

TEST REPORT

Test report no.: 1-7255-23-01-19_TR1-R01



Deutsche
Akkreditierungsstelle
D-PL-12047-01-00

Testing laboratory

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number:

D-PL-12047-01-00.

ISED Testing Laboratory Recognized Listing Number: DE0001

FCC designation number: DE0002

Applicant

Mammut Sports Group

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5703 Seon / SWITZERLAND

Phone:

Contact: Michael Vollmer

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Manufacturer

Mammut Sports Group

Birren 5

5703 Seon / SWITZERLAND

Test standard/s

FCC - Title 47 CFR Part 15 FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

RSS - 210 Issue 11 Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

RSS - Gen Issue 5 incl. Amendment 1 & 2 Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: **Avalanche beacon**

Model name: **Barryvox 2 & Barryvox S2**

FCC ID: **ARN-BARRYVOX2**

ISED certification number: **8038A-BARRYVOX2**

Frequency: 457 kHz

Technology tested: Proprietary

Antenna: Integrated antenna

Power supply: 3.0 V DC by 2 AAA batteries

Temperature range: -25°C to +45°C

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

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Testing Manager
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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH 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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2.2 Application details

Date of receipt of order:	2023-11-30
Date of receipt of test item:	2024-10-01
Start of test:*	2024-10-02
End of test:*	2024-10-02
Person(s) present during the test:	-/-

*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

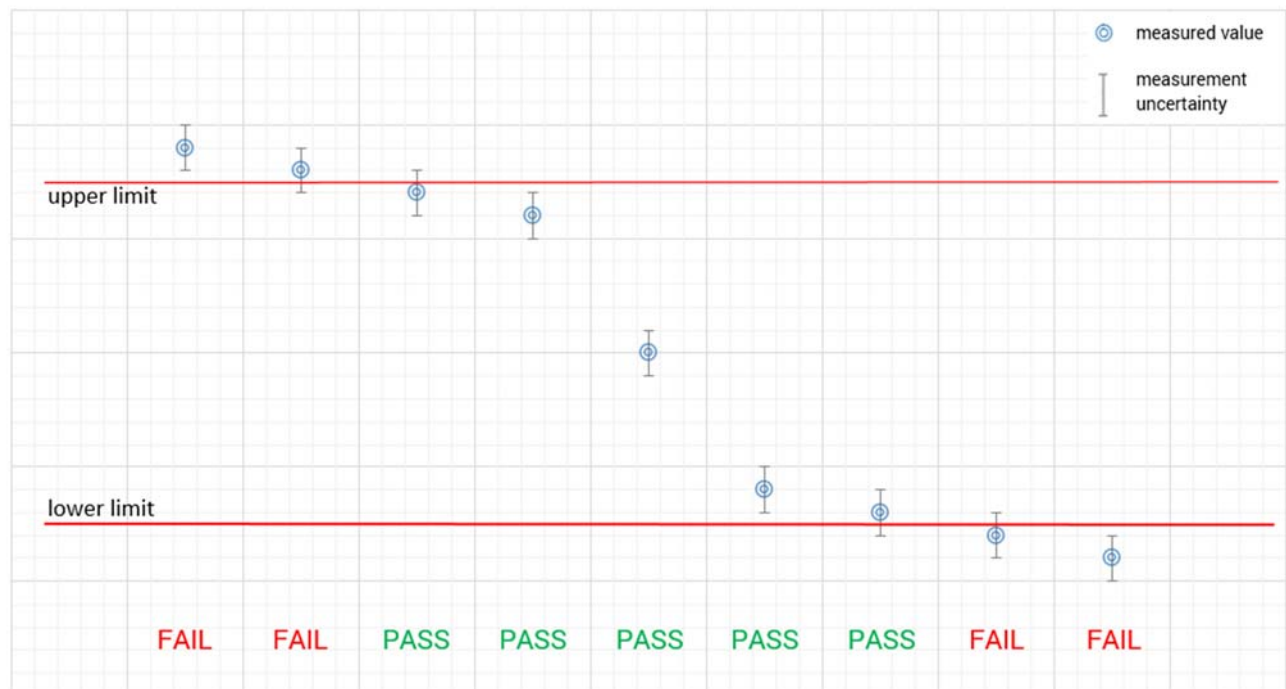
Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 11	25.06.2024	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
RSS - Gen Issue 5 incl. Amendment 1 & 2	February 2021	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus
Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.

The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

measured value, measurement uncertainty, verdict



5 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests No testing under extreme temperature conditions required. No testing under extreme temperature conditions required.
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	3.0 V DC by 2 AAA batteries No testing under extreme temperature conditions required. No testing under extreme temperature conditions required.

6 Test item

6.1 General description

Kind of test item	:	Avalanche beacon
Model name	:	Barryvox 2 & Barryvox S2
HMN	:	-/-
PMN	:	Barryvox 2 & Barryvox S2
HVIN	:	Barryvox 2: 7600.0055 Barryvox S2: 7600.0054
FVIN	:	-/-
S/N serial number	:	Barryvox 2: 2340200012 Barryvox S2: 2340100039
Hardware status	:	Barryvox 2: PR2 Rev. D01 HW index 5 Barryvox S2: PR2 Rev. D02 HW index 6
Software status	:	-/-
Firmware status	:	V2.037; SVN: 865
Frequency	:	457 kHz
Type of radio transmission	:	Modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	ASK
Number of channels	:	1
Antenna	:	Integrated antenna
Power supply	:	3.0V DC by 2 AAA batteries
Temperature range	:	-25°C to +45°C

6.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report:

1-7255-23-01-01_TR1-A101-R01
1-7255-23-01-01_TR1-A102-R01
1-7255-23-01-01_TR1-A103-R01

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

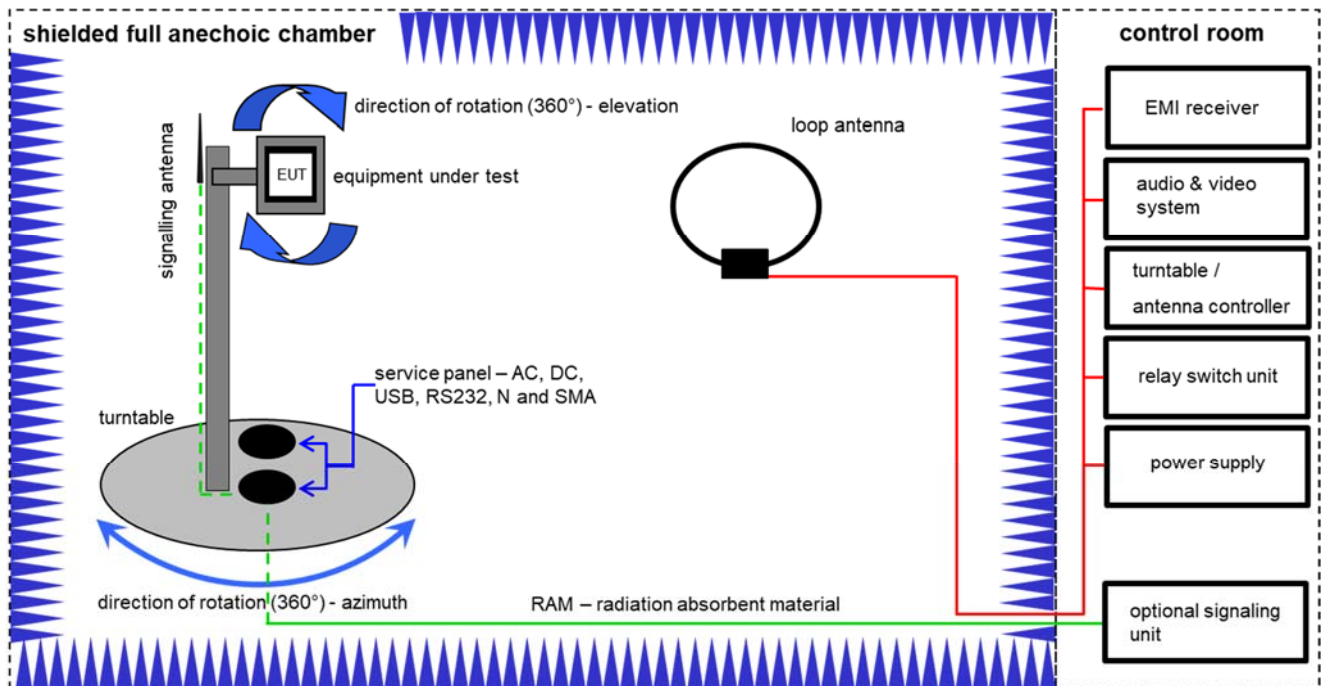
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

Agenda: Kind of Calibration

k/cal	calibration / calibrated	EK	limited calibration
Ne/cnn	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
Ev/chk	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress
cpu	check prior usage		

7.1 Shielded fully anechoic chamber



Measurement distance: loop antenna 3 meter

FS = UR + CA + AF

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

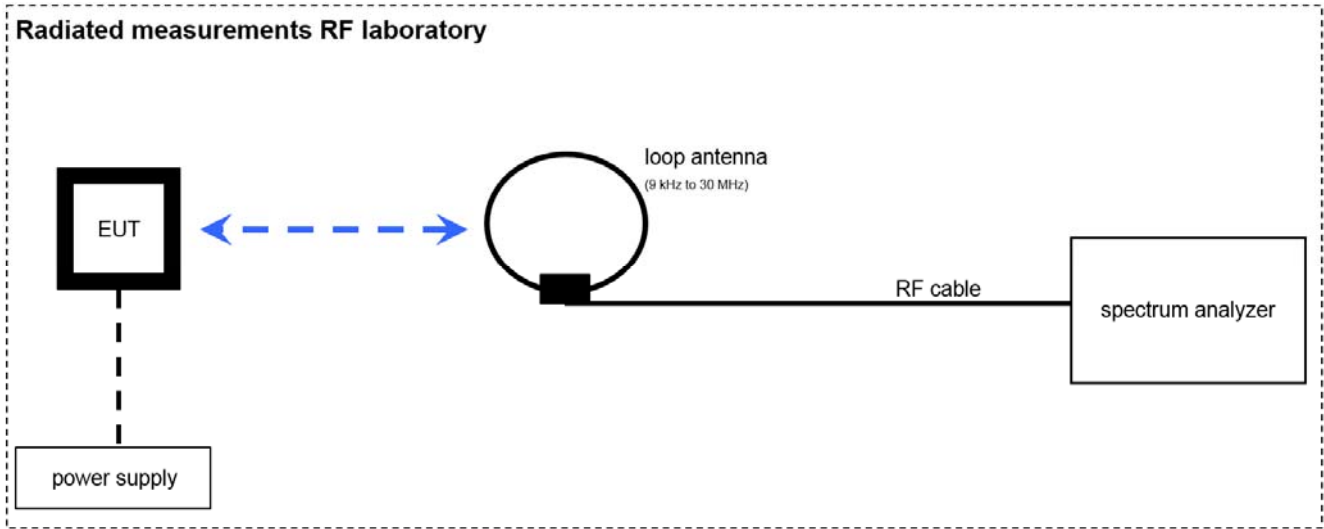
Example calculation:

FS [dBμV/m] = 40.0 [dBμV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBμV/m] (71.61 μV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vIKI!	02.08.2023	31.08.2025
2	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2023	31.12.2024
5	A	NEXIO EMV- Software	BAT EMC V2022.0.32.0	Nexio		300004682	ne	-/-	-/-

7.2 Radiated measurements RF laboratory



Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
11	A	Signal analyzer	FSV40	Rohde&Schwarz	101042	300004517	k	06.12.2023	31.12.2024
2	A	Loop Antenna		ZEG TS Steinfurt		400001208	ev	-/-	-/-
3	A	RF Cable BNC	RG58	Huber & Suhner		400001209	ev	-/-	-/-

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

9 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Occupied bandwidth	$\pm$ used RBW
Field strength of the fundamental	$\pm$ 3 dB
Field strength of the harmonics and spurious	$\pm$ 3 dB
Receiver spurious emissions and cabinet radiations	$\pm$ 3 dB
Conducted limits	$\pm$ 2.6 dB

10 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210 Issue 11 RSS Gen Issue 5	See table!	2024-10-22	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	C	NC	NA	NP	Remark
RSS Gen Issue 4 (6.6)	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209	Field strength of the fundamental	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 RSS Gen Issue 5 (6.13)	Field strength of the harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107 §15.207	Conducted limits	Nominal	Nominal	☐	☐	☒	☐	Battery powered only!

Note: NA = Not applicable; NP = Not performed; C = Compliant; NC = Not compliant

11 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

12 Measurement results

12.1 Occupied bandwidth

Measurement:

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

Measurement parameters	
Detector:	Peak
Resolution bandwidth:	1 % – 5 % of the occupied bandwidth*
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Analyser function:	99 % power function
Used test setup:	See sub clause 7.2 – A
Measurement uncertainty:	See sub clause 9

Limit:

IC
for RSP-100 test report coversheet only

Result:

Barryvox 2

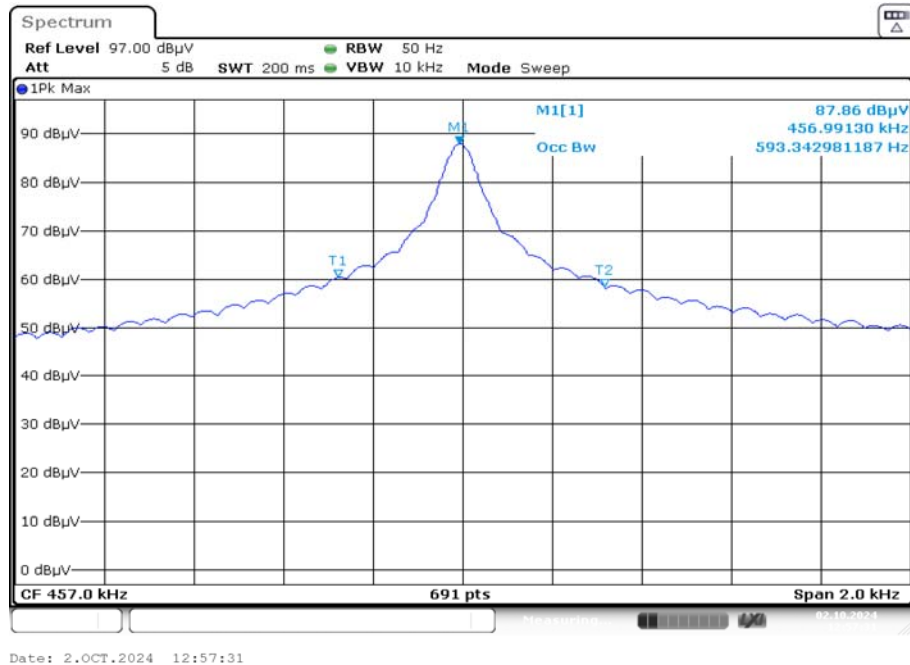
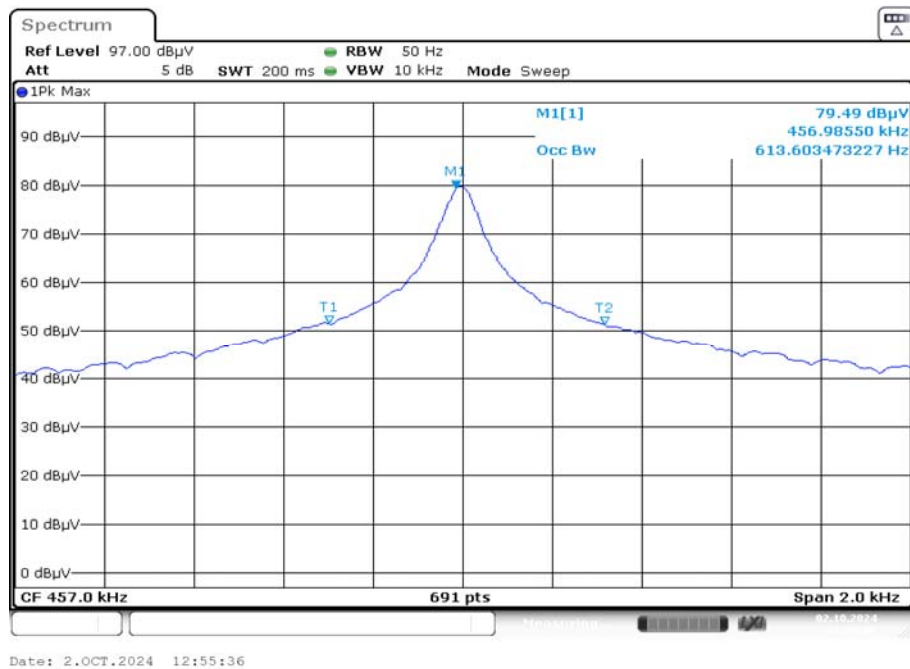
99% emission bandwidth
0.593 kHz

*The 1-5% RBW criterion is not applicable because of the low occupied bandwidth of the signal.

Barryvox S2

99% emission bandwidth
0.614 kHz

*The 1-5% RBW criterion is not applicable because of the low occupied bandwidth of the signal.

Plot:**Plot 1: 99 % emission bandwidth Barryvox 2****Plot 1: 99 % emission bandwidth Barryvox S2**

12.2 Field strength of the fundamental

Measurement:

The maximum detected field strength for the carrier signal.

Measurement parameters	
Detector:	average
Resolution bandwidth:	10 kHz
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Used test setup	See sub clause 7.1 – A
Measurement uncertainty:	See sub clause 9

Limit:

FCC		
Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
9 kHz – 490 kHz	2400 / F(kHz); 14.4 dBμV/m for 457 kHz	300

IC		
Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
9 kHz – 490 kHz	6.37 / F(kHz); -37.11 dBμV/m for 457 kHz	300

Recalculation:

According to ANSI C63.10		
Frequency	Formula	Correction value
457 kHz	$FS_{limit} = FS_{max} - 40 \log \left(\frac{d_{nearfield}}{d_{measure}} \right) - 20 \log \left(\frac{d_{limit}}{d_{nearfield}} \right)$ FS_{limit} is the calculation of field strength at the limit distance, expressed in dBμV/m FS_{max} is the measured field strength, expressed in dBμV/m $d_{nearfield}$ is the $\lambda/2\pi$ distance $d_{measure}$ is the distance of the measurement point from EUT d_{limit} is the reference limit distance	-70.8 from 3 m to 300 m

Result:

Barryvox 2

Field strength of the fundamental		
Frequency	457 kHz	
Distance	@ 3 m	@ 300 m
Measured / calculated value FCC	76.3 dB μ V/m	5.5 dB μ V/m
Measured / calculated value IC	24.8 dB μ A/m	-46.0 dB μ A/m

Barryvox S2

Field strength of the fundamental		
Frequency	457 kHz	
Distance	@ 3 m	@ 300 m
Measured / calculated value FCC	76.9 dB μ V/m	6.1 dB μ V/m
Measured / calculated value IC	25.4 dB μ A/m	-45.4 dB μ A/m

12.3 Field strength of the harmonics and spurious

Measurement:

The maximum detected field strength for the harmonics and spurious.

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz < F < 30 MHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz < F < 30 MHz: 100 kHz
Trace mode:	Max hold
Used test setup:	See sub clause 7.1 – A
Measurement uncertainty:	See sub clause 9

Limit:

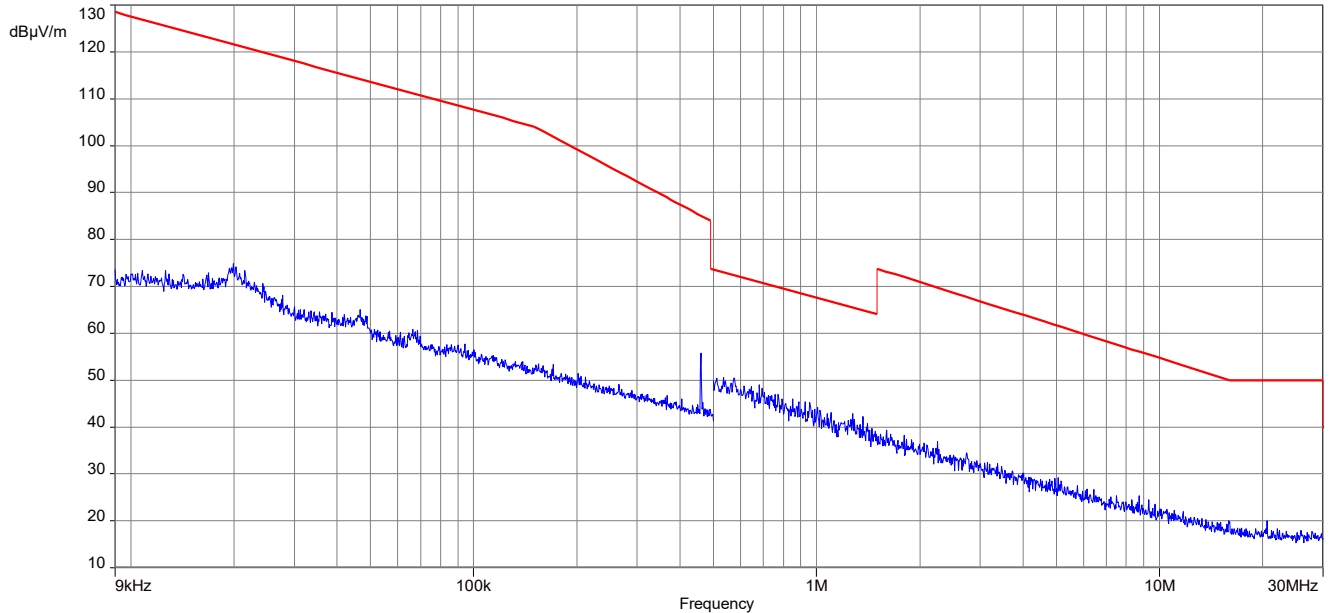
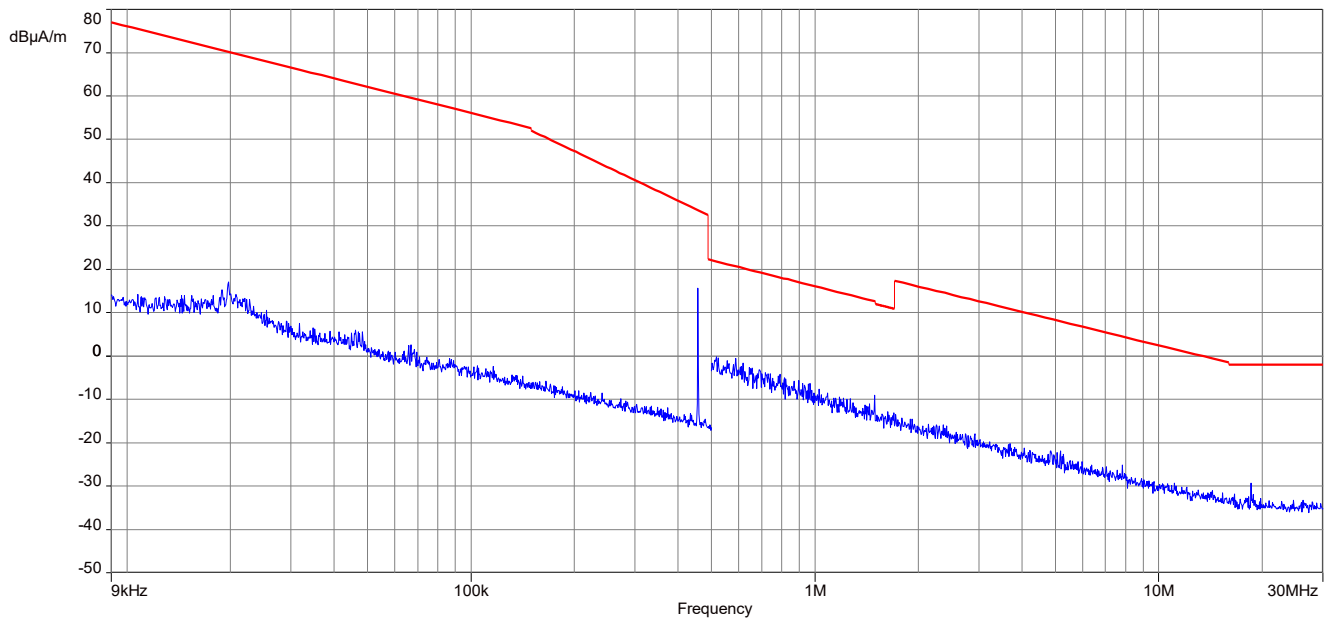
FCC		
Frequency (MHz)	Field strength (dB μ V/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30 (29.5 dB μ V/m)	30
30 – 88	100 (40 dB μ V/m)	3
88 – 216	150 (43.5 dB μ V/m)	3
216 – 960	200 (46 dB μ V/m)	3

IC		
Frequency (MHz)	Field strength (μ A/m)	Measurement distance (m)
0.009 – 0.490	6.37/F (F in kHz)	300
0.490 – 1.705	63.7/F (F in kHz)	30
1.705 – 30	0.08 (-22 dB μ A/m)	30

Result:

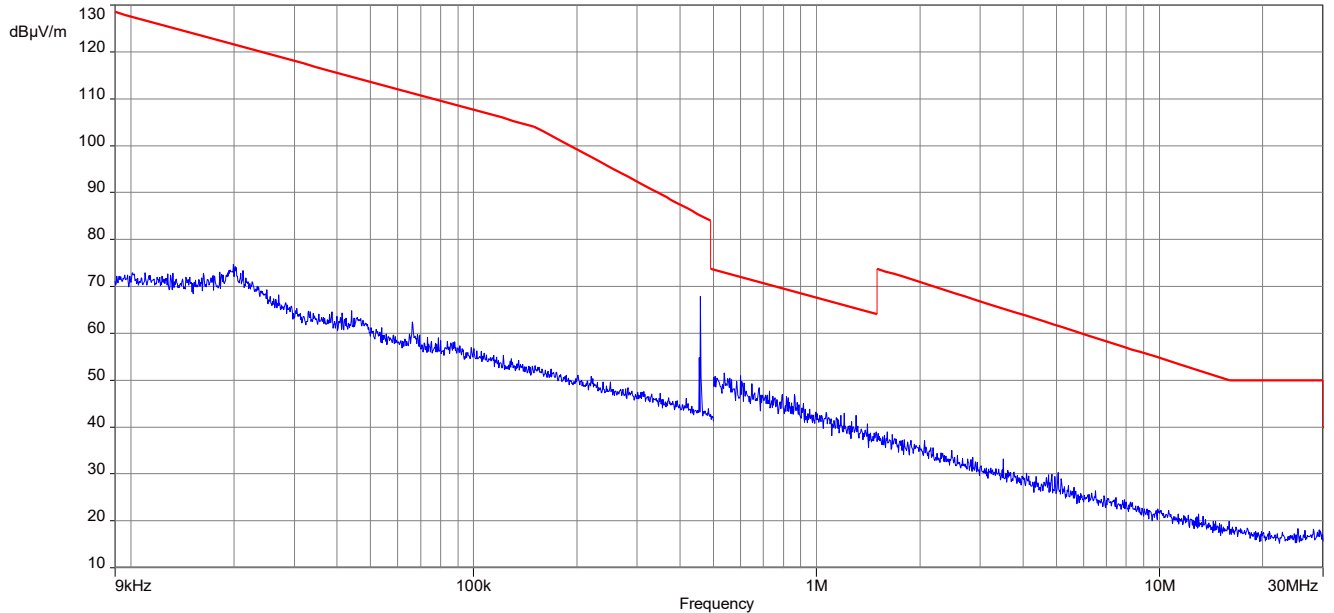
Barryvox 2 & Barryvox S2

Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value
All detected peak emissions below 30 MHz are more than 20 dB below the average limit.			

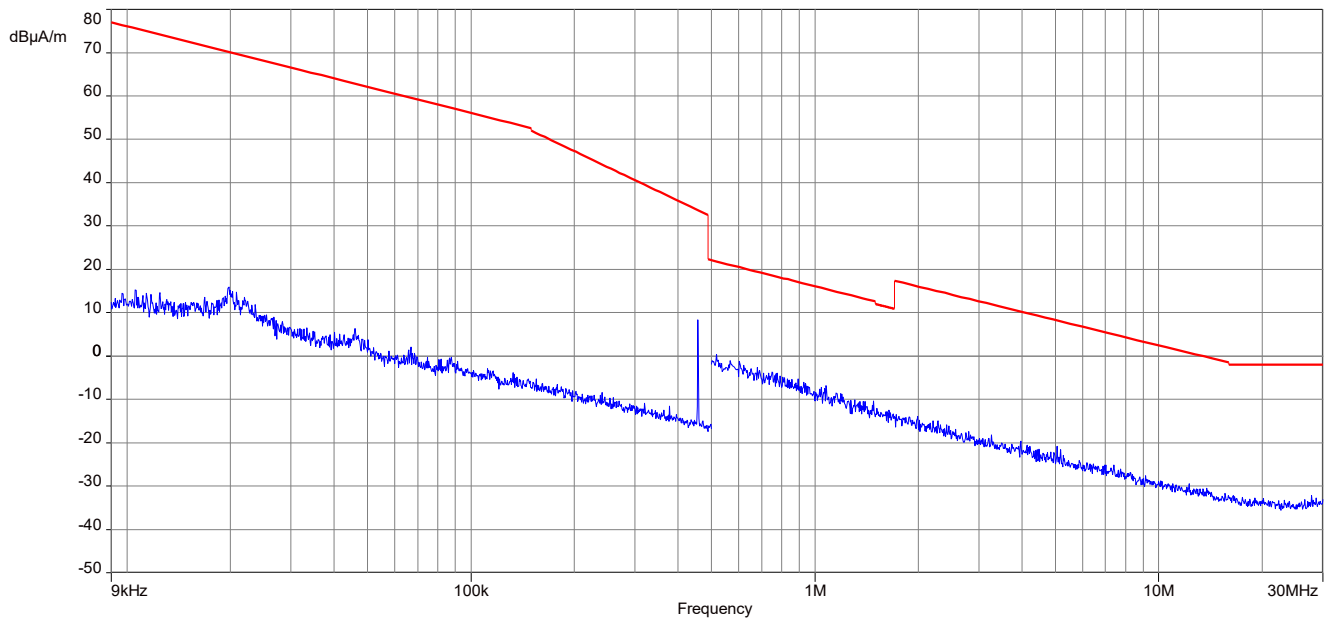
Plots: Barryvox 2**Plot 1:** 9 kHz – 30 MHz, magnetic spurious emissions FCC**Plot 2:** 9 kHz – 30 MHz, magnetic spurious emissions IC

Plots: Barryvox S2

Plot 1: 9 kHz – 30 MHz, magnetic spurious emissions FCC



Plot 2: 9 kHz – 30 MHz, magnetic spurious emissions IC



13 Observations

No observations except those reported with the single test cases have been made.

14 Glossary

AVG	Average
C	Compliant
C/N₀	Carrier to noise-density ratio, expressed in dB-Hz
CAC	Channel availability check
CW	Clean wave
DC	Duty cycle
DFS	Dynamic frequency selection
DSSS	Dynamic sequence spread spectrum
DUT	Device under test
EN	European Standard
ETSI	European Telecommunications Standards Institute
EMC	Electromagnetic Compatibility
EUT	Equipment under test
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
FHSS	Frequency hopping spread spectrum
FVIN	Firmware version identification number
GNSS	Global Navigation Satellite System
GUE	GNSS User Equipment
HMN	Host marketing name
HVIN	Hardware version identification number
HW	Hardware
IC	Industry Canada
Inv. No.	Inventory number
MC	Modulated carrier
NA	Not applicable
NC	Not compliant
NOP	Non occupancy period
NP	Not performed
OBW	Occupied bandwidth
OC	Operating channel
OCW	Operating channel bandwidth
OFDM	Orthogonal frequency division multiplexing
OOB	Out of band
OP	Occupancy period
PER	Packet error rate
PMN	Product marketing name
PP	Positive peak
QP	Quasi peak
RLAN	Radio local area network
S/N or SN	Serial number
SW	Software
UUT	Unit under test
WLAN	Wireless local area network

15 Document history

Version	Applied changes	Date of release
R01	Initial release	2024-10-10

END OF TEST REPORT