



LCIE



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TEST REPORT

N°: 21903474 – 799663B

Version : 02

Subject

Electromagnetic compatibility (EMC):

47 CFR Part 15.107 & Part 15.109
Subpart B of 2021
ANSI C63.4 of 2014
ICES-003 issue 7 of 2020 (P)

Issued to

DUNASYS Ingénierie
10 Rue de Penthièvre
75008 - Paris
FRANCE

Apparatus under test

Product DCar-S
Trade mark DUNASYS
Manufacturer DUNASYS Ingénierie
Model under test DCar-S
Serial number -
FCC ID 2BKU6-DCARS
IC 33018-DCARS

Test date

April 29, 2024 to May 2, 2024

Test location

LCIE, Villebon

Test performed by

Willy Daclinat

Composition of document

22 pages

Document issued on

October 3, 2024

Written by :

Written by :
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Tests operator

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PUBLICATION HISTORY

Each new edition of this test report replaces and cancels the previous edition. The control of the old editions of report is under responsibility of client.

Version	Date	Author	Modification
01	September 13, 2024	Willy DACLINAT	Creation of the document
02	October 3, 2024	Willy DACLINAT	Update for FCC ID & IC number

Date of receipt of test item April 29, 2024



SUMMARY

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1. Test Program

References

- ✓ CFR 47 Part 15 Subpart B - Radio frequency devices - Unintentional radiators 2021
- ✓ ICES -003 issue 7 of 2020 (H)
- ✓ ANSI 63.4 of 2014

Emission tests:

Test Description	Main characteristics	Test result - Comments
Measurement of radiated electric field in shielded room 15.109 (a), (b) & (c)	☐ Class A ☒ Class B	☒ PASS ☐ FAIL ☐ NA ☐ NP (Limited Program)
Measurement of radiated electric field in open space	☐ Class A ☐ Class B	☐ PASS ☐ FAIL ☒ NA ☐ NP (Limited Program)
Measurement of conducted disturbance on the DC main power port 15.107 (a) (c) (d) for information only	☐ Class A ☒ Class B	☒ PASS ☐ FAIL ☐ NA (1) ☐ NP (Limited Program)

(1): EUT not directly or indirectly connected to the AC Power Public Network

The product is compliant according to CFR 47 Part 15 Subpart B - Radio frequency devices - Unintentional radiators & ICES -003 standards.

PASS: EUT complies with standard's requirement

FAIL: EUT does not comply with standard's requirement

NA: Not Applicable

NP: Test Not Performed

2. Equipment Description (declared by provider)

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT): DCar-S

Serial Number: -



Equipment Under Test



Inputs/outputs - Cable:

Access	Inputs / Outputs	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Main power supply	Input	L1-N	-	Yes	☐	☒	-

Auxiliary equipment used during test:

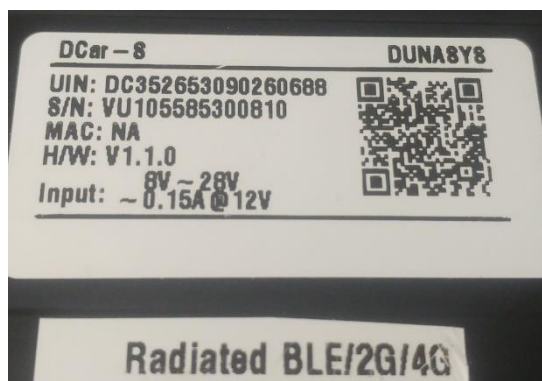
Type	Reference	Sn	Comments
Laptop	DELL Inspiron 15 3511	-	Provided by Dunasys

Equipment information: (Declared by provider)

Apparatus Description	DCar-S			
Type of power source:	☐ AC power supply	☒ DC power supply	☐ Battery (Select Type)	
Test source voltage:	Vmin-Vmax:	☐ Vmin - Vmax V / Fmin - Fmax Hz		☒ 12/24 VDC
Operating Modes	Mode 1	RX & TX mode		
Highest internal frequency (PLL, Quartz, Clock, Microprocessor...):	Highest:		1.3	GHz



2.2. EQUIPMENT LABELLING



Equipment Labelling

2.3. EQUIPMENT MODIFICATIONS

☒ None ☐ Modification:



2.4. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

$$FS = RA + AF + CF - AG$$

Where:

FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Factor

AG = Amplifier Gain

Example:

Assume a receiver reading of 52.5dB μ V is obtained. The antenna factor of 7.4 and a cable factor of 1.1 are added. The amplifier gain of 29dB is subtracted, giving a field strength of 32 dB μ V/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$

The 32 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32\text{dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}.$$

2.5. Test distance extrapolation – FCC/ISED

The field strength is extrapolated to the new measurement distance using formula from FCC Part15.31 (f) and §6.5-6.6 RSS-GEN:

Below 30MHz,

$$FS_{\text{limit}} = FS_{\text{max}} - 40 \log \left(\frac{d_{\text{limit}}}{d_{\text{measure}}} \right)$$

Above 30MHz,

$$FS_{\text{limit}} = FS_{\text{max}} - 20 \log \left(\frac{d_{\text{limit}}}{d_{\text{measure}}} \right)$$

Where:

FS_{limit} is the calculation of field strength at the limit distance, expressed in dB μ V/m

FS_{max} is the measured field strength, expressed in dB μ V/m

d_{measure} is the distance of the measurement point from the EUT

d_{limit} is the reference limit distance



3. Measurement of radiated emissions

3.1. ENVIRONMENTAL CONDITIONS

Test performed by : **Willy Daclinat**
Date of test : April 29, 2024
Ambient temperature : 23°C
Relative humidity : 40%

3.2. TEST SETUP

Specifications:

Frequency	30 – 1000 MHz	RBW 120 kHz
	1-12GHz	RBW 1MHz
Detector	Peak, average and Quasi-Peak	

Pre characterization in semi anechoic room is performed to define the critical frequencies

Operating conditions:

- The Equipment under Test is installed:

- ☒ Measure in semi anechoic room
☐ Measure in open area site

- Measuring distance:

- ☒ 3m
☐ 10m

- Deviation method:

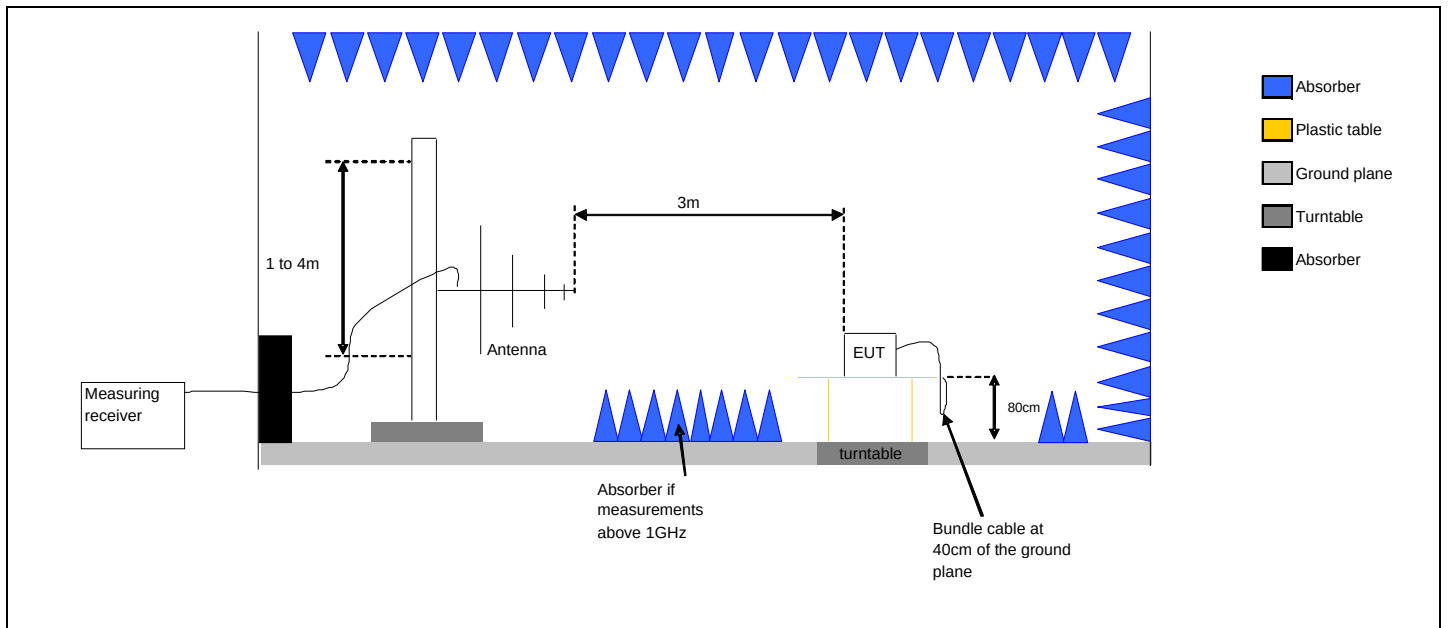
- ☐ Yes
☒ No

-Product installation:

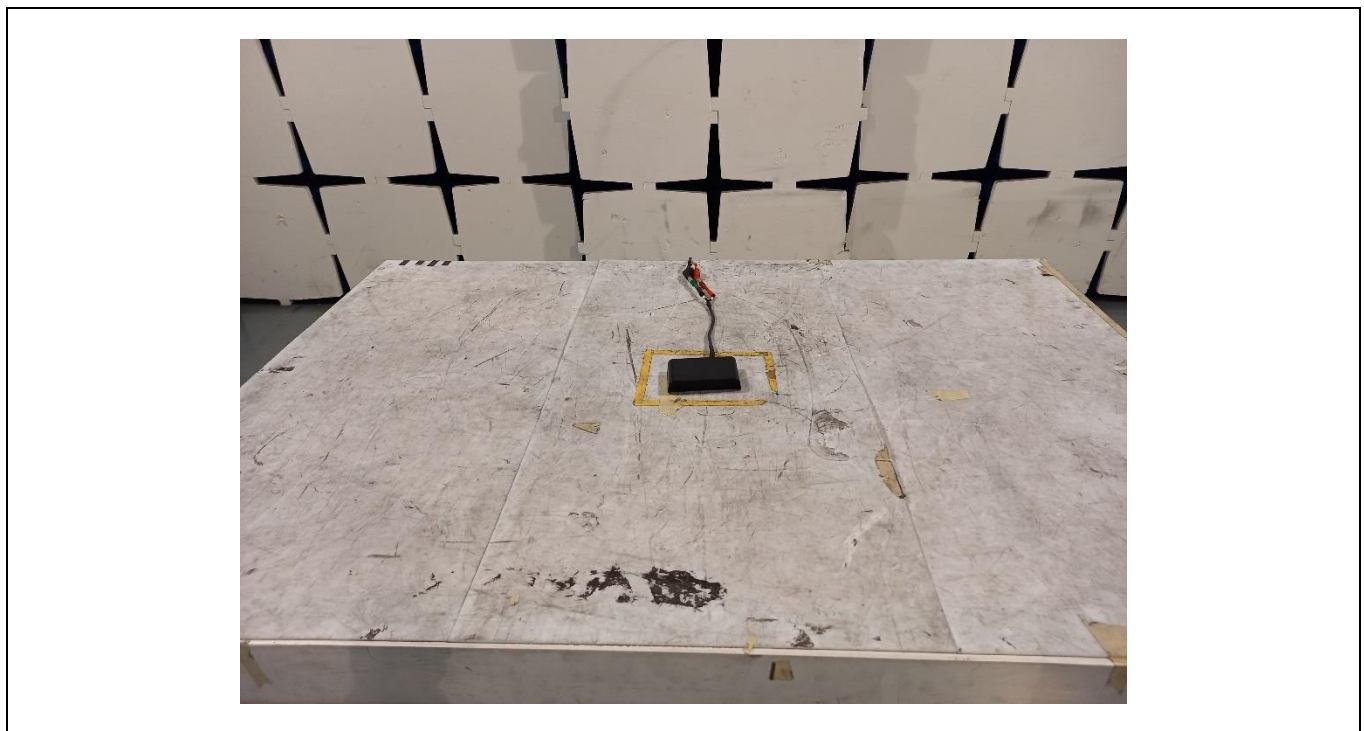
- ☒ The EUT was tested as a tabletop equipment and was placed on a non-conducting platform the top of which is 0.8m above the metal ground plane.
☐ The EUT is at 10cm height from reference plane

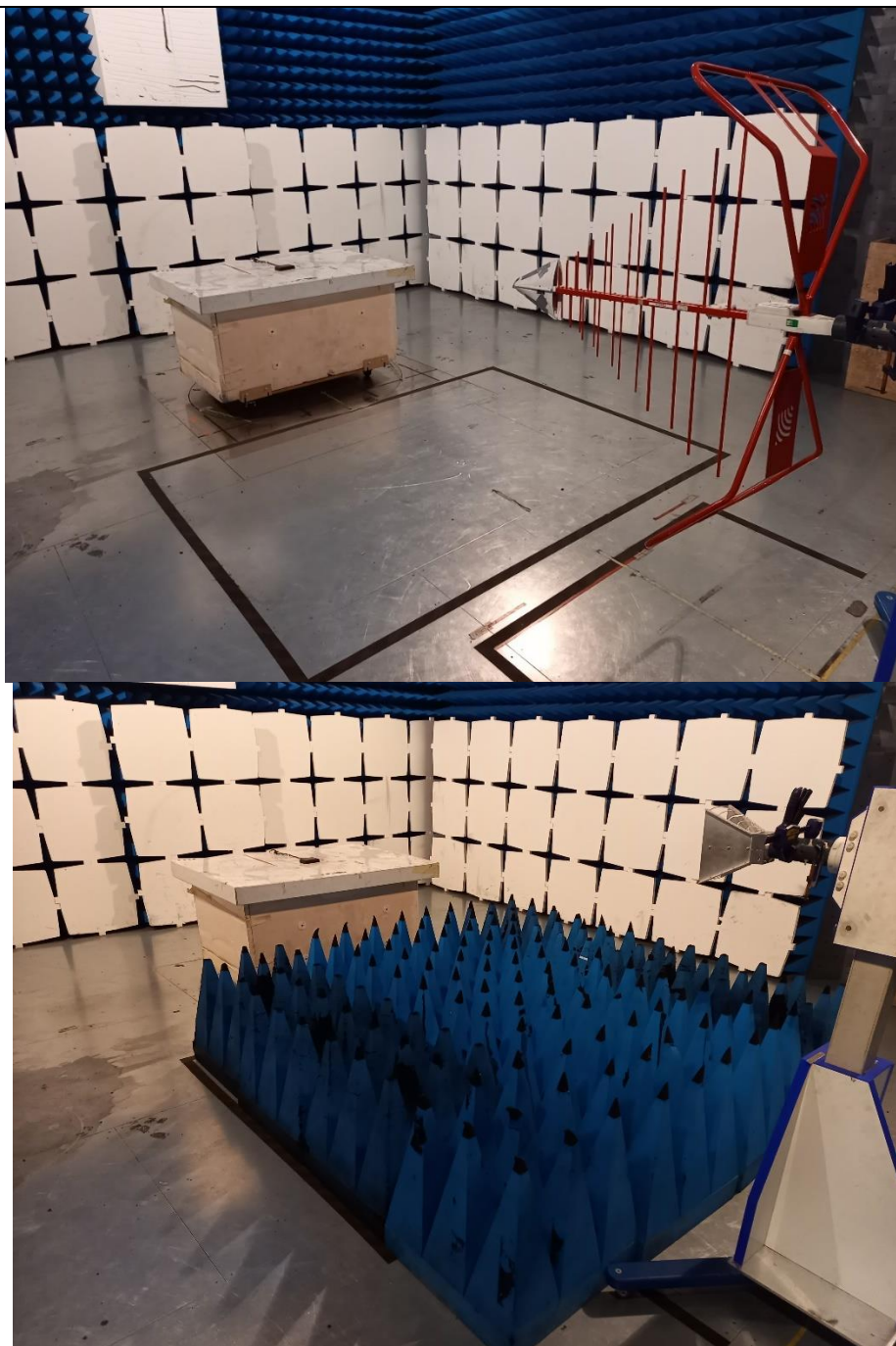
Operating mode:

- ☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ...



Test Set up for radiated measurement in semi anechoic chamber





Measurement of radiated disturbances.



3.3. LIMIT FOR FCC

☒ Class B in semi-anechoic room

Frequency Bands/frequencies	dB (μV/m) quasi-peak	dB (μV/m) peak	dB (μV/m) average	Distance
30-88MHz	40	-	-	3m
88 – 216MHz	43.5	-	-	3m
216 – 960 MHz	46	-	-	3m
960 – 1000 MHz	54	-	-	3m
1000-6000MHz	-	74	54	3m

3.4. LIMIT FOR IECS 003

☒ Class B in semi-anechoic room

Frequency Bands/frequencies	dB (μV/m) quasi-peak	dB (μV/m) peak	dB (μV/m) average	Distance
30-88MHz	40	-	-	3m
88 – 216MHz	43.5	-	-	3m
216 – 230 MHz	46	-	-	3m
230 – 960 MHz	47	-	-	3m
960 – 1000 MHz	54	-	-	3m
1000-6000MHz	-	74	54	3m

3.5. TEST EQUIPMENT LIST

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi anechoic chamber	SIEPEL	V01 (ANE)	D3044025	2024/04	2027/04
Semi anechoic chamber	SIEPEL	V01 (VSWR)	D3044025	2024/04	2027/04
Software v3.21.0.32	NEXIO	BAT-EMC	LCIE	-	-
Receiver	ROHDE & SCHWARZ	ESW26	A2642039	2024/02	2026/02
Antenne bico	Schwarzbeck	VHBB9124 + BBA 9106	C2040295	2023/02	2025/02
cable	-	-	A5330050	2024/04	2025/04
cable	-	-	A5330049	2024/04	2025/04
Preamplifier	SCHWARZBECK	BBV9743 B	A7080076	2023/04	2025/04
cable	-	-	A5330043	2023/11	2024/11
Cable	-	N/N_8m	A5330085	2024/04	2025/04
Bilog antenna	ETS LINDGREN	3142E	C2040216	2023/02	2025/02
Horn antenna	A-infoMW	Broadband 1-18	C2042056	2023/10	2025/10
Thermo-hygrometer	OREGON	BAR388HG	B4204076	2024/03	2026/03
Multimeter	KEITHLEY	2000	A1241115	2022/12	2024/12
Variable power supply DC	SODILEC	SDRI 403	-	-	-

TEST REPORT



3.6. RESULTS

Diagram N°1
Horizontal Polarization (30MHz-1GHz)

— FCC/FCC 15.109 - Classe: - QCrête/3.0m/
— IECS 003/IECS 003 - Classe: - Q-Peak/3.0m/
— Peak (Horizontale)

Description Sous-bande 1

Fréquences: 30 MHz - 1 GHz (Mode: Lin, Pas: 50 kHz)

Réglages: RBW: 120kHz, VBW: Auto, Durée balayage : 30 ms/Pts, Atténuation : Auto, Nombre de Balayages : 1, Preamp : On: 10 dB, LN Preamp : Off, Preselecteur: Off

Polarisation: Horizontale

Distance: 3 m

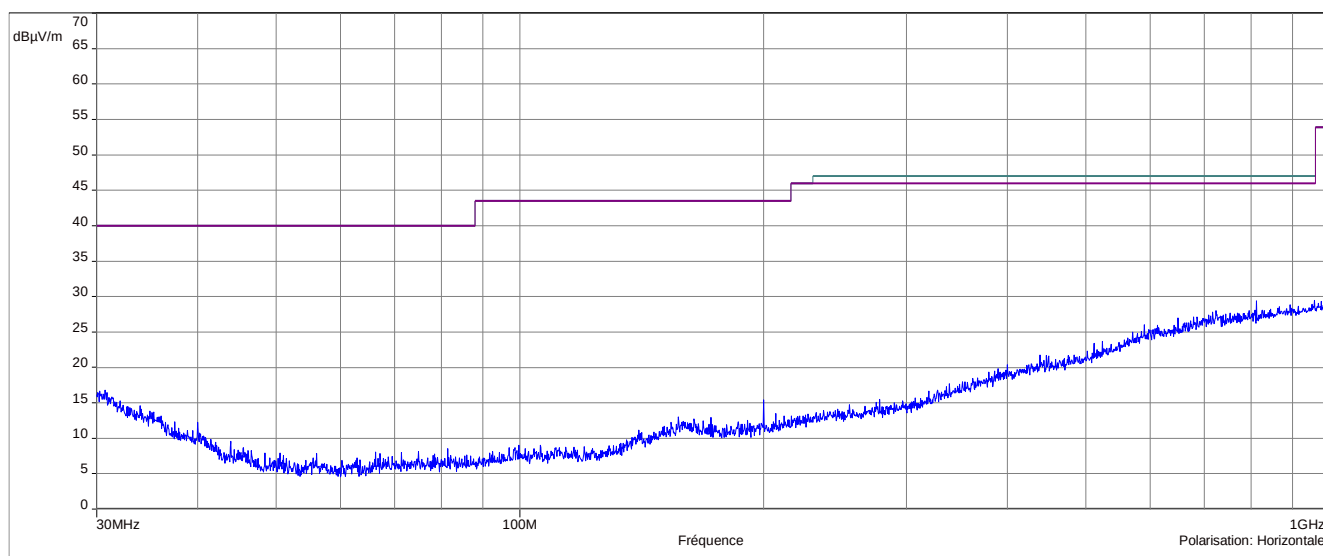


Diagram N°2
Horizontal Polarization (1GHz-6GHz)

— FCC/FCC 15.109 - Classe: - Moyenne/3.0m/
— FCC/FCC 15.109 - Classe: - Crête/3.0m/
— IECS 003/IECS 003 - Classe: - Avg/3.0m/
— IECS 003/IECS 003 - Classe: - Peak/3.0m/
— Peak (Horizontale)
— Avg (Horizontale)

Description Sous-bande 1

Fréquences: 1 GHz - 6 GHz (Mode: Lin, Pas: 500 kHz)

Réglages: RBW: 1MHz, VBW: Auto, Durée balayage : 10 ms/Pts, Atténuation : Auto, Nombre de Balayages : 1, Preamp : On: 10 dB, LN Preamp : Off, Preselecteur: Off

Polarisation: Horizontale

Distance: 3 m

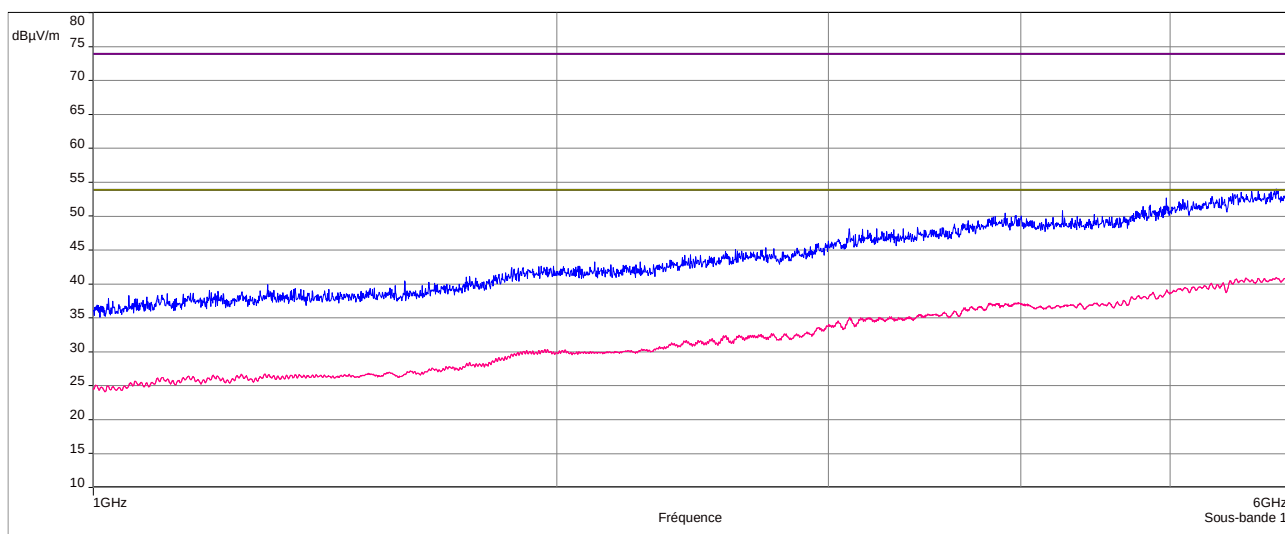


Diagram N°3



Vertical Polarization (30MHz-1GHz)

FCC/FCC 15.109 - Classe: - QCrête/3.0m/
IECS 003/IECS 003 - Classe: - Q-Peak/3.0m/
Peak (Verticale)

Description Sous-bande 2

Fréquences: 30 MHz - 1 GHz (Mode: Lin, Pas: 50 kHz)

Réglages: RBW: 120kHz, VBW: Auto, Durée balayage: 30 ms/Pts, Atténuation: Auto, Nombre de Balayages: 1, Preamp: On: 10 dB, LN Preamp: Off, Preselecteur: Off

Polarisation: Verticale

Distance: 3 m

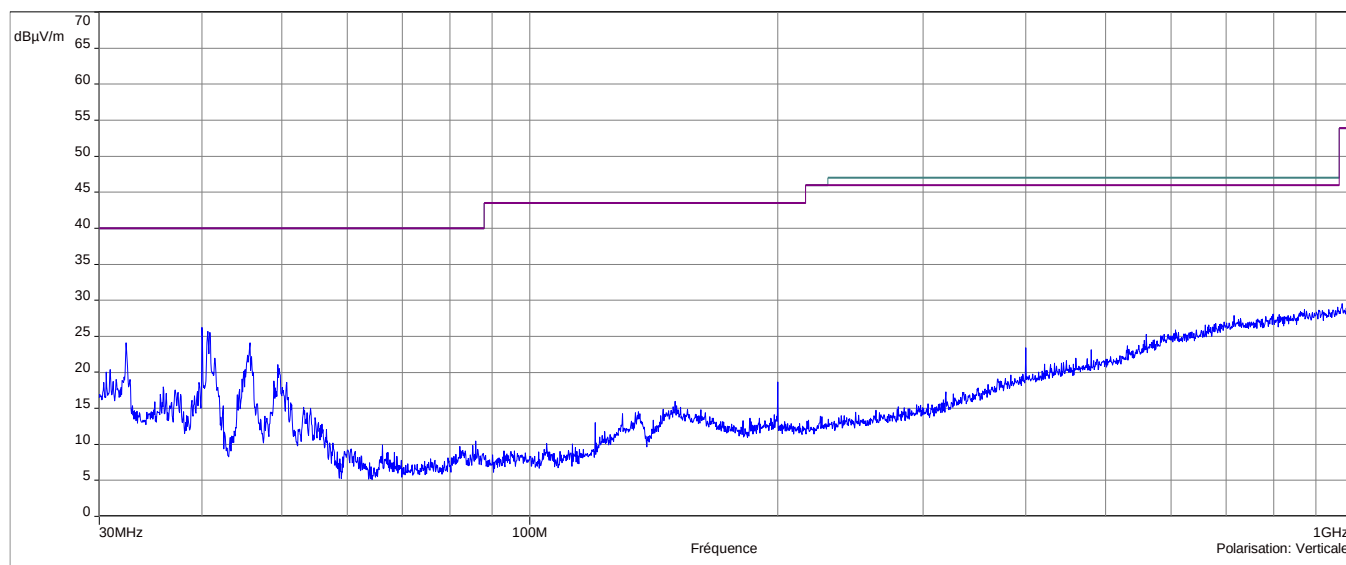


Diagram N°4 Vertical Polarization (1GHz-6GHz)

FCC/FCC 15.109 - Classe: - Moyenne/3.0m/
FCC/FCC 15.109 - Classe: - Crête/3.0m/
IECS 003/IECS 003 - Classe: - Avg/3.0m/
IECS 003/IECS 003 - Classe: - Peak/3.0m/
Peak (Verticale)
Avg (Verticale)

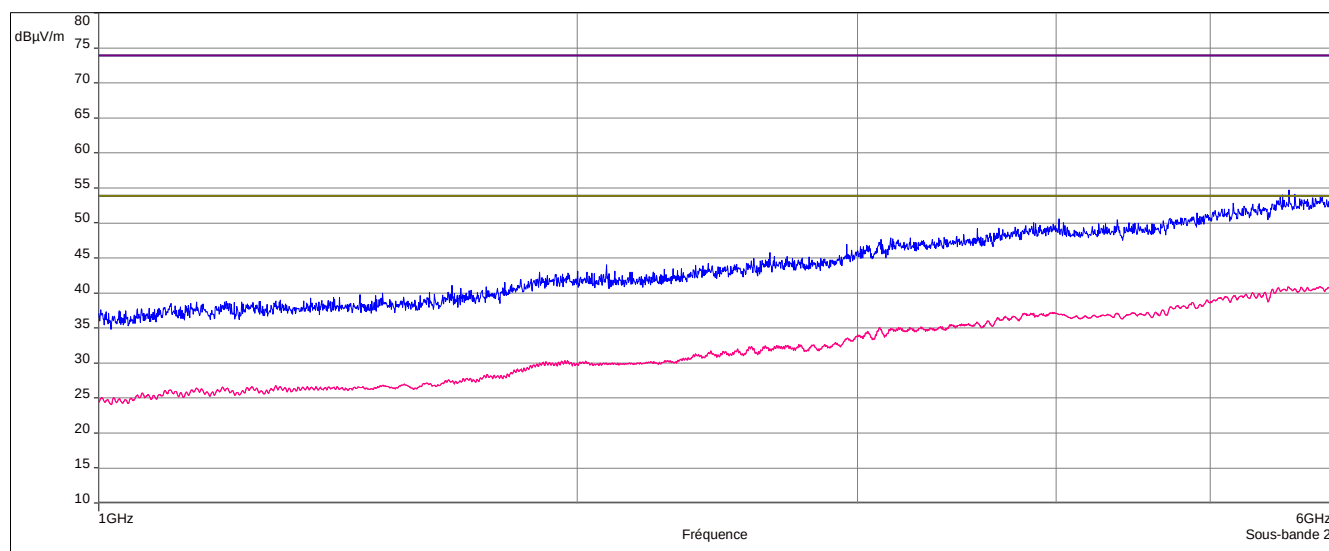
Description Sous-bande 2

Fréquences: 1 GHz - 6 GHz (Mode: Lin, Pas: 500 kHz)

Réglages: RBW: 1MHz, VBW: Auto, Durée balayage: 10 ms/Pts, Atténuation: Auto, Nombre de Balayages: 1, Preamp: On: 10 dB, LN Preamp: Off, Preselecteur: Off

Polarisation: Verticale

Distance: 3 m





Fréquence (MHz)	SB	Peak (dBµV/m)	Lim.Q-Peak (dBµV/m)	Polarisation	Correction (dB)
32.35	2	24.08	40.00	Verticale	15.53
40	2	26.26	40.00	Verticale	11.14
40.65	2	25.68	40.00	Verticale	10.89
45.7	2	24.12	40.00	Verticale	8.80
716.05	2	27.89	47.00	Verticale	25.80

*The measurement results of at least the six highest emissions relative to the limit, unless they are 10 dB or more below the limit, shall be recorded in the test report.

3.7. CONCLUSION

Measures of Radiated Emission, performed on the sample of the product DCar-S, SN: -, in configuration and description presented in this test report, show levels conform to the FCC part 15 & ICES -003 limits.



4. Measurement of conducted disturbance (for information only)

4.1. ENVIRONMENTAL CONDITIONS

Test performed by : **Willy Daclinat**
Date of test : May 2, 2024
Ambient temperature : 22°C
Relative humidity : 36%

4.2. TEST SETUP

Specifications:

Frequency 0.15 – 30 MHz RBW 9 kHz
Detector Peak, Quasi Peak and average

The measurement is performed on power supply with a LISN and telecommunication lines with RSI or current clamp for shielded cables.

Operating conditions:

- Deviation method:

☐ Yes

☒ No

-Product installation:

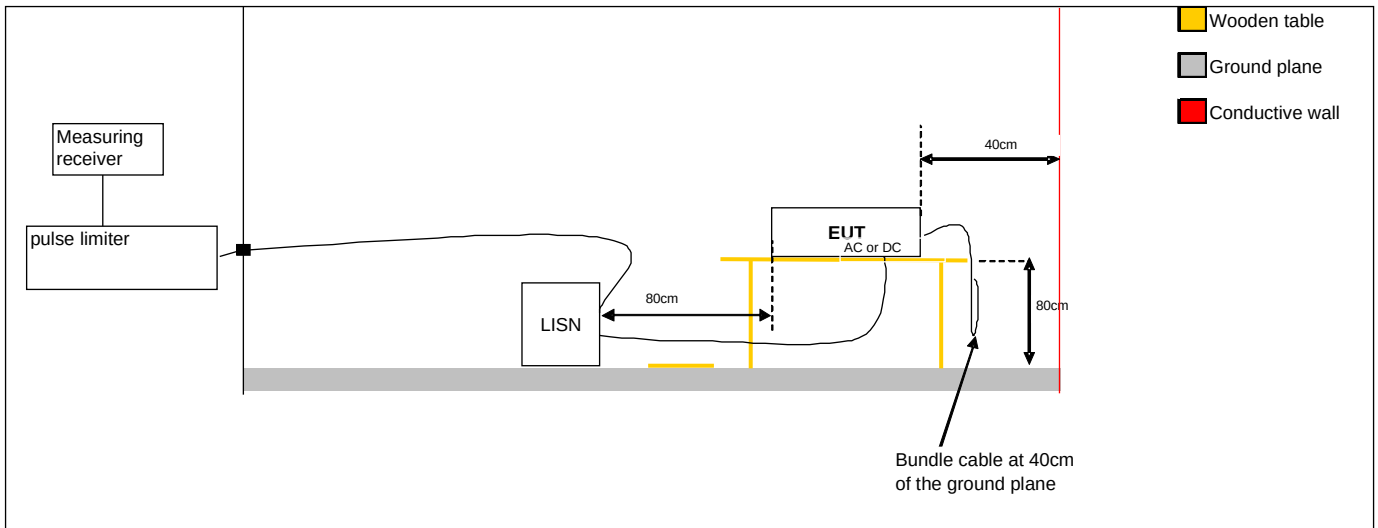
☒ The EUT is installed on a wooden table 80 cm above the reference plane, at 80cm of the LISN and at 40cm of the vertical conductive wall

☐ The EUT is installed on a wooden table 40 cm above the reference plane, at 80cm of the LISN.

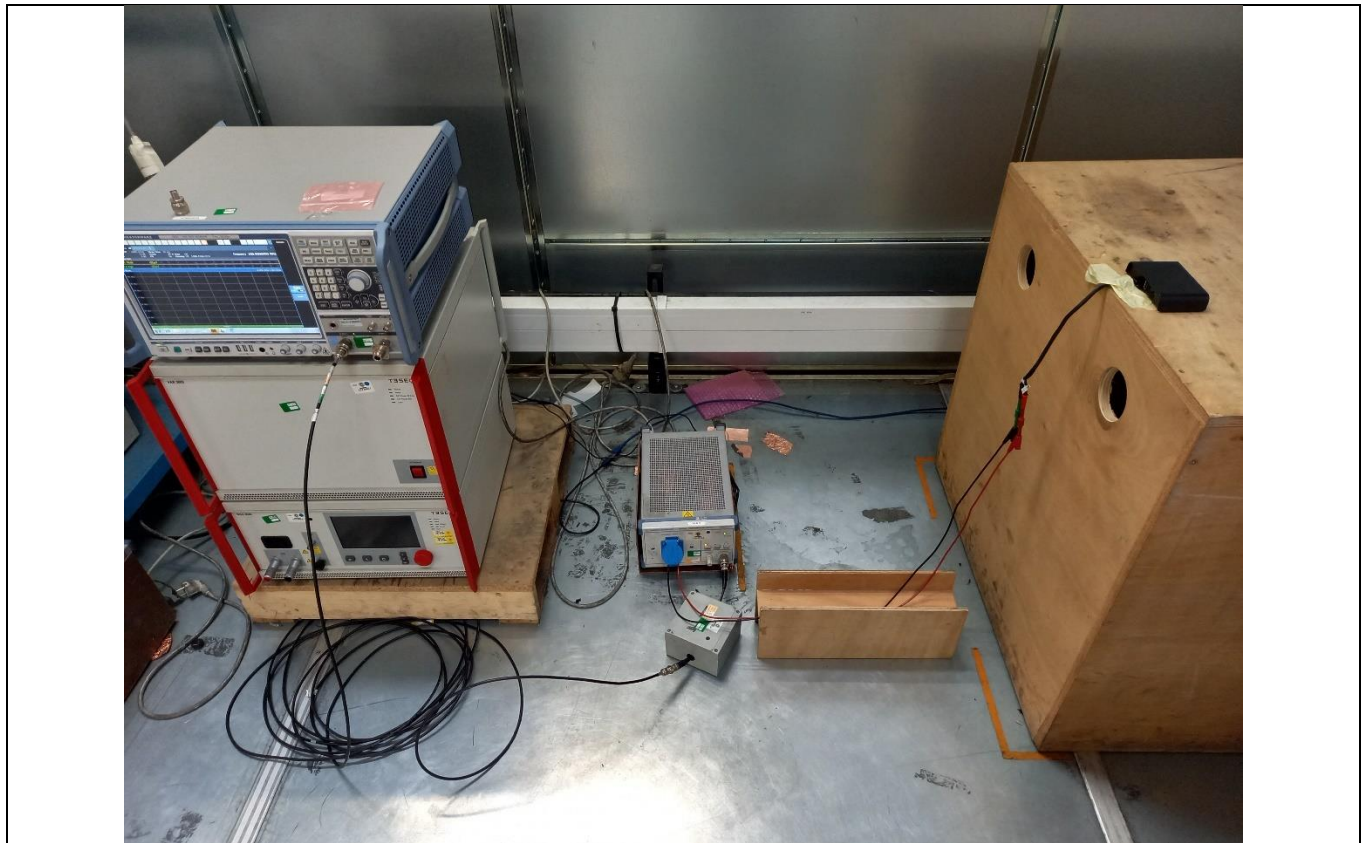
☐ The EUT is installed 10 cm above the reference plane, at 80cm of the LISN.

Operating mode :

☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ...



Test set up of conducted emission on power supply



Test set up of conducted emission on power supply



4.3. LIMIT

☒ Power supply Class B

Frequency Bands/frequencies	dB (μV/m) quasi-peak	dB (μV/m) average
0.15-0.5MHz	66-56	56-46
0.5-5 MHz	56	46
5-30 MHz	60	50

4.4. TEST EQUIPMENT LIST

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Reference ground plane 3 x 6,5 m	LCIE	V03	-	-	-
Software v3.21.0.32	NEXIO	BAT-EMC	LCIE	-	-
Receiver	ROHDE & SCHWARZ	ESW26	A2642039	2024/02	2026/02
Cable		BNC/BNC_1,5m	A5329715	2023/04	2025/04
Current absorber	LCIE	-	A5329924	2023/08	2025/08
RSIL	ROHDE & SCHWARZ	ENV216	C2320162	2023/08	2024/08
Thermo-hygrometer	OTIO	-	B4204093	2023/04	2025/04
Multimeter	KEITHLEY	2000	A1241115	2022/12	2024/12
Variable power supply DC	SODILEC	SDRI 403	-	-	-



4.5. RESULTS

Diagram N°1

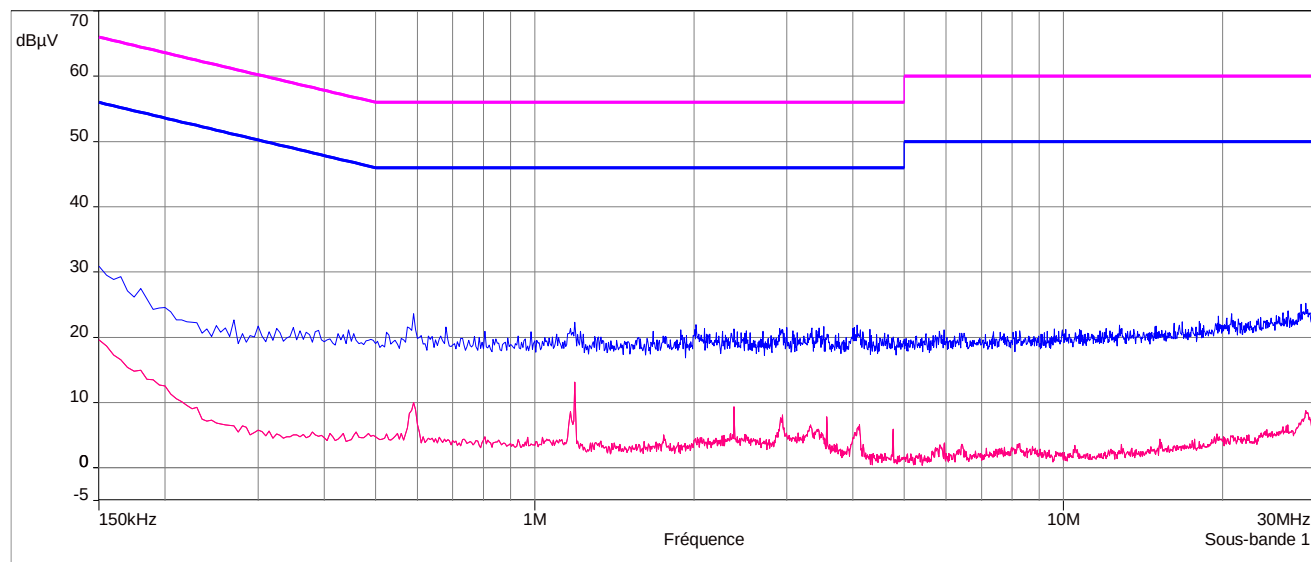
FCC/FCC 15.107 - Classe:B - Moyenne/
FCC/FCC 15.107 - Classe:B - QCrête/
Peak (Phase 1)
Avg (Phase 1)

Description Sous-bande 1

Fréquences: 150 kHz - 30 MHz (Mode: Lin, Pas: 5 kHz)

Réglages: RBW: 9kHz, VBW: Auto, Durée balayage : 50 ms/Pts, Atténuation : Auto, Nombre de Balayages : 1, Preamp : Off, LN Preamp : Off, Preselecteur: On

Ligne:Phase 1



12V

Diagram N°2

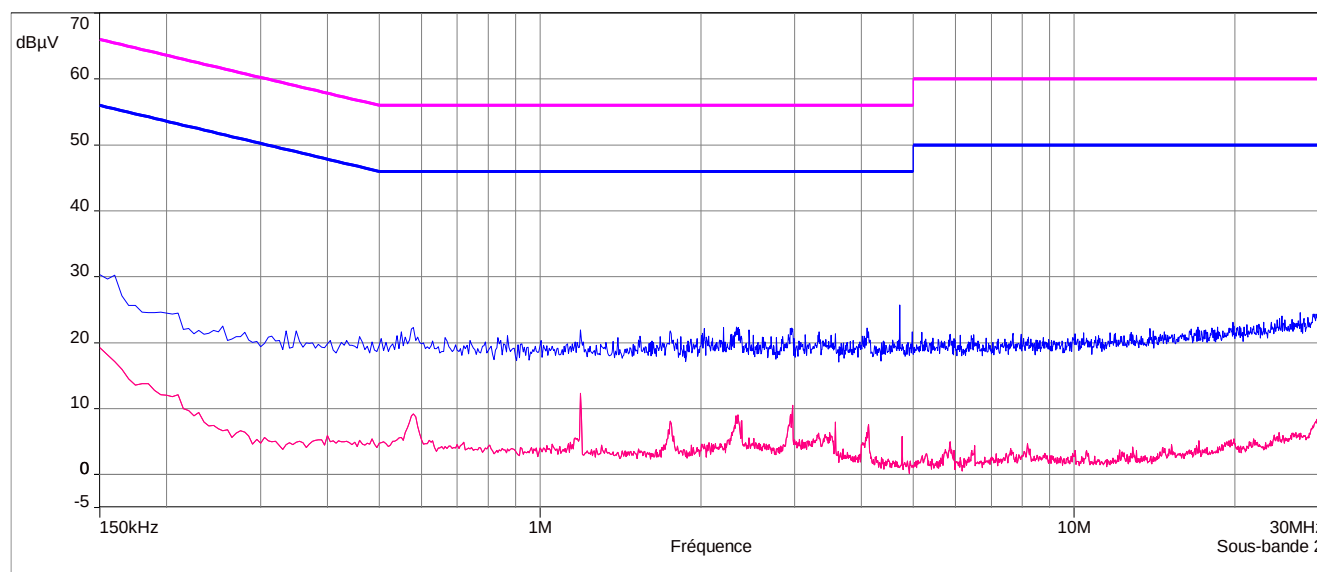
FCC/FCC 15.107 - Classe:B - Moyenne/
FCC/FCC 15.107 - Classe:B - QCrête/
Peak (Neutre)
Avg (Neutre)

Description Sous-bande 2

Fréquences: 150 kHz - 30 MHz (Mode: Lin, Pas: 5 kHz)

Réglages: RBW: 9kHz, VBW: Auto, Durée balayage : 50 ms/Pts, Atténuation : Auto, Nombre de Balayages : 1, Preamp : Off, LN Preamp : Off, Preselecteur: On

Ligne:Neutre



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Diagram N°3

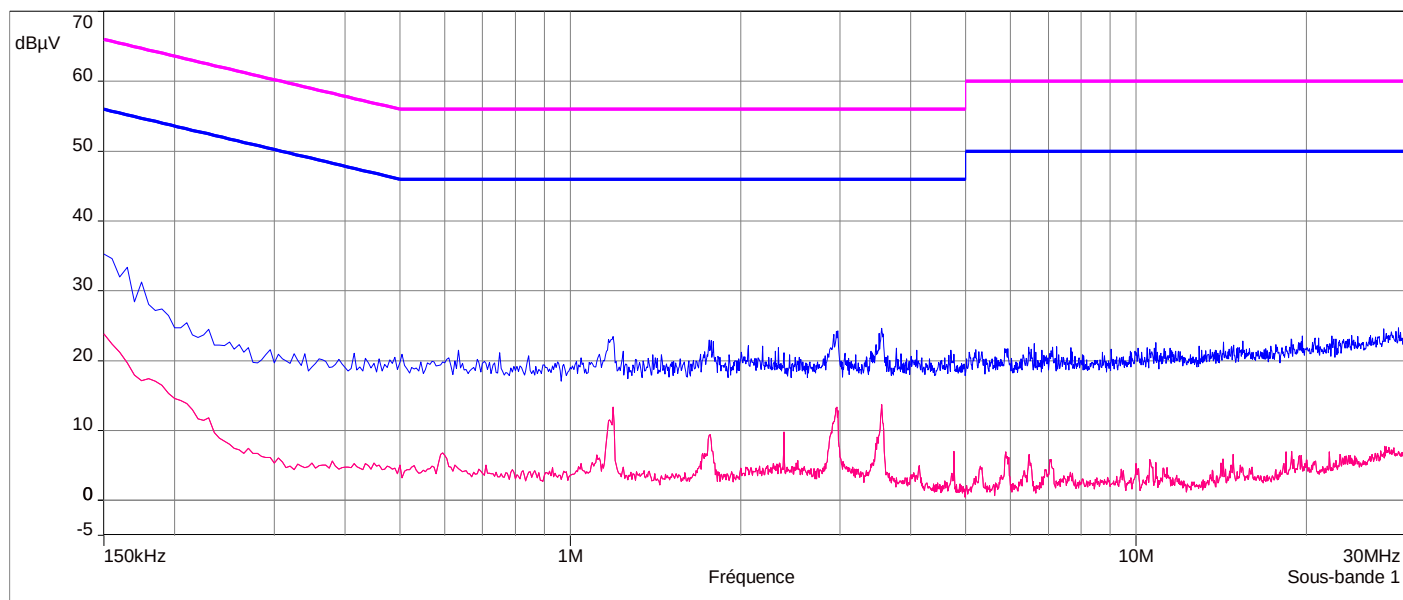
Description Sous-bande 1

Fréquences: 150 kHz - 30 MHz (Mode: Lin, Pas: 5 kHz)

Réglages: RBW: 9kHz, VBW: Auto, Durée balayage: 50 ms/Pts, Atténuation: Auto, Nombre de Balayages: 1, Preamp: Off, LN Preamp: Off, Preselecteur: On

Ligne:Phase 1

FCC/FCC 15.107 - Classe:B - Moyenne/
FCC/FCC 15.107 - Classe:B - QCrête/
Peak (Phase 1)
Avg (Phase 1)



24V

Diagram N°4

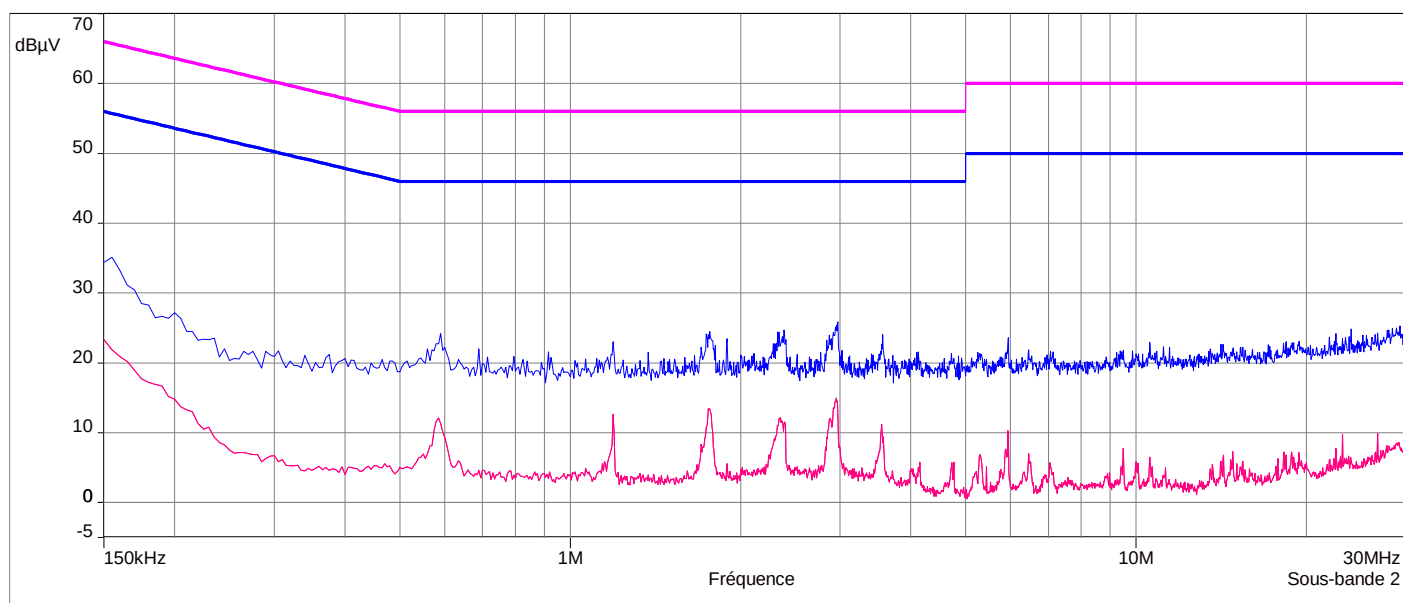
Description Sous-bande 2

Fréquences: 150 kHz - 30 MHz (Mode: Lin, Pas: 5 kHz)

Réglages: RBW: 9kHz, VBW: Auto, Durée balayage: 50 ms/Pts, Atténuation: Auto, Nombre de Balayages: 1, Preamp: Off, LN Preamp: Off, Preselecteur: On

Ligne:Neutre

FCC/FCC 15.107 - Classe:B - Moyenne/
FCC/FCC 15.107 - Classe:B - QCrête/
Peak (Neutre)
Avg (Neutre)



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Fréquenc...	SB	Peak (dBμV)	Avg (dBμV)	Lim.Avg (dBμV)	Lim.Q-Peak (dBμV)	Ligne	Correction (dB)
0.59	2	24.19	11.30	46.00	56.00	Neu...	9.66
1.765	2	24.52	13.44	46.00	56.00	Neu...	9.82
2.385	2	24.74	11.27	46.00	56.00	Neu...	9.89
2.975	2	25.87	11.98	46.00	56.00	Neu...	9.93

*The measurement results of at least the six highest emissions relative to the limit, unless they are 10 dB or more below the limit, shall be recorded in the test report.

4.6. CONCLUSION

Measures of Conducted Emission, performed on the sample of the product DCar-S, SN: -, in configuration and description presented in this test report, show levels conform to the FCC part 15 & ICES -003 limits.



5. Uncertainties Chart

Kind of measurement	Wide uncertainty laboratory (k=2) $\pm x$ (dB)	CISPR uncertainty limit $\pm y$ (dB)
Measurement of conducted disturbances in voltage on the AC power port (9 kHz – 150 kHz)	3.68	3.8
Measurement of conducted disturbances in voltage on the AC power port (150 kHz – 30 MHz)	3.22	3.4
Measurement of conducted disturbances in Capacitive voltage (150 kHz – 30 MHz)	3.69	3.9
Measurement of conducted disturbances in voltage AAN avec aLCL = 55 ... 40 dBc	4.15	4.2
Measurement of conducted disturbances in voltage AAN avec aLCL = 65 ... 50 dBc	4.54	4.59
Measurement of conducted disturbances in voltage AAN avec aLCL = 75 ... 60 dBc	4.97	5.03
Measurement of conducted disturbances in current (current clamp)	2.9	2.9
Measurement of disturbance power	4.31	4.5
Measurement of radiated magnetic field from 10kHz to 30MHz in SAC	4.48	/
Measurement of radiated electric field from 30 to 1000MHz in horizontal position on OATS & SAC	5.79	6.3
Measurement of radiated electric field from 30 to 1000MHz in vertical position on OATS & SAC at 3m	6.3	6.3
Measurement of radiated electric field from 6 to 18GHz	5.36	5.5
Measurement of radiated electric field from 30 to 1000MHz in horizontal position in OATS at 10m	5.7	6.3
Measurement of radiated electric field from 30 to 1000MHz in vertical position in in OATS at 10m	5.61	6.3
Measurement of radiated electric field from 1 to 6 GHz	4.98	5.2
Measurement of radiated magnetic field from 10kHz to 30MHz on the OATS (Ecuelles)	4.48	/
Measurement of current harmonics	11.11%	/
Measurement of Flicker	9.26%	/
Immunity to radiated. radio-frequency. electromagnetic field in SAC C01 (80MHz-1GHz)	2.26	/
Immunity to radiated. radio-frequency. electromagnetic field in SAC C01 (1-6GHz)	2.42	/
Immunity to radiated. radio-frequency. electromagnetic field in SAC V01 (80MHz-1GHz)	2.5	/
Immunity to radiated. radio-frequency. electromagnetic field in SAC V01 (1-6GHz)	2.64	/
Immunity to radiated. radio-frequency. electromagnetic field in SAC V05 (80MHz-1GHz)	2.27	/
Immunity to radiated. radio-frequency. electromagnetic field in SAC V05 (1-6GHz)	2.64	/

End of test report