plastic	/
AC power	/	/
DC power	3 V DC	/
Earth	/	/
Telecommunication	/	/
Signal	/	/
Control	/	/
Antenna	Internal	/

STATE OF THE EUT DURING TESTS

Ref.	Mode	Description
#1	Operating	Standby mode

SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested:

Equipment	Manufacturer	Model
/	/	/

ELECTROMAGNETICALLY RELEVANT COMPONENTS

Component	No.	Manufacturer	Model
Main board	1	ELESA	T080 V1.2
Battery board	1	ELESA	S612 V1.0
Control board	1	ELESA	S615 V1.1
Radio module	1	TEXAS INSTRUMENTS	CC2500

RFI SUPPRESSION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EMI PROTECTION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EUT TECHNICAL DOCUMENTATION

Document	Reference
/	/

5. METHODS OF MEASUREMENT

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4:2014, ANSI C63.10:2013 and Section 15.31 of CFR47 Part 15 – Subpart A (General).

Additional test requirements have been adopted according to the reference Section indicated in the § 6 of this test report.

FREQUENCY RANGE INVESTIGATED

Conducted emission tests: from 150 kHz to 30 MHz.

Radiated emission tests: from 9 kHz to 13 GHz (fifth harmonic of highest frequency)

6. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS:	
Test object meets the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

CFR47 Part 15	TITLE	RESULT
§ 15.107	Conducted emission	N.A. ⁽¹⁾
§ 15.109	Radiated disturbances	PASS

Note 1	Port not present, battery operating device
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7. TEST RESULTS

7.1 RADIATED DISTURBANCES

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Semi-anechoic chamber
Test distance	3 meters
Frequency range	9 kHz to 13 GHz
IF bandwidth (below 30 MHz)	9 kHz
IF bandwidth (below 1,000 MHz)	120 kHz
IF bandwidth (above 1,000 MHz)	1 MHz
Deviation to test procedure	None
Limits	sections 15.109
EUT operating condition	#1
Remark	(* In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is: Extrapolation (dB) = $40\log(300\text{meter} / 3\text{meter}) = +80\text{db}$ Extrapolation (dB) = $40\log(30\text{meter} / 3\text{meter}) = +40\text{db}$
Testing dates	2021-01-29 ÷ 2021-02-01

TEST RESULT

The EUT meets the requirements of sections 15.109

LIMITS FOR SPURIOUS		
Band of operations	Limit $\mu\text{V/m}$	Limit $\text{dB}\mu\text{V/m}$
30÷88 MHz	100	40
88÷216 MHz	150	43,5
216÷960 MHz	200	46
Above 960MHz	500	54
Band of operations	Limit $\text{dB}\mu\text{V/m}$ Peak	Limit $\text{dB}\mu\text{V/m}$ Average
Above 1000 MHz	74	54

TEST PROCEDURE

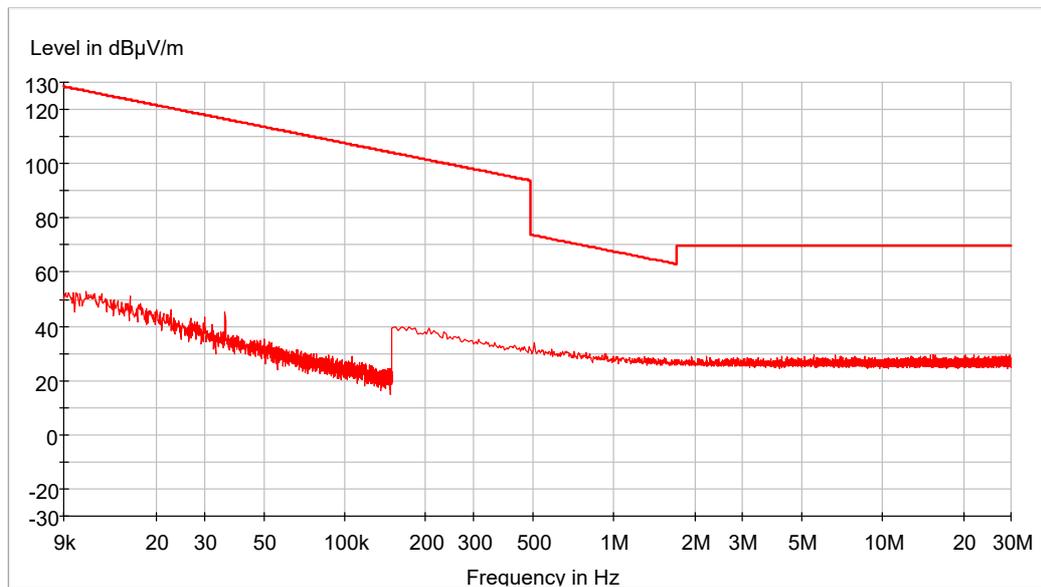
- 1) The EUT was placed on turntable which is 0.8 m above the ground plane
- 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level.
- 3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission.
- 4) The measurements were made with the detector set to **PEAK** amplitude within a bandwidth of 120 kHz below 1000 MHz and 1 MHz above 1000 MHz.
- 5) The receiving antenna was positioned in both horizontal and vertical polarization.
- 6) The measurements with Quasi-Peak detector, below 1000 MHz are performed only for frequencies for which the Peak values are \geq Q.P. limit – 6 dB (♦ mark symbol).

NOTE

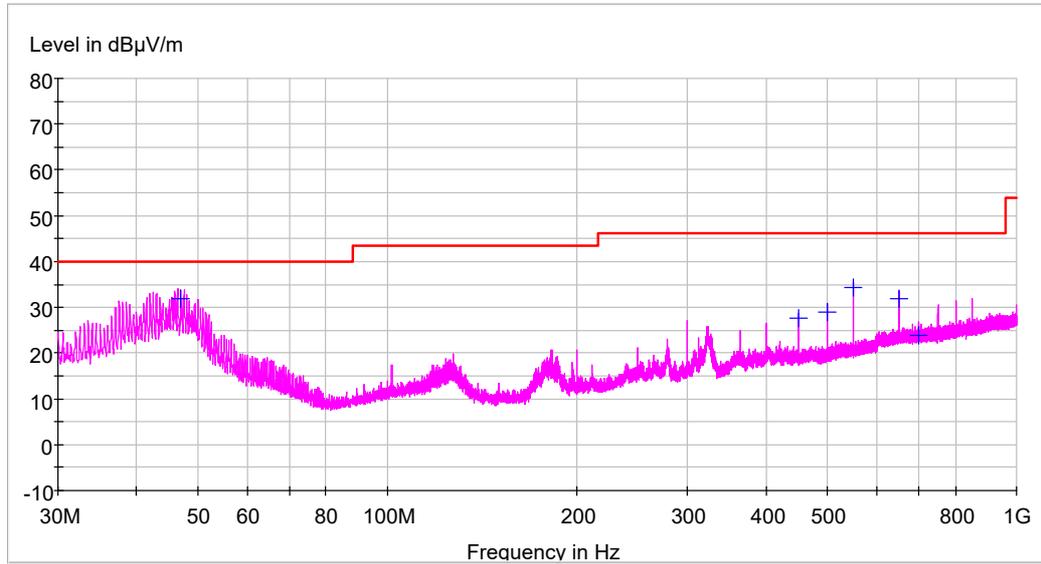
The product falls into class A. In any case, class B limits are included in the report, which are more restrictive than class A.

MEASUREMENTS RESULTS

Range: 9 kHz ÷ 30 MHz

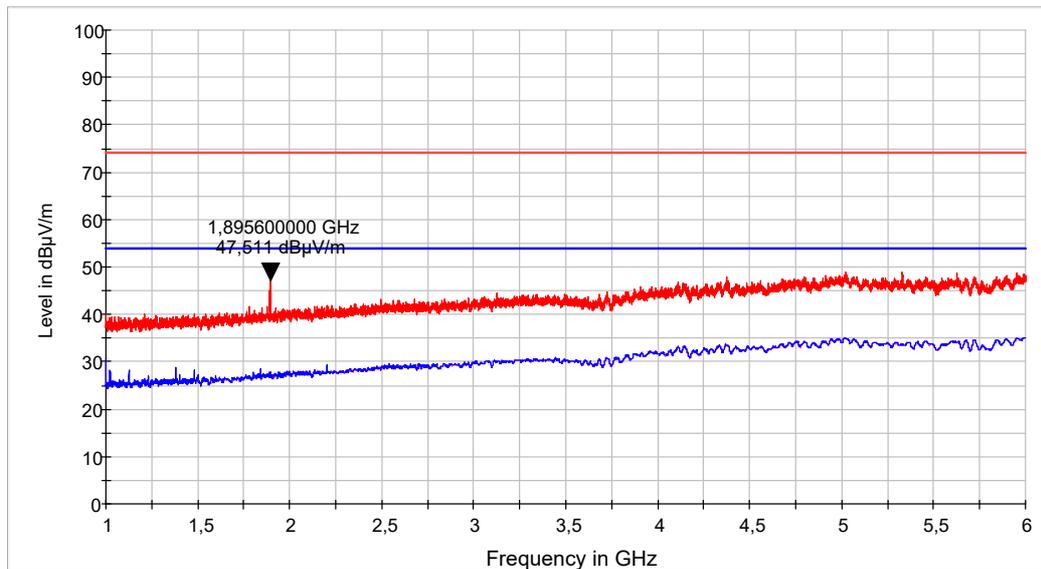


Range: 30 ÷ 1000 MHz



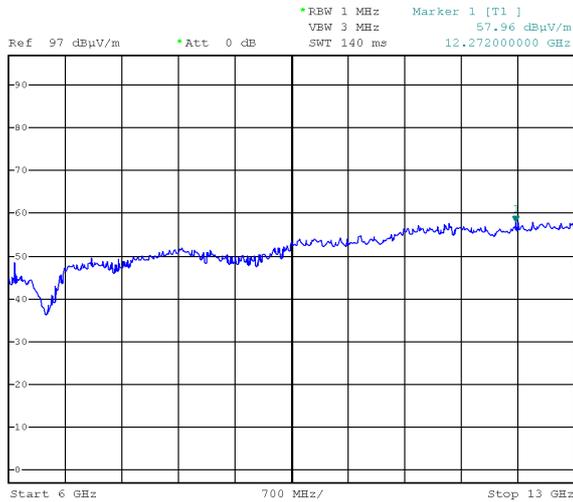
Frequency (MHz)	Peak (dBµV/m)	Polarization	Margin (dB)
47.040000	31.8	V	8.2
450.000000	27.5	H	18.5
500.000000	29.0	V	17.0
550.000000	34.4	H	11.6
650.000000	31.9	H	14.1
700.000000	23.8	V	22.2

Range: 1 ÷ 6 GHz

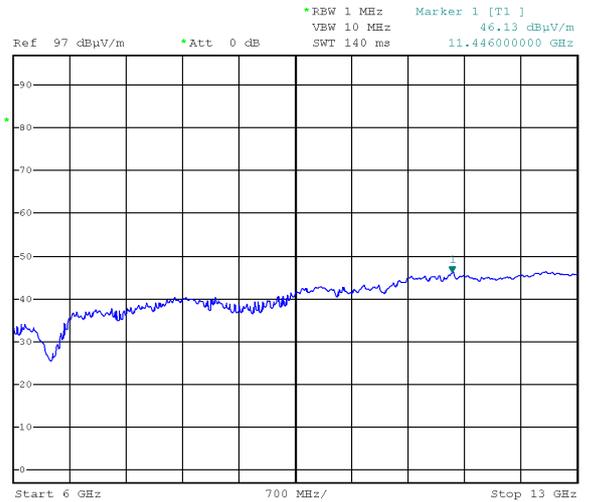


Worst case measurement result >6,000 MHz

Worst case – H antenna Peak



Worst case – H antenna Average



Tabular worst case measurement result >6,000 MHz (PK & AV)

PEAK RESULT (RBW=1MHz; VBW=3MHz)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correct reading	PK Limit (AV + 20dB)		Margin
(MHz)	(dBµV)	(dB@3m)	(dB)	(dB)	(dBµV/m)	(µV/m)	(dBµV/m)	(dB)
f>6000	No significant values were found					5000	74	/

AVERAGE RESULT (RBW=1MHz; VBW=10Hz)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correct reading	AV Limit		Margin
(MHz)	(dBµV)	(dB@3m)	(dB)	(dB)	(dBµV/m)	(µV/m)	(dBµV/m)	(dB)
f>6000	No significant values were found (see also above plots)					500	54	/

See above the measurements plots.

8. MEASUREMENTS AND TESTS UNCERTAINTY

Unless otherwise stated the uncertainties for the tests and measurements are evaluated in according to IMQ Operational Instruction IO-LAB-001 and IO-LAB-004. and requirement of NIST Technical Note 1297 and NIS 81:1994 “The Treatment of Uncertainty in EMC Measurements”

The expanded uncertainty was calculated for all measurements and tests listed in this test report according to CISPR 16-4-2 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainty in EMC Measurements”, with UKAS document LAB 34 and is documented in the quality system accordance to ISO/IEC 17025.

Internal Procedure PG-037 ensures that the requirements for traceability of calibrations, of all test equipment requiring calibration, and calibration intervals are met.

Methods/Standard	Parameter	Expanded Uncertainty	Unit	Confidence level
Radiated disturbance	QP detector (30 MHz - 100 MHz) H polarization	4.3	dB	95%
	QP detector (30 MHz - 100 MHz) V polarization	4.2	dB	95%
	QP detector (100 MHz - 200 MHz) H polarization	3.4	dB	95%
	QP detector (100 MHz - 200 MHz) V polarization	4.8	dB	95%
	QP detector (200 MHz - 1000 MHz) H polarization	3.9	dB	95%
	QP detector (200 MHz - 1000 MHz) V polarization	3.8	dB	95%
	P detector 1 - 6 GHz	4.8	dB	95%
	P detector 6 - 18 GHz	5.1	dB	95%

9. LIST OF MEASURING EQUIPMENT AND CALIBRATION INFORMATION

Instrument	Manufacturer	Model	IMQ Ref.	Cal. Date	Cal. Due
Shielded semi-anechoic chamber	SIDT	/	P01709	2019-10-21	2021-10-31
Turntable controller unit	FRANKONIA	FCTAM01	P02486	/	/
Mast antenna	FRANKONIA	FAM4	P02488	/	/
Log antenna	ARA	LPB-2513	S02385	2020-07-20	2021-07-31
Horn Antenna	SCHWARZBECK	BBHA 9120D	S03463	2020-07-06	2021-07-31
Loop Antenna	ROHDE & SCHWARZ	HFH2-Z2	S02508	2020-08-18	2021-08-31
Spectrum Analyzer	Rohde & Schwarz	FSP40	S03629	2020-12-10	2021-12-31
Preamplifier	Hewlett Packard	HP 8449B	S03542	2020-04-05	2021-04-30
Software	ROHDE & SCHWARZ	EMC32 Ver. 6.30	W-00199/E	/	/
PC	/	/	H-00165	/	/

END OF REPORT