

FCC Test Firm Designation Number: FR0014
ISED Wireless Device Testing Laboratory CAB Number: FR0004

Matériel testé :
Equipment under test:

TAQT / TAQT-ONE (TAQT1001)
(Trademark / Marketing name or product reference)

Client : **AEMC LAB**
Customer: 19 rue François Blumet
38360 SASSENAGE - France

Demandeur de certification : **Taqt**
Applicant for certification: Claude-Emmanuel Serre
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Référence de la proposition : 062021-24713
Proposal number:

Numéro d'affaire : 14587
Work number :

Date de l'essai : 5 Juillet, 8 Aout et 26 Octobre 2022
Date of test: July 5th August, 8th, and October 26th, 2022

Objectif des essais : EMC qualification according to following standards:
Test purpose: - CFR 47, FCC Part 15, Subpart C
(Chapter 15.225 - Operation within the band 13.110-14.010 MHz)
- Industry Canada, RSS-Gen Issue 5 & RSS-210 Issue 10, section B.6
(Band 13.110-14.010 MHz)
Measurement standards:
ANSI C63.10 (2013)

Lieu du test: SMEE, 385 Rue René Rambaud
Test location: 38500 VOIRON - France

Test réalisé par : Chemseddine KERMICHE / Laurent CHAPUS
Test realized by:

Conclusion : L'équipement satisfait aux prescriptions et essais des normes citées en référence.
Conclusion: The appliance complies with requirements and tests of above mentioned standards.

Ed.	Date	Modifications Pages	Written by: Visa	Approved by: Visa
1	October 26 th , 2022	Initial Edition	Chemseddine KERMICHE Test Operator	Laurent CHAPUS Technical Manager

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This new edition of this report cancels and replaces the previous edition. Changes made to a new edition of this report are indicated by a vertical line to the left of the page.



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COORDONNEES

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Glossaire / Glossary

EUT: Equipment Under Test
 EMC: Electromagnetic Compatibility
 FS OATS: Free Space Open Area Test Site
 SAR: Semi Anechoic Chamber
 FAR: Full Anechoic Chamber
 C-AV: CISPR-Average (Detector)
 QP: Quasi-Peak (Detector)

1. Normative References

FCC qualification according to:		
Standards	Applied	Title
ANSI C63.10 (2013)	X	American National Standard for Testing Unlicensed Wireless Devices
CFR47, Part 15 (August 2022)	X	Telecommunication – Federal Communication Commission – Radio frequency devices, Sections 15.207 / 15.209 / 15.225

Industry Canada qualification according to:		
Standards	Applied	Title
RSS-Gen (Issue 5/2018, amendments 2019 and 2021)	X	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 (Issue10/2019)	X	Licence-exempt Radio Apparatus: Category I Equipment, Section B.6: Band 13.110-14.010MHz

Deviation from standard:

- None.

2. Test synthesis

TEST	Paragraph number FCC Part 15 ISED RSS-210	Spec. FCC Part 15 ISED RSS-210	RESULTS (comments)
Conducted emissions test	15.207 (a) RSS-Gen §8.8	15.207 (a) Table 4, §8.8	N/A
Field Strength of fundamental	15.225 (a) (b) (c) RSS-210: §B.6 (a) (b) (c)	Measure at 30m 13.110-13.410 MHz: 40.5dBµV/m 13.410-13.553 MHz: 50.5dBµV/m 13.553-13.567 MHz: 84.0dBµV/m 13.567-13.710 MHz: 50.5dBµV/m 13.710-14.010 MHz: 40.5dBµV/m	PASS
Fundamental frequency tolerance	15.225 (e) RSS-210: §B.6	shall be maintained to ±0.01% (±100 ppm)	PASS
Unwanted emissions outside the specified frequency band	15.209 / 15.225 (d) RSS-210 §B.6 (d) / RSS-Gen §8.9	Measure at 300m 9-490kHz: 2400µV/m/F(kHz) 6.370µA/m/F (kHz) Measure at 30m 0.490-1.705M: 24000µV/m/F(kHz) 63.70µA/m/F (kHz) 1.705-30MHz: 30µV/m 0.08µA/m Measure at 3m 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m	PASS
Occupied Bandwidth	FCC Part 15.215 RSS-Gen §6.7	-20dB and 99% BW shall be inside 13.110-14.010MHz	PASS

- General conclusion:

Measures and tests performed on the sample of the product *TAQT One*, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart C and Industry Canada RSS-Gen & RSS-210.

3. Equipment Under Test (EUT)

**Nom /
Identification**

TAQT / TAQT-ONE (TAQT1001)
(Trademark / Marketing name or product reference)

Sn: 865456054422694

**FCC ID:
IC:
Model:**

2A7ZF-T1001
28815-T1001
TAQT1001

**Alimentation /
Power supply**

6X 1.5V AA batteries (FR6 Li-FeS2)

**Auxiliaires /
Auxiliaries**

NFC Tag.

**Entrées-Sorties /
Input / Output**

	Câbles pour essai / Cables for test	Blindé / Shielded	Prévu pour >3m / Intended for >3m
None	-	-	-

**Mode de fonctionnement /
Running mode**

Equipment running modes are:
The tested sample is able to be set in following modes:
- Transmit a continuous modulated carrier frequency at 13.56MHz

**Version programme interne /
Firmware version**

N.C

**Programme de test /
Test program /**

None.

**Informations supplémentaires /
Additional informations**

Declaration of the applicant:
- Emission bands: 13.110-14.010 MHz
- Equipment intended for use as a fixed station
- Equipment designed for continuous operation
- Antenna type: Integrated 13.56MHz coil (read/write)

**Dimensions de l'EST /
Dimensions of EUT**

21x15x2.2cm

Note: Information above are declared by the manufacturer and are under his responsibility.

4. Test conditions

Power supply voltage:

Equipment under test: 6X 1.5V AA batteries (FR6 Li-FeS2)
Auxiliaries (AC mains): None.

5. Modifications of the EUT

None.

6. Special accessories

None.

7. Measurement Uncertainty

Test Description	Expanded uncertainty
Conducted emissions test (150k-30MHz, AC mains)	± 3.5dB
Radiated emission test (9kHz-30MHz, electric field)	± 4.0dB
Radiated emission test (30-200MHz, SAC 3m)	± 5.6dB
Radiated emission test (200-1000MHz, SAC 3m)	± 5.3dB
Radiated emission test (1-18GHz, FAC 3m)	± 5.6dB
Radiated emission test (18-40GHz, FAC 3m)	± 5.6dB
AC and DC voltage	±1%

Note: Expanded uncertainty at 95% confidence (k=2)

8. Field Strength Calculation

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

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

Where FS = Field Strength (Level)

RA = Receiver Amplitude (Meter Reading)

AF = Antenna Factor

CF = Cable Factor

AG = Amplifier Gain

$$\text{Total factor} = AF + CF - AG$$

$$\text{Margin value} = \text{Emission level} - \text{Limit value}$$

Example:

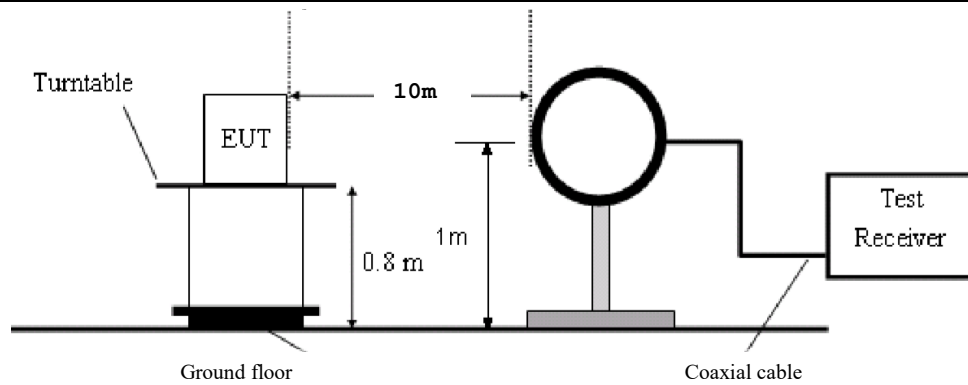
RA: 14.0dBμV / AF: 16.5 dBm⁻¹ / CF: 3.5dB / AG: 15dB

→ Total factor: 5dBm⁻¹

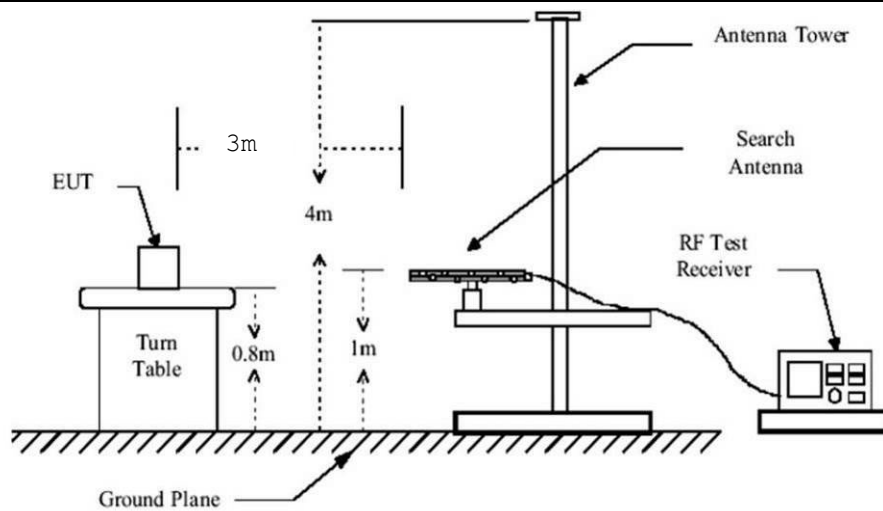
→ Field level: 19.0dBμV/m (-21.0dB for margin if limit is 40dBμV/m)

9. Test Setup Diagram

Test Setup for radiated emission

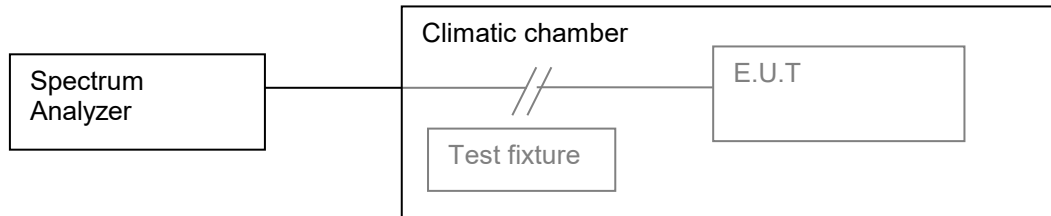


Test setup for 9k-30MHz (FS OATS)

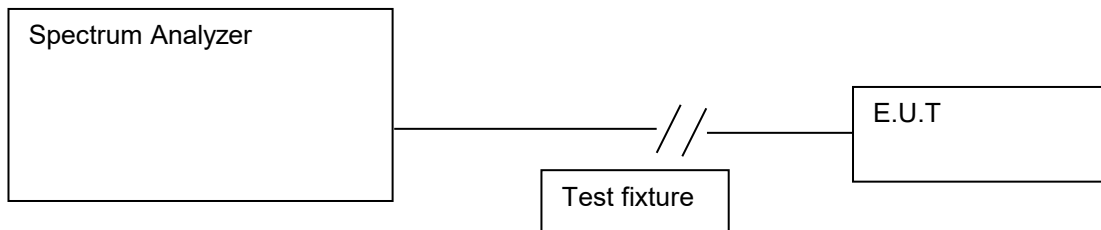


Test setup for 30-1000MHz (SAC 3m)

Test Setup for frequency stability



Test Setup for radiated emission (Test fixture)

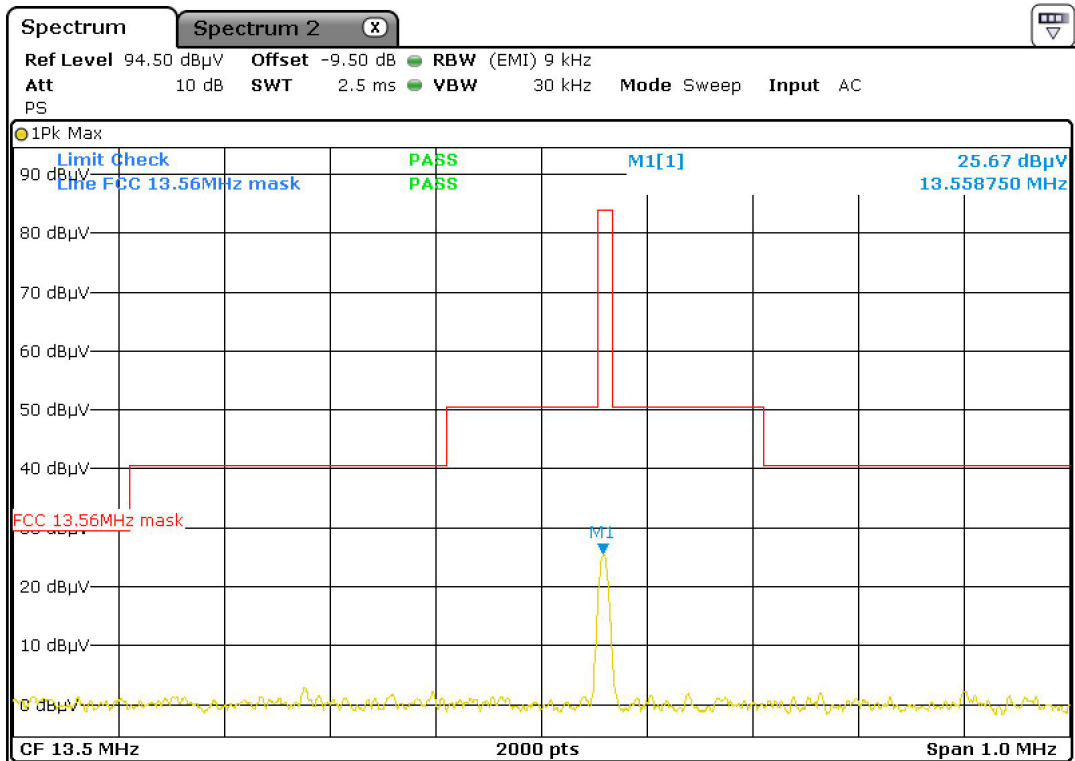


10. Field Strength of fundamental

TEST: Field strength of fundamental / FCC part 15.225 – RSS 210 §B.6			Verdict
<u>Method:</u> Measurements were made in a 10-meter Open Area Test Site (OATS) Measurements were performed with a quasi-peak detector using a 9kHz RBW. The EUT was rotated 360° about its azimuth with the receive antenna located at 1-meter in horizontal and vertical polarities. Final measurements (Quasi-Peak) were then performed by rotating the EUT 360°. The tested equipment is set to transmit operation with modulation. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.			Pass
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	17 - 27 °C	25°C ± 2	
Relative Humidity	25 - 65 %	45% ± 5	
Limits – FCC Part 15.225 (a) (b) (c) / RSS-210 §B.6 (a) (b) (c) Operation within the band 13.110-14.010 MHz			
Frequency (MHz)	Limits (dBµV/m)		
	Level / Distance	Results	
13.553-13.567 MHz	84.0dBµV/m / 30m	Pass	
13.410-13.553 / 13.567-13.710	50.5dBµV/m / 30m	Pass	
13.110-13.410 / 13.710-14.010	40.5dBµV/m / 30m	Pass	
Outside 13.110 to 14.010 MHz	29.5dBµV/m / 30m	See chapter 12	
Supplementary information: Test location: SMEE Test date: July 5 th , 2022. Tested by CK / LC Power supply voltage: 6x AA LR6 Batteries (2x 4.5V)			

Tabulated Results for Field Strength of fundamental						
FREQ	RF field @ 30m	Limit @ 30m	Margin	Antenna angle	Table angle	Total Fact. (TF)
MHz	dBμV/m	dBμV/m	dB	Degree	Degree	dB
13.56	24.8	84.0	-59.2	V / 0°	90	10.5
RBW:		9kHz (150kHz-30MHz)				
Measurement distance:		10m				
Limit:		FCC Part 15.225 (a) (b) (c) / RSS-210 §B.6				
Final measurement detector:		Quasi-Peak				
RESULT:		PASS				
Note:		Measure have been done at 10m distance and corrected according to requirements of 15.209.e / RSS-Gen clause 6.5) (M@30m = M@10m-19.1dB) Loop antenna used and rotated about its axis to maximize any emission.				

Graphical representation of Radiated E-field Band Edge compliance within the band 13.110-14010 MHz



Frequency band investigated:	13MHz to 14MHz
Unit :	dBμV/m
RBW :	9kHz
Voltage:	9V DC
Limit:	FCC Part 15.225 (a) (b) (c) / RSS-210 §B.6
Measurement detector:	Peak

11. Fundamental frequency tolerance

TEST: Fundamental frequency tolerance / FCC part 15.225 – RSS-210 §B.6		Verdict
Method: The frequency tolerance of the carrier signal shall be maintained within ± 0.01% of the operating frequency when the temperature is varied from -20°C to +50°C at the nominal power voltage and the primary power voltage is varied from 85% to 115% of the rated supply voltage at 20°C. The equipment is placed in a climatic chamber. Carrier level and frequency are measured using a test fixture.		Pass
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	17 - 27 °C	22°C ± 2
Relative Humidity	25 - 65 %	44% ± 5
Fully configured sample scanned over the following frequency range		
Carrier Signal :	13.56MHz	
Normal test temperature :	20°C	
Normal power voltage :	9V DC (6x 1.5V AA Batteries)	
Extreme Temperature variation:	-20°C to +50°C	
Extreme Voltage variation:	Performed using a new battery.	
Limits – FCC Part 15.225 (e) / RSS-210 §B.6 (e)		
Frequency (MHz)	Limits	Results
13.56MHz	± 0.01% or 100ppm Min. and Max. frequency shall be within 13.553 to 13.567 MHz	Pass
Supplementary information: Test location: SMEE Test date: August 8 th , 2022. Tested by CK / LC Power supply voltage: 6x AA LR6 Batteries (2x 4.5V)		

Tabulated Results for fundamental frequency stability						
Temperature (°C)	VOLTAGE (V DC)	Frequency after 0s (Startup) (Hz)		Frequency after 2min (Hz)	Frequency after 5min (Hz)	Frequency after 10min (Hz)
50	9	13560284		13560284	13560282	13560284
40	9	13560310		13560310	13560308	13560308
30	9	13560370		13560368	13560365	13560362
20	9	13560440		REF	REF	REF
10	9	13560466		13560466	13560466	13560428
0	9	13560489		13560489	13560490	13560492
-10	9	13560518		13560518	13560520	13560520
-20	9	13560527		13560527	13560527	13560526
Ref Value		13560440	Hz			
MIN Frequency		13560282	Hz			
Limit MIN Frequency		> 13.553	MHz			
MAX frequency		13560527	Hz			
Limit MAX Frequency		< 13.567	MHz			
Overall stability		245	Hz			
Limit for stability		1356.044	Hz			
Result		PASS				

12. Unwanted emissions

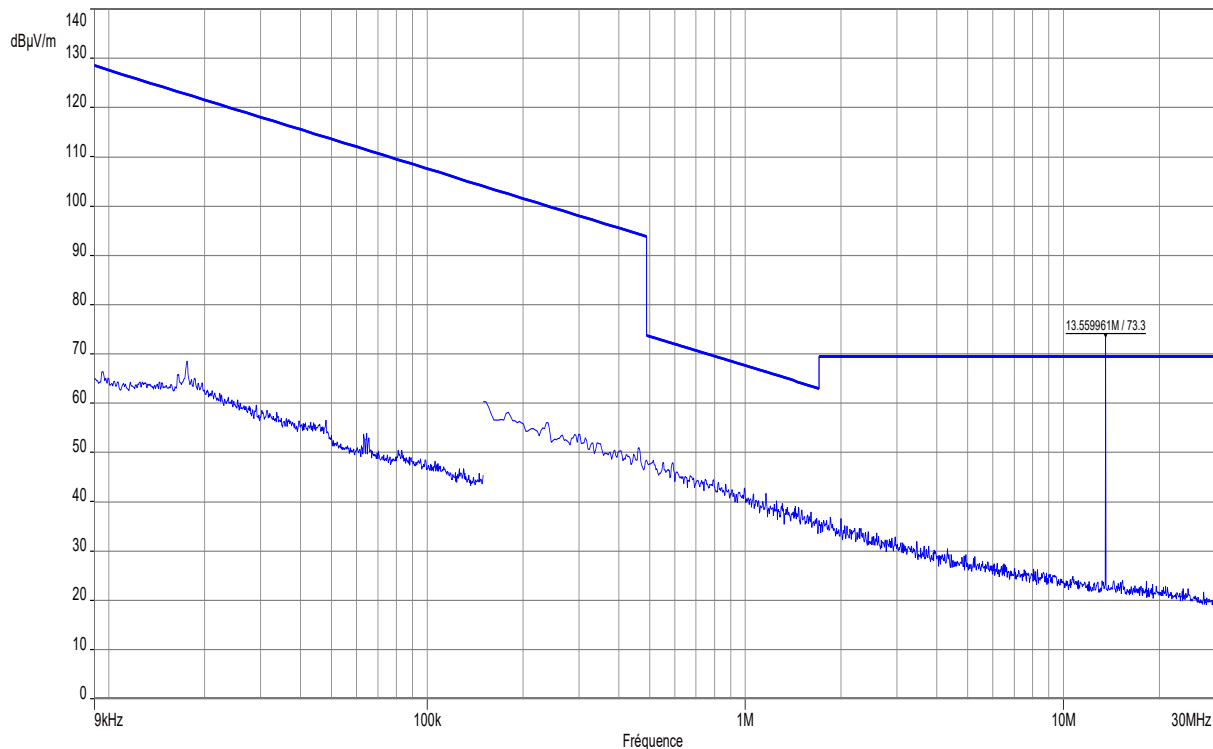
TEST: Unwanted emissions outside the specified frequency band / FCC part 15.209, 15.225 - RSS-210 §B.6		Verdict
Method: Measurements were made in a 3-meter Semi Anechoic Room (SAR) for frequency 30MHz to 1GHz and in a 3-meter Full Anechoic environment (SAR with floor absorbers) above 1GHz. The Semi Anechoic Room complies with CISPR16-1-4 / ANSI C63.4 requirements. For frequency 9kHz to 30MHz, measurements are performed on a free-space open area test site at 10m distance. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak, Quasi-peak, Average) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.		Pass
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	17 - 27 °C	23°C ± 2
Relative Humidity	25 - 65 %	46% ± 5
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point
	9kHz – 30MHz	10 m measurement distance
	30MHz – 1GHz	3 m measurement distance
Limits – FCC Part 15.209, 15.225 (d) / RSS-210 §B.6		
Frequency (MHz)	Limits (dBµV/m)	
	Level / Detector / Distance	Results
0.009 to 0.090	107.6 – 87.6 / AV / 10m 127.6 – 107.6 / PK / 10m	Pass
0.090 to 0.110	87.6 – 85.9 / QP / 10m	Pass
0.110 to 0.490	85.9 – 72.9 / AV / 10m 105.9 – 92.9 / PK / 10m	Pass
0.490 to 1.705	52.9 – 42.1 / QP / 10m	Pass
1.705 to 30	48.6 / QP / 10m	Pass
30 to 88	40.0 / QP / 3m	Pass
88 to 216	43.5 / QP / 3m	Pass
216 to 960	46.0 / QP / 3m	Pass
960-1000	54.0 / QP / 3m	Pass
Above 1GHz	54.0 / AV / 3m 74.0 / PK / 3m	Pass
Supplementary information: Test location: SMEE Test date: July 5th, 2022. Tested by CK / LC Power supply voltage: 6x AA LR6 Batteries (2x 4.5V)		

Tabulated Results for Unwanted emissions (9kHz-490kHz)							
FREQ	RF field @ 300m	Limit @ 300m	Detector	Margin	Ant. angle	Table angle	Total Fact. (TF)
MHz	dBμV/m	dBμV/m	Pk / QP / AV	dB	Degree	Degree	dB
All levels are at least 20dB below applicable limits							
Supplementary information: Frequency list measured has been created with pre-scan results.							
Frequency band investigated:		9kHz-490kHz					
RBW:		200Hz (9kHz-150kHz) 9kHz (150kHz-30MHz)					
Measurement distance:		10m					
Final measurement detector:		Peak / Quasi-Peak / Average					
Limit:		FCC Part 15.209, RSS-Gen					
Note:		Measure have been done at 10m distance and corrected according to requirements of 15.209.e / RSS-Gen clause 6.5) (M@300m = M@10m-59.1dB) Loop antenna used and rotated about its axis to maximize any emission.					

Tabulated Results for Unwanted emissions (490kHz-30MHz)							
FREQ	RF field @ 30m	Limit @ 30m	Detector	Margin	Ant. angle	Table angle	Total Fact. (TF)
MHz	dBμV/m	dBμV/m	Pk / QP	dB	Degree	Degree	dB
All levels are at least 20dB below applicable limits							
Supplementary information: Frequency list measured has been created with pre-scan results.							
Frequency band investigated:		490kHz-30MHz					
RBW:		9kHz (150kHz-30MHz)					
Measurement distance:		10m					
Final measurement detector:		Quasi-Peak					
Limit:		FCC Part 15.209, RSS-Gen					
Note:		Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@30m = M@10m-19.1dB) Loop antenna used and rotated about its axis to maximize any emission.					

Tabulated Results for Radiated Disturbance (3m measurement in semi anechoic room, 30MHz-1GHz)								
FREQ MHz	Field level	Field level	Limit	Margin	Table angle	Antenna height	Total factor	Pol
	(Pk) dBμV/m	(QP) dBμV/m	(QP) dBμV/m	dB	Degree	m	dB	
30.2008	19.76	13.95	40	-26.05	219	1.51	18.42	H
31.1721	18.37	12.8	40	-27.2	0	3	18.05	H
31.2336	18.12	12.72	40	-27.28	177.7	1	18.03	H
941.551	26.65	20.6	46	-25.4	231.3	1	25.19	H
947.449	26.4	20.94	46	-25.06	183	3	25.25	H
950.613	26.17	20.55	46	-25.45	0	1	25.26	H
30.000	19.97	14.36	40	-25.64	0	1.27	18.5	V
39.943	15.83	10.14	40	-29.86	0	1	15.92	V
40.5582	15.82	10.12	40	-29.88	178.2	1	15.73	V
914.059	26.09	20.41	46	-25.59	0	1.9	24.98	V
957.732	27.23	20.82	46	-25.18	360	1	25.43	V
959.331	27.42	20.78	46	-25.22	0.2	3	25.52	V
Frequency band investigated:			30MHz-1GHz					
RBW:			120kHz					
Measurement distance:			3m					
Limit:			FCC Part 15.209, RSS-Gen					
Final measurement detector:			Quasi-Peak					
RESULT:			PASS					

Graphical representation of Radiated Disturbance Measurement (Peak detection, semi anechoic chamber pre-scan, 9kHz-30MHz / 3m / Parallel & Perpendicular antenna position / Transmit mode)

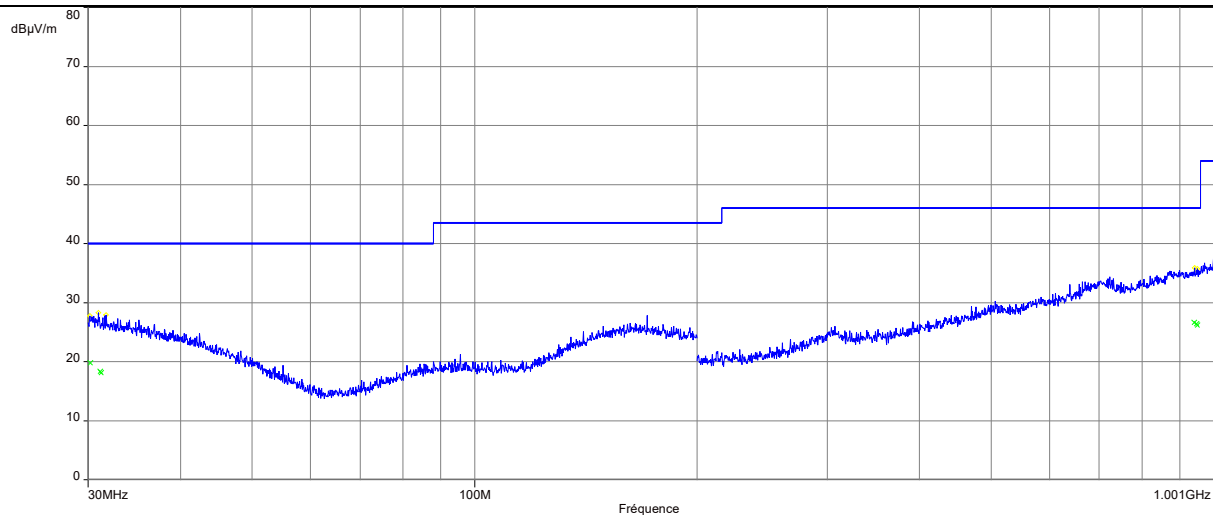


Notes: Pre-scan graph only for identification purpose.

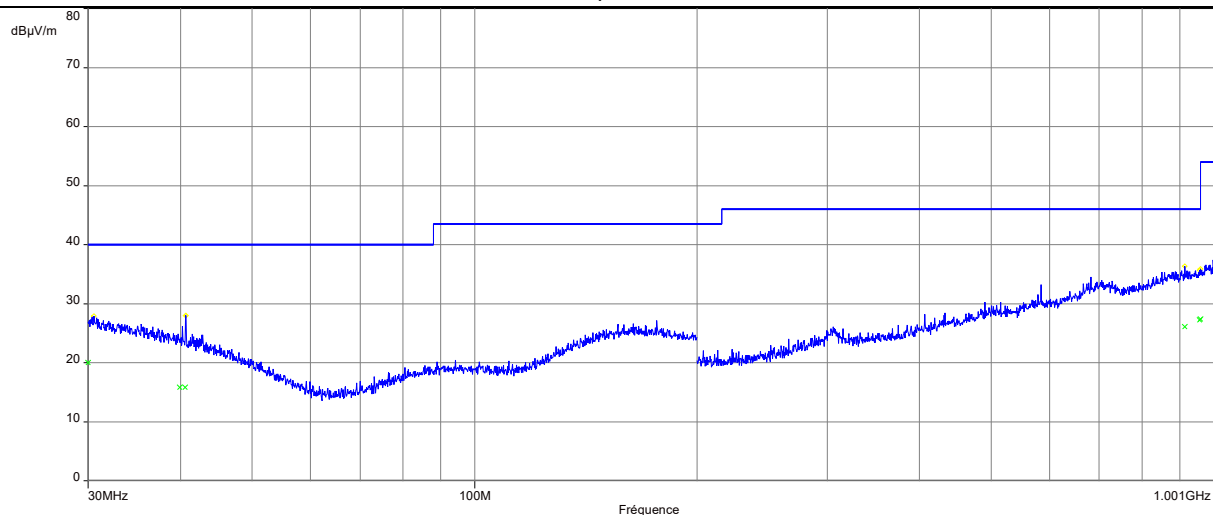
Frequency band investigated:	9kHz-30MHz
Unit :	dBμV/m
RBW :	200Hz (9kHz-150kHz) 9kHz (150kHz-30MHz)
Antenna polarization :	Parallel & Perpendicular to measurement axis
Measurement detector:	Peak

Graphical representation of Radiated Disturbance Measurement (Semi anechoic chamber pre-scan, 30MHz-1GHz / 3m)

Horizontal polarization



Vertical polarization



----- : Peak measure / limits

Note: See tabulated results for final measurement (QP maximization) on markers

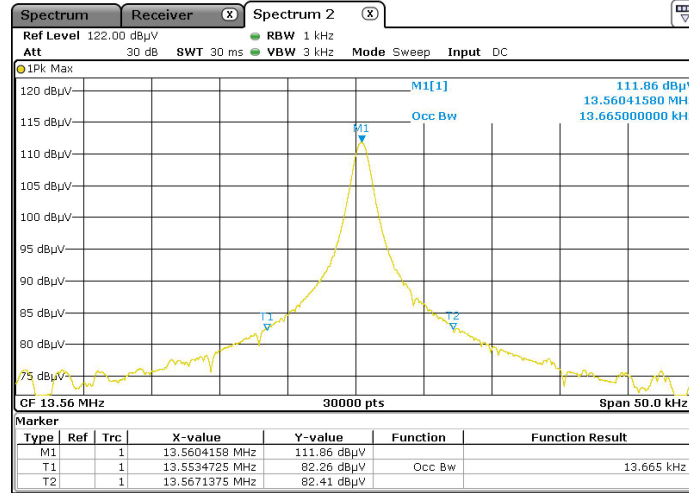
13. Occupied Bandwidth

TEST: Occupied bandwidth / RSS-GEN		Verdict
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. A radiated measurement is performed. The RBW is set in the range of 1% to 5% of the occupied bandwidth, with VBW $\geq 3 \times$ RBW. The SPAN is wide enough to capture all products of the modulation process. A Peak detector is used. Measure is performed with OBW 99% and 20dB BW function of the spectrum analyser. The tested equipment is set to transmit operation with modulation.		Pass
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	17 - 27 °C	24°C $\pm$ 2
Relative Humidity	25 - 65 %	51% $\pm$ 5
Supplementary information: Test location: SMEE. Test date: October 4th, 2022. Tested by CK. Power supply voltage: 6x AA LR6 Batteries.		

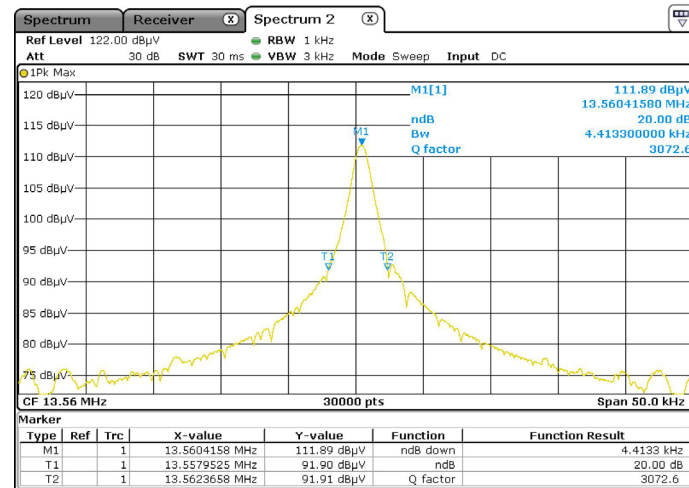
Tabulated Results for Occupied Bandwidth	
Frequency (MHz)	99% Bandwidth (kHz)
13.56	13.665

Tabulated Results for Occupied Bandwidth	
Frequency (MHz)	20dB Bandwidth (kHz)
13.56	4.4133

Graphical representation of Occupied Bandwidth



99% Occupied Bandwidth



20dB Occupied Bandwidth

Frequency: 13.56MHz

RBW / VBW: 1kHz/3kHz

Measurement detector: Peak

14. Test Equipment List

Test Equipment Used for radiated emission					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Biconnic antenna	COM-POWER	AB- 900A	ANT-201-021	2020/12	2022/12
Horn antenna	COM-POWER	AH-118	ANT-101-004	2021/7	2024/7
Loop antenna	EMCO	6502	ANT-101-009	2021/9	2023/9
Log-periodic antenna	EMCO	3146	ANT-191-019	2021/7	2023/7
RF cable	Div	OATS/20m	CAB-101-017	2022/5	2023/5
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2022/5	2023/5
RF cable	TMS	LMR-400 / 9m	CAB-201-039	2022/5	2023/5
Semi anechoic room	COMTEST	218292	CAG-201-002	2022/5	2023/5
Shielded loop antenna	SMEE	5cm	ANT-171-018	-	-
Antenna mast SAC	Innco- Systems	MA4640-XP-ET	MAT-201-002	-	-
Turntable	Innco- Systems	CT0800	PLA-141-002	-	-
Turntable SAC	Innco- Systems	DS1500-S-1t	PLA-201-003	-	-
Measuring Rec	Rohde&Schwarz	ESRP	REC-151-002	2021/9	2023/11
Climatic chamber	VÖTSCH	VT 3050	CLI-101-001	2020/12	2022/12
FS OATS	Div	10m	SIT-201-002	-	-
EMC Software	NEXIO	BAT EMC V2022.0.6.0	SOF-101-001	-	-