Template : July 29th, 2022

TEST REPORT

N°: **15015967-778552-C (FILE#3282601)** Version: **01**

Subject **Electromagnetic compatibility tests according to the standards:**
FCC CFR 47 Part 15, Subpart B
ANSI C63.4 (2014) / ANSI C63.4a (2017)
ICES-003 (2016)

Issued to **ENLAPS**
26 avenue Jean Kuntzmann
38330 – MONTBONNOT-SAINT-MARTIN

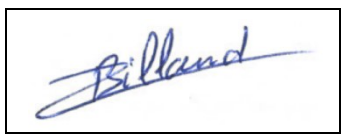
Apparatus under test

Product	**Timelapse digital cameras**
Trade mark	**ENLAPS**
Manufacturer	**ENLAPS**
Family range	**None**
Model under test	**TIKEE**
Serial number	**T-3PP-3M-D01017**
FCCID	**2ASLI-TIKEE002**
IC	**24785-TIKEE002**

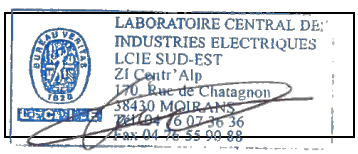
Conclusion See Test Program chapter

Test date	August 17, 2022 to August 18, 2022
Test location	LCIE Grenoble
FCC Test site	FR0008 - 197516
ISED Test site	FR0008 - 6500A
Sample receipt date	August 17, 2022
Composition of document	19 pages
Document issued on	September 6, 2022

Written by :
Nicolas BILLAUD
Tests operator



Approved by :
Nathalie BUGANZA
Technical manager



PUBLICATION HISTORY

Version	Date	Author	Modification
01	September 6, 2022	Nicolas BILLAUD	Creation of the document

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 / ICES-003

Standard:

- ✓ **FCC Part 15, Subpart B (Digital Devices)**
- ✓ **ANSI C63.4 (2014) / ANSI C63.4a (2017)**
- ✓ **ICES-003 (2016)**

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- 13GHz* **FCC §15.109**	**Access: Enclosure port of ancillary equipment**			**PASS**
	Frequency	**Peak @3m**	**Average @3m**	
	1- 13GHz	74.0 dBµV/m	54.0 dBµV/m	

NA: Not Applicable / NP: Not Performed, 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).

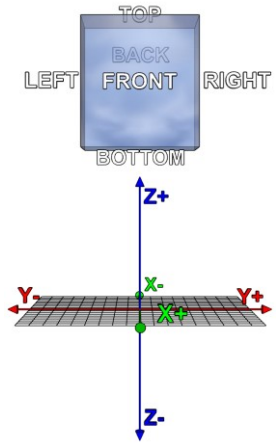
2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. INFORMATIONS

The equipment is a connected timelaps digital cameras system which works on battery.

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES)

Equipment under test (EUT):

Model under test :	**TIKEE**
Serial Number:	**T-3PP-3M-D01017**
	
Dimensions:	18.5cm x 18cm x 8cm (Length x Width x Height)
Type :	Table-Top

Power supply:
During all the tests, EUT is supplied by its internal battery by V_{nom}: 3.6Vdc.
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	Battery	/	/	Internal battery only charged by solar panel

NC: Not communicated by provider

Earth:

Access	Type	Length (m)	Width (mm)	Thickness (mm)	Under test	Comments
Earth	None	/	/	/	/	/

NC: Not communicated by provide

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Access1	Optional solar panel	None	Yes	No	No	/
Access2	µUSB connector	None	NA	NA	No	Debug access
Access3	µSD connector	None	NA	NA	NA	/
Access4	SIM connector	None	NA	NA	NA	/

NC: Not communicated by provider

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
None	None	None	/

2.3. EUT CONFIGURATION

Hardware information			
Highest internal frequency (PLL, Quartz, Clock, Microprocessor…):	**$F_{Highest}$:**	**NC**	**MHz**
Firmware (if applicable):	**V. :**	MICROCONTROLLER : 5.0.6 MICROPROCESSOR : MP1.10	
Software (if applicable):	**V. :**	None	
Time necessary for the EUT to be exercised and to respond:	**Dwell:**	**1**	**s**

NC: Not communicated by provider

Access	Running mode N°1: radiated emission	
Cameras	**Process**	Photos taken in loop
	Auxiliary for test	Laptop & wifi rooter
	Control	Before and after test
	Performance criteria	None (for radiated emission test only)
GPS	**Process**	Only supplied
	Auxiliary for test	None
	Control	None
	Performance criteria	None (not verified)
LTE	**Process**	Only supplied
	Auxiliary for test	Anritsu, cable, antenna
	Control	Before and after test: visual on Anritsu
	Performance criteria	None (for radiated emission test only)
WIFI	**Process**	Only supplied
	Auxiliary for test	Laptop & wifi rooter
	Control	Before and after test: visual on CMD windows, ping must be stable
	Performance criteria	None (for radiated emission test only)
BLE	**Process**	Only supplied
	Auxiliary for test	Laptop
	Control	Before and after test: visual: must be attached to laptop
	Performance criteria	None (for radiated emission test only)

2.4. EQUIPMENT MODIFICATIONS DURING THE TESTS

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

2.6. TEST DISTANCE EXTRAPOLATION

The field strength is extrapolated, from 30MHz to 1GHz under Class B, to the new measurement distance using an inverse linear distance extrapolation factor (20 dB/decade), formula from FCC Part15.31 (f):

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

Where *FS_{limit} is the calculation of field strength at the limit distance, expressed in dBµV/m*
FS_{max} is the measured field strength, expressed in dBµV/m

Example: *Measurement @10m with test distance limit @3m; FS_{limit} (dBµV/m) = FS_{max} (dBµV/m) + 10.5dB*

2.7. 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

3.1. TEST CONDITIONS

Date of test	:	August 17, 2022	August 18, 2022
Test performed by	:	Nicolas BILLAUD	Nicolas BILLAUD
Atmospheric pressure (hPa)	:	988	989
Relative humidity (%)	:	57	56
Ambient temperature (°C)	:	25	25

3.2. TEST SETUP

The EUT and auxiliaries are set 80cm above the ground on the non-conducting table (Table-top equipment).
The EUT is powered by V_{nom}.

Test setup in anechoic chamber – Frequency <1GHz

Test setup on OATS

Test setup in anechoic chamber – Frequency >1GHz

3.3. TEST METHOD

3.3.1. 30MHz –1GHz

Pre-qualification measurement

A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber. Test is performed with antenna centered on EUT in horizontal (H) and vertical (V) polarization, continuous linear turntable azimuth search was performed with 360 degrees range. Measurements are performed on all axis of EUT used in normal configuration. The pre-characterization graphs are obtained in PEAK detection.

Qualification

The installation of EUT is identical than for pre-qualification measurements on an Open Area Test Site with a 10 meters distance between EUT and antenna. In this case, it corrected according to requirements of 15.209.e), M@3m = M@10m+10.5dB. Test is performed in horizontal (H) and vertical (V) polarization and the height antenna is varied from 1m to 4m. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurements are performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.

3.3.2. 1GHz – 13GHz:

Pre-qualification measurement

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. Test is performed with antenna centered on EUT in horizontal (H) and vertical (V) polarization, continuous linear turntable azimuth search was performed with 360 degrees range. Measurements are performed on all axis of EUT used in normal configuration. The pre-characterization graphs are obtained in PEAK and AVERAGE detection.

Qualification

The installation of EUT is identical for pre-characterization measurements. Test is performed in horizontal (H) and vertical (V) polarization and the height antenna is fixed and centered on the EUT, EUT smaller than the beamwidth of the measurement antenna.

Minimal beamwidth of the measurement antenna used: AINFO 10180 / w@3m=1.4m<14GHz / w@3m=0.8m<18GHz

Continuous linear turntable azimuth search was performed with 360 degrees range. Measurements are performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.

3.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Amplifier 100kHz - 18GHz	LCIE SUD EST	_	A7085027	11/20	11/22
Antenna Bi-Log XWing	TESEQ	CBL6144	C2040146	¤	¤
Antenna horn 18GHz	AINFO	LB	C2042078	04/21	04/23
BAT EMC	NEXIO	v3.21.0.32	L1000115	¤	¤
Cable 0.75m	SUCOFLEX	18GHz	A5329919	08/21	08/22
Cable 2.2m N	SUCOFLEX	SF118A/2x11N/2.2M	A5329990	08/21	08/22
Cable 5m	SUCOFLEX	18GHz	A5329918	08/21	08/22
CALCUL_FACTEURS	LCIE SUD EST	V4	L2000035	¤	¤
Comb EMR HF	YORK	CGE01	A3169114	¤	¤
Diameter 1.2m / Height 2.25m	LCIE	VSWR 1GHz - 18GHz	D3044015_VSWR	06/19	10/22
Radiated emission comb generator	BARDET	_	A3169050	¤	¤
Semi-Anechoic chamber #2	SIEPEL	_	D3044015	06/22	06/23
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A4060049	04/20	08/22
Table C2/OATS	LCIE	_	F2000438	¤	¤
Thermo-hygrometer (C2)	LACROSS Techn.	WS-2357	B4206015	12/20	12/22
Turntable chamber (Cage#2)	ETS Lingren	Model 2165	F2000404	¤	¤
Turntable controller (Cage#2)	ETS Lingren	Model 2066	F2000393	¤	¤
Antenna Bi-log	CHASE	CBL6111A	C2040172	04/22	04/24
Antenna Mat (OATS)	ETS Lingren	2071-2	F2000392	¤	¤
Cable (OATS)	_	1GHz	A5329623	08/21	08/22
Emission Cable	SUCOFLEX	6GHz	A5329061	08/21	08/22
Emission Cable	MICRO-COAX	1GHz	A5329656	08/21	08/22
OATS	_	_	F2000409	07/22	07/23
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/20	10/22
Table C1/OATS	LCIE	_	F2000445	¤	¤
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	01/21	01/23
Turntable (OATS)	ETS Lingren	Model 2187	F2000403	¤	¤
Turntable / Mast controller (OATS)	ETS Lingren	Model 2066	F2000372	¤	¤

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

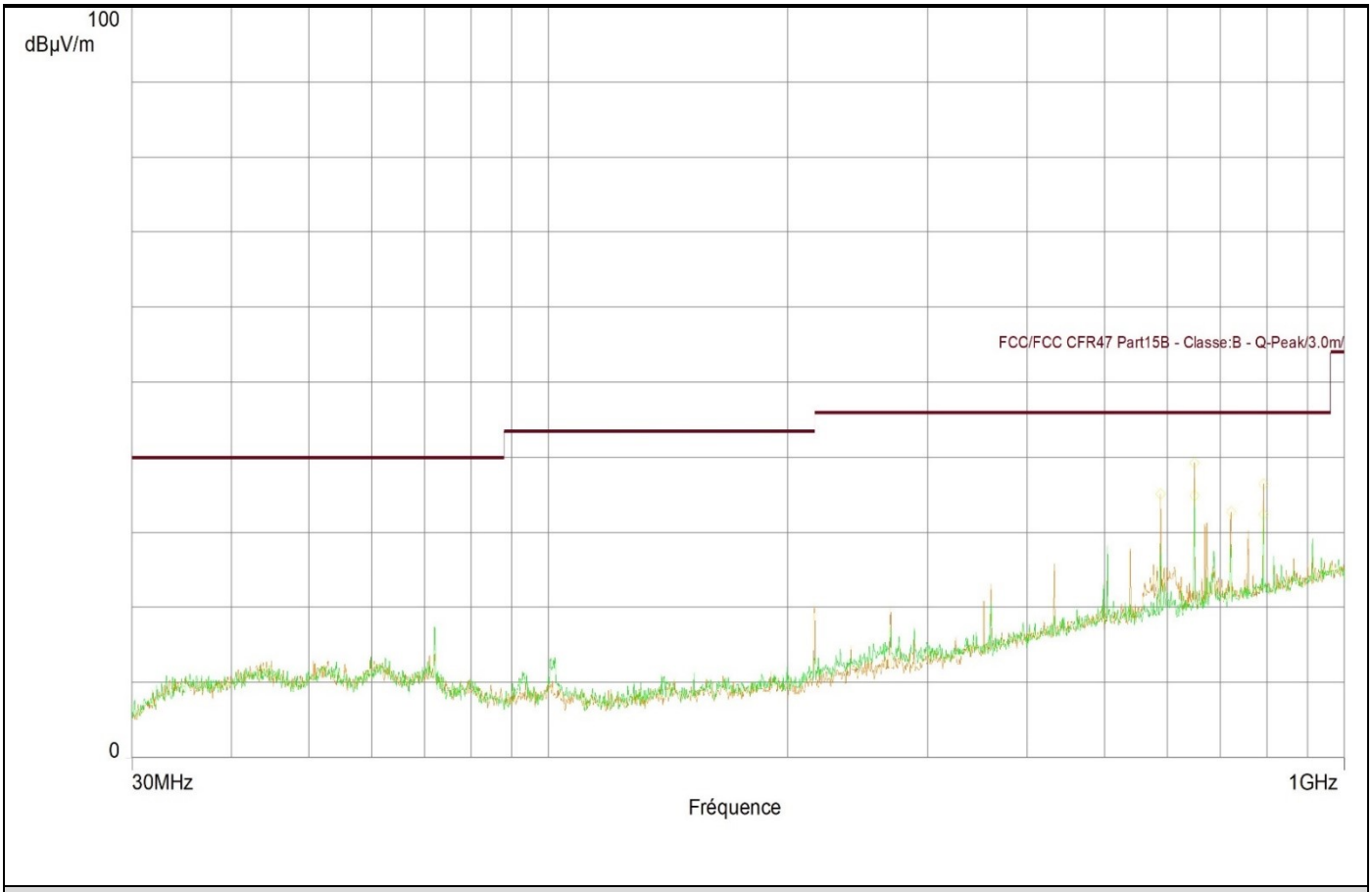
3.6. TEST RESULTS – RUNNING MODE N°1

3.6.1. 30MHz –1GHz

Pre-qualification measurement

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	C2 - FSL (H+V) [0.03-1]GHz - FCC		
Class:	B			
Frequency range: [30MHz - 1GHz]				
Antenna polarization:	Horizontal & Vertical	**RBW:** 100kHz	**VBW:** 300kHz	
Azimuth:	**Trace color & detector:** F<GHz: Only Peak detector: Antenna Polarization: Vertical Horizontal			
0° - 360°	**Trace color & detector:** F>GHz: for both Antenna Polarization: detector: PEAK AVG			



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Lim.Q-Peak (dBµV/m)	Peak-Lim.Q-Peak (dB)	Polarization
648.080	34.9	46.0	-11.1	Vertical
792.120	32.5	46.0	-13.5	Vertical
588.080	35.1	46.0	-10.9	Horizontal
648.080	39.3	46.0	-6.7	Horizontal
720.080	32.8	46.0	-13.2	Horizontal
792.120	36.5	46.0	-9.5	Horizontal

Qualification

The frequency list is created from the results obtained during the pre-qualification.
Measurements are performed using a QUASI-PEAK detection.

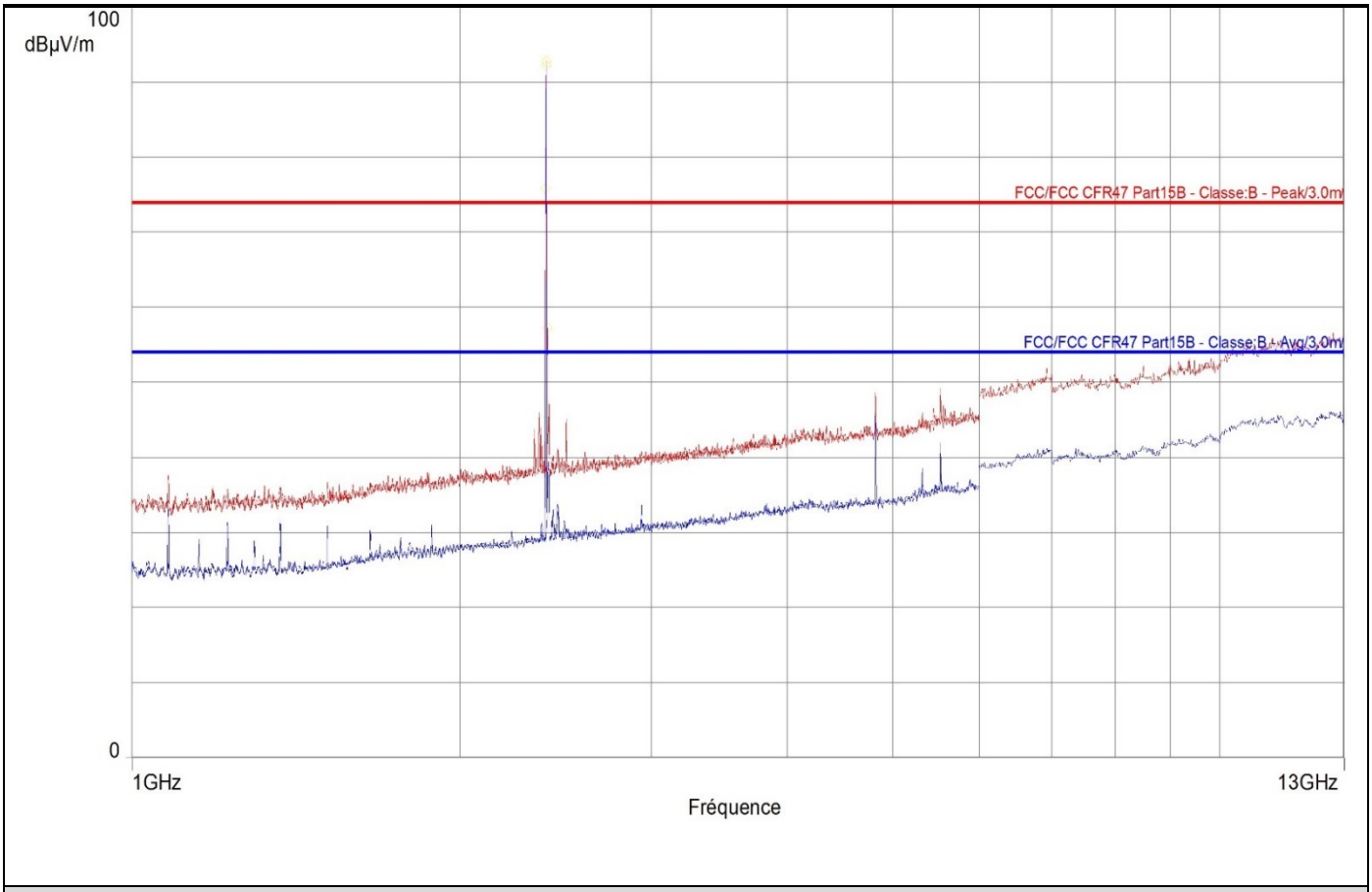
Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
588.08	15.5	QP	H	80	200	26.7	42.2	46.0	**-3.8**
648.08	14.5	QP	V	80	250	27.1	41.6	46.0	**-4.4**
648.08	14.0	QP	H	80	350	27.1	41.1	46.0	**-4.9**
720.08	14.5	QP	H	80	375	28.3	42.8	46.0	**-3.2**
792.12	13.5	QP	V	80	350	29.2	42.7	46.0	**-3.3**
792.12	13.5	QP	H	80	350	29.2	42.7	46.0	**-3.3**

3.6.2. 1GHz - 13GHz

Pre-qualification measurement

Graph identifier	Polarization	EUT position	Comments	
Emr# 2	Vertical+Horizontal	Axis XY	/	See below

RADIATED EMISSIONS				
Graph name:	Emr#2	**Test configuration:**		
Limit:	FCC CFR47 Part15B	C2 - FSV (H+V) [1-13]GHz - FCC		
Class:	B			
Frequency range: [1GHz - 13GHz]				
Antenna polarization:	Horizontal & Vertical	**RBW:** 1MHz	**VBW:** 3MHz	
Azimuth:	**Trace color & detector:** F<GHz: Only Peak detector: Antenna Polarization: Vertical Horizontal			
0° - 360°	**Trace color & detector:** F>GHz: for both Antenna Polarization: detector: PEAK AVG			



Spurious emissions

Frequency (MHz)	Average (dBµV/m)	Lim.Average (dBµV/m)	Average-Lim.Average (dB)	Polarization
2401.875*	92.3	54.0	38.3	Horizontal
Frequency (MHz)	**Peak (dBµV/m)**	**Lim.Peak (dBµV/m)**	**Peak-Lim.Peak (dB)**	**Polarization**
2399.844*	75.8	74.0	1.8	Horizontal
2402.188*	92.8	74.0	18.8	Horizontal
2410.156*	57.2	74.0	-16.8	Horizontal

*: frequencies are due to radio, refer to radio test repport. Other frequencies have more than 10dB of margin

Qualification

The frequency list is created from the results obtained during the pre-qualification.

Measurements are performed using a PEAK and AVERAGE detection.
Frequencies others than due to radio have margin upper than 10dB.

3.7. CONCLUSION

The sample of the equipment **TIKEE**, Sn : **T-3PP-3M-D01017**, tested in the configuration presented in this test report **satisfies** to requirements of the product family standard applied (See §Test Program) 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 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

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*