TEST REPORT

N°: 164327-744721-A (FILE#1035688) **Version : 03**

Subject	**Electromagnetic compatibility tests according to the standards: FCC CFR 47 Part 15, Subpart B.**
Issued to	**GROUPE LDLC** 2 rue des Erables 69760 - LIMONEST France
Apparatus under test	
Product	**Lightsaber Elite**
Trade mark	**SOLAARI**
Manufacturer	**Groupe LDLC**
Model under test	**WAAN**
Serial number	**None**
FCCID	**2AXTU-ELITE**
Conclusion	See Test Program chapter
Test date	October 17, 2019
Test location	MOIRANS
Sample receipt date	October 10, 2019
Composition of document	10 pages
Document issued on	July 13, 2021

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	December 4, 2019	Loic BOURET	Creation of the document
02	October 12, 2020	Loic BOURET	Page 5: Add FCCID of radio single modular
03	July 13, 2021	Loic BOURET	Page 1: Add FCCID of the equipment

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.

SUMMARY

1. TEST PROGRAM

1.1. FCC PART15B

Standard:

✓ **FCC Part 15, Subpart B (Digital Devices)**

1.1.1. Requirements for disturbance emissions – Class B

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance 150kHz-30MHz **FCC §15.107**	**Access: AC power**			**NA**
	Frequency	**Quasi-peak**	**Average**	
	150-500kHz	66 to 56 dBµV	56 to 46 dBµV	
	0.5-5MHz	56 dBµV	46 dBµV	
	5-30MHz	60 dBµV	50 dBµV	
Radiated emissions 30MHz-1GHz **FCC §15.109**	**Access: Enclosure port of ancillary equipment**			**PASS**
	Frequency	**Quasi-peak @10m**		
	30MHz-88MHz	40.0 dBµV/m		
	88MHz-216MHz	43.5 dBµV/m		
	216MHz-960MHz	46.0 dBµV/m		
	Above 960MHz	54.0 dBµV/m		
Radiated emissions 1GHz-40GHz* **FCC §15.109**	**Access: Enclosure port of ancillary equipment**			**NA**
	Frequency	**Peak @3m**	**Average @3m**	
	1-GHz	74.0 dBµV/m	54.0 dBµV/m	

NP: Not Performed / NA: Not Applicable / NR: Not Requested by the customer (It cannot be taken into account for the declaration of conformity)
[D]: Divergence, the last version is used to make it possible to test the product with the standard which describes the current state of the art and thus to answer as well as possible his environment of final use.
***§15.33:** The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.
- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.
- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.
- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.
If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.
Special condition for intentional radiator:

- For a composite system comprised of a digital device using a clock frequency of 1 GHz as the highest frequency for the digital logic and an intentional radiator operating at 2.4 GHz, the composite is required to be investigated to the upper frequency of 24 GHz (in this case, 10 times the intentional radiator frequency is the higher frequency).

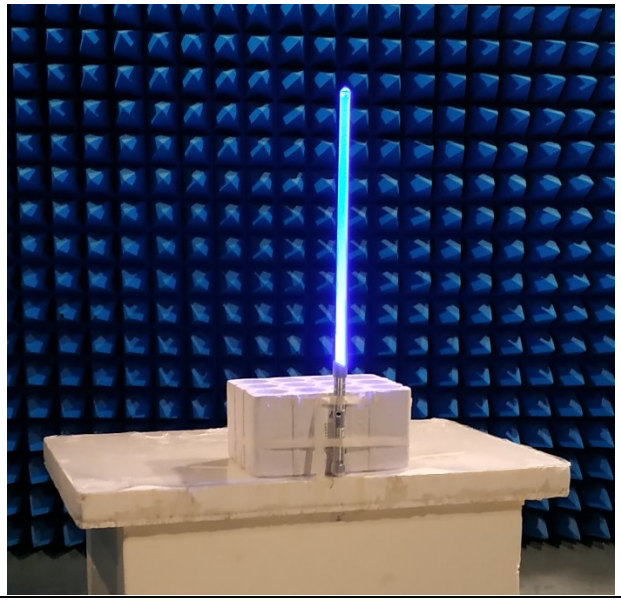
- For a composite system comprised of a digital device using a clock frequency of 2 GHz as the highest frequency for the digital logic and an intentional radiator operating at 913 MHz, the composite is required to be investigated to the upper frequency of 10 GHz (in this case, 5 times the unintentional radiator clock frequency is the higher frequency).

2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT): WAAN **Serial Number:** None

Contain FCC ID : SSSBC127-X (single modular BC127)



Equipment Under Test

Power supply:
During all the tests, EUT is supplied by battery.
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply	Battery	2 x 3,63V 3250mAh	Tenergy 30016-06 Li-Ion	-

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply	Battery	-	☐	☐	☐	

2.2. EUT CONFIGURATION – RUNNING MODE

Hardware information			
Highest internal frequency (PLL, Quartz, Clock, Microprocessor…):	**$F_{Highest}$:**	**48**	**MHz**
Firmware (if applicable):	**V. :**	**V1.13**	
Software (if applicable):	**V. :**	**V 1.0.5.3 (Smartphone)**	

***Configuration n°1*:** The sword is on, without communication.

2.3. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

2.4. SPECIAL ACCESSORIES

None

2.5. 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

Assume a receiver reading of 52.5dBµV is obtained. The antenna factor of 7.4 and a cable factor of 1.1 is added. The amplifier gain of 29dB is subtracted, giving field strength of 32 dBµV/m.
FS = 52.5 + 7.4 + 1.1 – 29 = 32 dBµV/m
The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.
Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

2.6. CALIBRATION DATE

The calibration intervals are extended at 12+2 months. This extended interval is based on the fact that there is sufficient calibration data to statistically establish a trend or based on experience of use of the test equipment to assure good measurement results for a longer period.

3. MEASUREMENT OF RADIATED EMISSION (30MHZ-1GHZ)

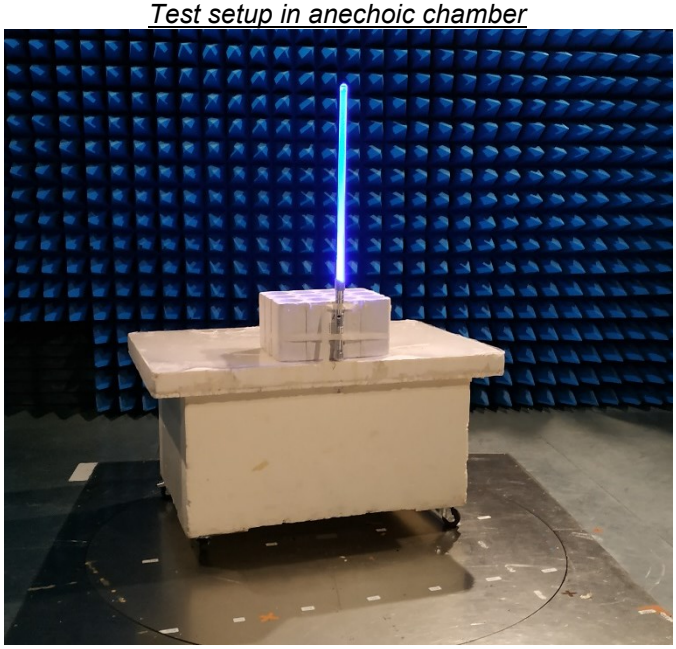
3.1. ENVIRONMENTAL CONDITIONS

Date of test	:	October 17, 2019
Test performed by	:	Loïc BOURET
Atmospheric pressure (hPa)	:	992
Relative humidity (%)	:	39
Ambient temperature (°C)	:	28

3.2. TEST SETUP

The installation of EUT is identical for pre-characterization measures in a 3 meters semi- anechoic chamber and for measures on the 10 meters Open site.
The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment)
☐ 10cm above the ground on isolating support (Floor standing equipment)
The EUT is powered by V_{nom}.

Test setup in anechoic chamber



3.3. TEST METHOD

The product has been tested according to FCC part 15 subpart B.

Pre-characterisation measurement: (30MHz –1GHz)
A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization during the test for maximized the emission measurement. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration.

3.1. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Calibration date**	**Calibration due date**
Amplifier 100kHz - 18GHz	LCIE SUD EST	_	A7085027	07/19	07/20
Antenna Bi-log	AH System	SAS-521-7	C2040180	10/18	10/20
Antenna mast (Cage#1)	MATURO Gmbh	AM 4.0	F2000407		
BAT EMC	NEXIO	v3.9.0.10	L1000115		
Cable 0.75m	SUCOFLEX	18GHz	A5329920	09/19	09/20
Cable 2m	-	18GHz	A5329904	08/19	08/20
Emission Cable	SUCOFLEX	18GHz	A5329899	07/19	07/20
HF Radiated emission comb generator	LCIE SUD EST	_	A3169088		
Radiated emission comb generator	BARDET	_	A3169050		
Semi-Anechoic chamber #1	SIEPEL	_	D3044016_BF	07/19	07/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/18	03/20
Table C1/OATS	MATURO Gmbh	_	F2000437		
Thermo-hygrometer (C1)	OREGON	WMR 80	B4206013	06/18	06/20
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Turntable chamber (Cage#1)	MATURO Gmbh	TT 2.0 SI	F2000406		
Turntable controller (Cage#1)	MATURO Gmbh	Control Unit	F2000408		

3.2. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☐ None ☑ Divergence: Only axis X and Y are tested

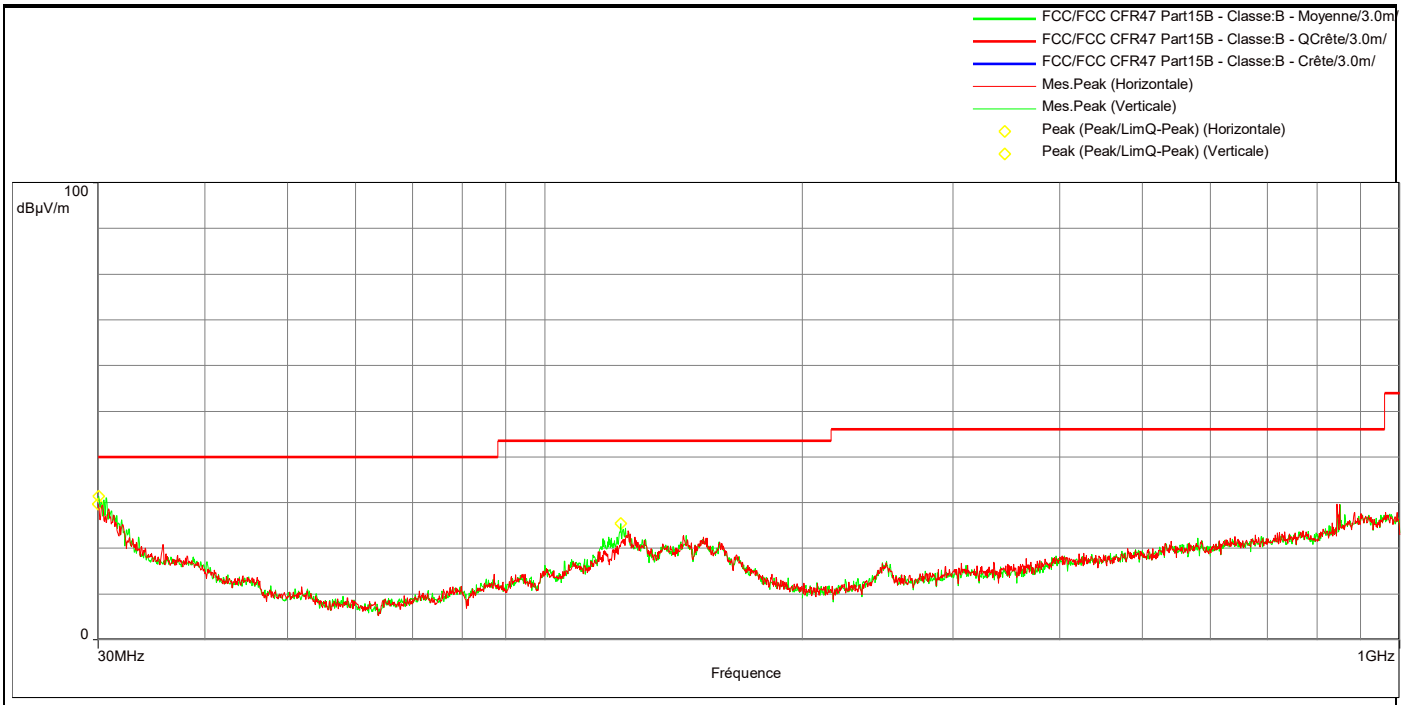
3.3. TEST RESULTS

Pre-characterisation measurement (30MHz-1GHz): pre-scan measurement at 3m (PEAK detection, graph examples)

See graphs:

Graph identifier	Polarization	EUT position	Comments
Emr# 1	Vertical/ Horizontal	Axis XY	See below

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	C1 - FSV(H+V)[0.3-1]GHz - Cfg 1	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions
No signicative frequency

3.4. CONCLUSION

The sample of the equipment **WAAN**, Sn: **None**, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part15B, for radiated emissions.

4. UNCERTAINTIES CHART

Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) ±x	Incertitude limite du CISPR / CISPR uncertainty limit ±y
Mesure des perturbations conduites en tension sur le réseau d'énergie (monophasé /triphasé) 10kHz-150kHz *Measurement of conducted disturbances in voltage on the power port (single & three phases)10kHz-150kHz*	3.27dB	3.8dB
Mesure des perturbations conduites en tension sur le réseau d'énergie (monophasé /triphasé) 150kHz-30MHz *Measurement of conducted disturbances in voltage on the power port (single & three phases)150kHz-30MHz*	3.29dB	3.4dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication *Measurement of conducted disturbances in voltage on the telecommunication port.*	3.26dB	5dB
Mesure des perturbations discontinues conduites en tension *Measurement of discontinuous conducted disturbances in voltage*	3.33dB	3.4dB
Mesure des perturbations conduites en courant *Measurement of conducted disturbances in current*	2.67dB	2.9dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 30MHz à 1GHz *Measurement of radiated electric field in half-anechoic Faraday room From 30MHz to 1GHz*	5.06dB	5.3dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 1GHz à 6GHz *Measurement of radiated electric field in half-anechoic Faraday room From 1GHz à 6GHz*	5.18dB	5.2dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 6GHz à 18GHz *Measurement of radiated electric field in half-anechoic Faraday room From 6GHz to 18GHz*	5.21dB	5.5dB
Mesure du champ électrique rayonné sur le site en espace libre de Moirans 30MHz – 1GHz. *Measurement of radiated electric field on the Moirans open area test site 30MHz – 1GHz.*	5.2dB	6.3dB
Mesure du champ électrique rayonné IN SITU de 30 à 1000 MHz *IN SITU measurement of radiated electric field from 30 to 1000MHz*	A l'étude / Under consideration	5.2dB
Mesure de la puissance perturbatrice *Measurement of disturbance power*	3.32dB	4.5dB
Mesure des harmoniques de courant *Measurement of current harmonics*	11.11%	/
Mesure du flicker *Flicker measurement*	9.26%	/

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par le CISPR, la conformité de l'échantillon est établie directement par les niveaux limites applicables. Ce tableau regroupe l'ensemble des incertitudes maximales pour les essais réalisables dans le laboratoire, qu'ils aient été ou non réalisés dans le cadre du présent rapport */ The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the CISPR. The conformity of the sample is directly established by the applicable limits values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report*

Note - L'incertitude de mesure instrumentale est déterminée selon la CISPR 16-4-2. / *The instrumentation measurement uncertainty is determined according to CISPR16-4-2*