



LCIE

Wireless Coexistence Template: Release October 12th, 2021

TEST REPORT

N°: 172996-766533-A(FILE#2598443)

Version : 01

Subject

Wireless Coexistence

Issued to

Wattsense

39 Chemin du Moulin Carron
69570 Dardilly
FRANCE

Apparatus under test

- ↪ Product
- ↪ Trade mark
- ↪ Manufacturer
- ↪ Model under test
- ↪ Serial number

Box

Wattsense
Wattsense
V1.3.3
3a4c7c31b0c3403f

Conclusion

See Test Program chapter

Test date

January 26, 2022

Test location

Moirans

FCC Test site

FR0008 - 197516

ISED Test site

FR0008 - 6500A

Sample receipt date

January 26, 2022

Composition of document

18 pages

Document issued on

February 9, 2022

Written by :

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Tests operator

Approved by :

Anthony MERLIN

Technical manager



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PUBLICATION HISTORY

Version	Date	Author	Modification
01	February 9, 2022	Gaetan DESCHAMPS	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

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1. TEST PROGRAM

References

- 47 CFR Part 15.247
- KDB 996369 D04 Module Integration Guide v02
- ANSI C63.10-2013

Radio requirement:

Test Description	Test result - Comments
Wireless Coexistence & Unwanted Emissions in Restricted Frequency Bands	See test results
This table is a summary of test report, see conclusion of each clause of this test report for detail.	

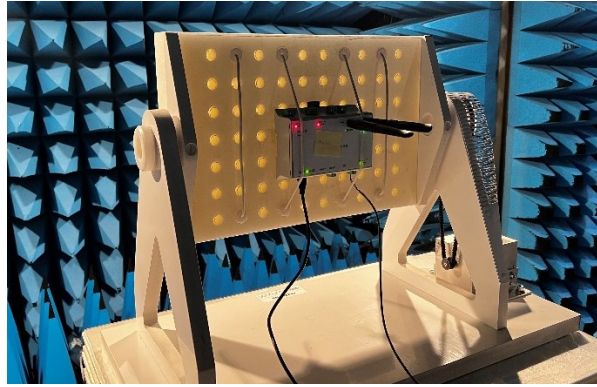
2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):

Model under test: V1.3.3

Serial Number: 3a4c7c31b0c3403f



Equipment Under Test

Power supply:

During all the tests, EUT is supplied by V_{nom} : **24VDC**

For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	DC	12-24V	-	-

NC: Not communicated by provider

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	2 wires	5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
Access1	Ethernet	5	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
Access2	KNX		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-
Access3	M-Bus		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-
Access4	X-Bus		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-
Access5	RS485		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-
Access6	USB		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-

Auxiliary equipment used during test:

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Power supply DC	METRIX	AX503	A7042308		
Radio communication analyser 2G/3G/4G	ANRITSU	MT8820C	A2440008		

Equipment information (declared by the provider):

Type:	LoRa		
Frequency band:	[902 – 928] MHz		
Antenna Type:	<input type="checkbox"/> Integral	<input checked="" type="checkbox"/> External	<input type="checkbox"/> Dedicated
Antenna connector:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Temporary for test
Transmit chains:	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	
Receiver chains:	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	
Type of equipment:	<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in	<input type="checkbox"/> Combined
Ad-Hoc mode:	<input type="checkbox"/> Yes		<input checked="" type="checkbox"/> No
Duty cycle:	<input checked="" type="checkbox"/> Continuous duty	<input type="checkbox"/> Intermittent duty	<input type="checkbox"/> 100% duty
Equipment type:	<input checked="" type="checkbox"/> Production model		<input type="checkbox"/> Pre-production model
Operating temperature range:	Tnom:	20°C	
Type of power source:	<input type="checkbox"/> AC power supply	<input checked="" type="checkbox"/> DC power supply	<input type="checkbox"/> Battery
Operating voltage range:	Vnom:	<input type="checkbox"/> 120V/60Hz	<input checked="" type="checkbox"/> 24 Vdc
		<input type="checkbox"/> 240V/50Hz	<input checked="" type="checkbox"/> X Vdc

Type:	GSM850		
Frequency band:	Uplink: 824.2 MHz à 848.8 MHz Downlink: 869.2 MHz à 893.8 MHz		
Antenna Type:	<input type="checkbox"/> Integral	<input checked="" type="checkbox"/> External	<input type="checkbox"/> Dedicated
Antenna connector:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Temporary for test
Transmit chains:	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	
Receiver chains:	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	
Type of equipment:	<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in	<input type="checkbox"/> Combined
Ad-Hoc mode:	<input type="checkbox"/> Yes		<input checked="" type="checkbox"/> No
Duty cycle:	<input checked="" type="checkbox"/> Continuous duty	<input type="checkbox"/> Intermittent duty	<input type="checkbox"/> 100% duty
Equipment type:	<input checked="" type="checkbox"/> Production model		<input type="checkbox"/> Pre-production model
Operating temperature range:	Tnom:	20°C	
Type of power source:	<input type="checkbox"/> AC power supply	<input checked="" type="checkbox"/> DC power supply	<input type="checkbox"/> Battery
Operating voltage range:	Vnom:	<input type="checkbox"/> 120V/60Hz	<input checked="" type="checkbox"/> 24 Vdc
		<input type="checkbox"/> 240V/50Hz	<input checked="" type="checkbox"/> X Vdc

LoRa:

CHANNEL PLAN	
Channel	Frequency (MHz)
Cmax	927

GSM850:

CHANNEL PLAN	
Channel	Frequency (MHz)
Cmid	836.6



2.2. RUNNING MODE

Test mode	Description of test mode
Test mode 1	<p>There are 2 RF module which are in Permanent emission on a fixed channel (see Channel Plan)</p> <p>LoRa details: Permanent emission with modulation on a fixed channel in the data rate that produced the highest power All tests are performed at Cmax.</p> <p>GSM850 details: The EUT is set in the following modes during tests with a cellular network generator: Permanent emission with modulation on a fixed channel in the data rate that produced the highest power All tests are performed at Cmid.</p>

Hardware information		
Software (if applicable):	V. :	3.x

2.3. EQUIPMENT MODIFICATION

None Modification:

3. WIRELESS COEXISTENCE & UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS

3.1. TEST CONDITIONS

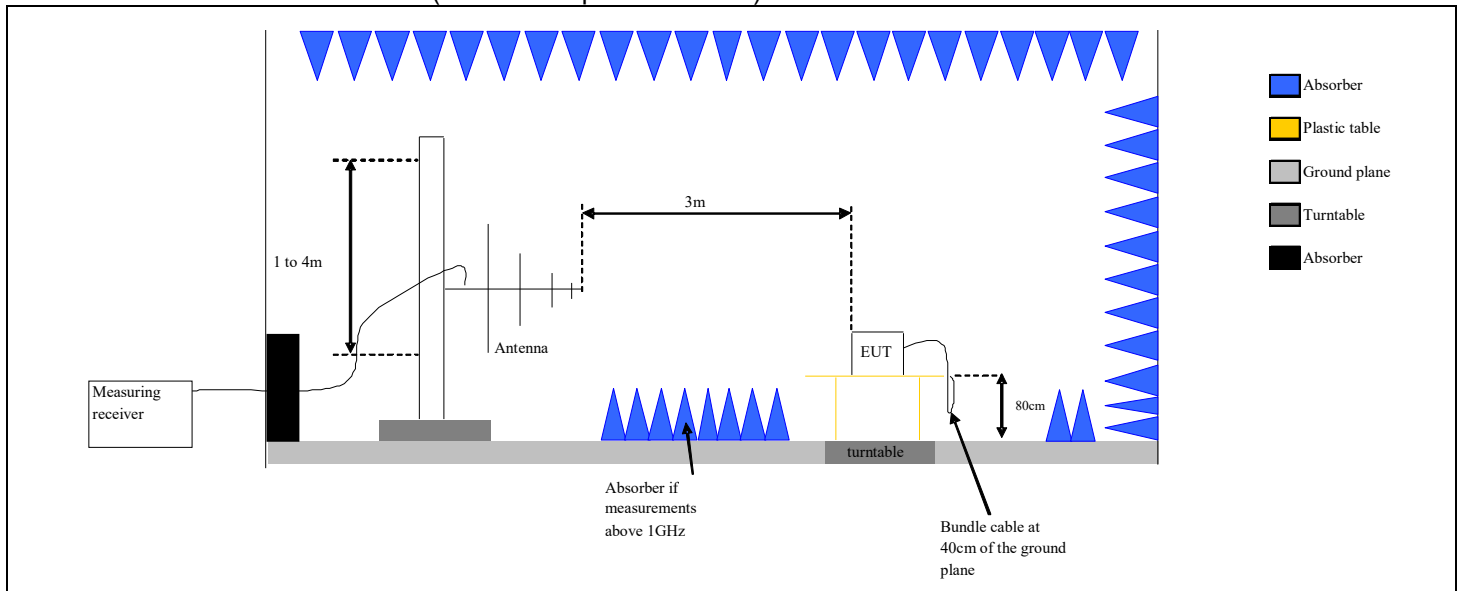
Test performed by : Gaetan DESCHAMPS
 Date of test : January 26, 2022
 Ambient temperature : 22 °C
 Relative humidity : 45 %

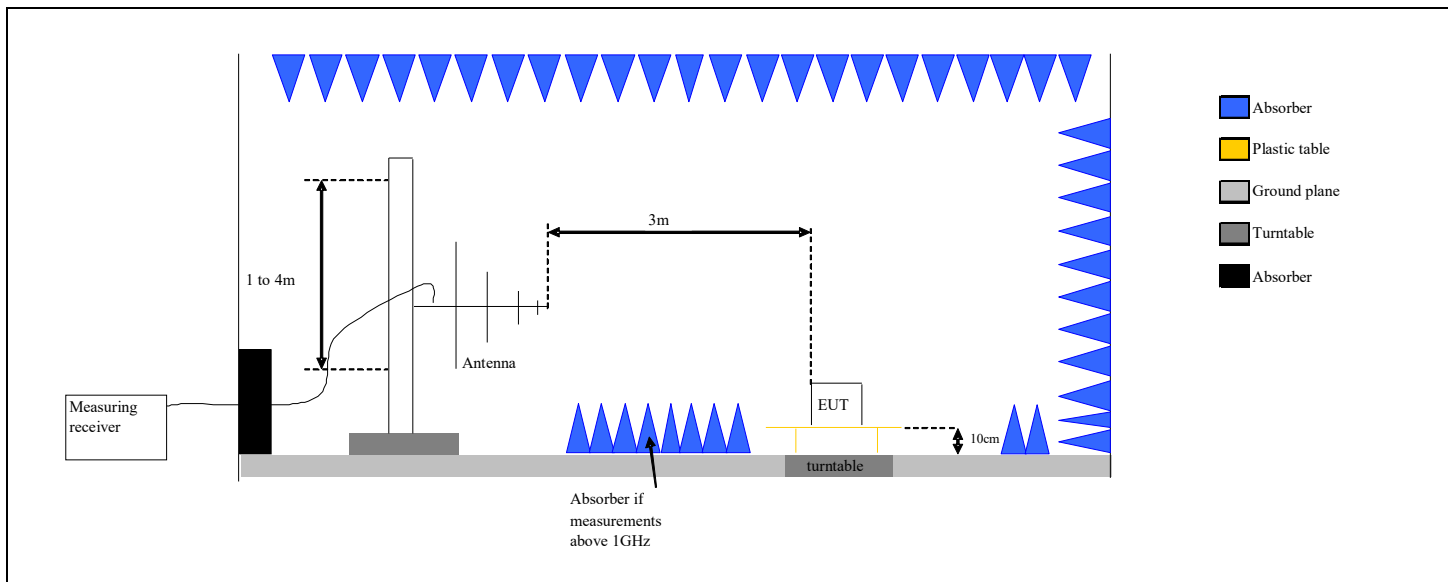
3.2. TEST SETUP

The product has been tested according to ANSI C63.10 (2013) and FCC part15 subpart C. Test is performed in parallel, perpendicular and ground parallel axis with a loop antenna below 30MHz. Measurement bandwidth was 200Hz below 150kHz and 9kHz between 150kHz & 30MHz. The level has been maximised by the turntable rotation of 360 degrees range on all axis of EUT used in normal configuration. Antenna height was 1m. The EUT is placed **in a semi-anechoic chamber**. Distance between measuring antenna and the EUT is **3m**.

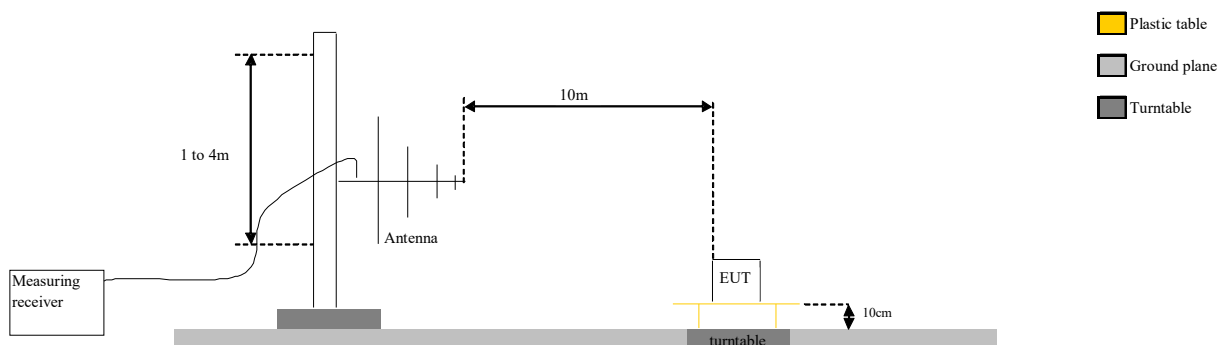
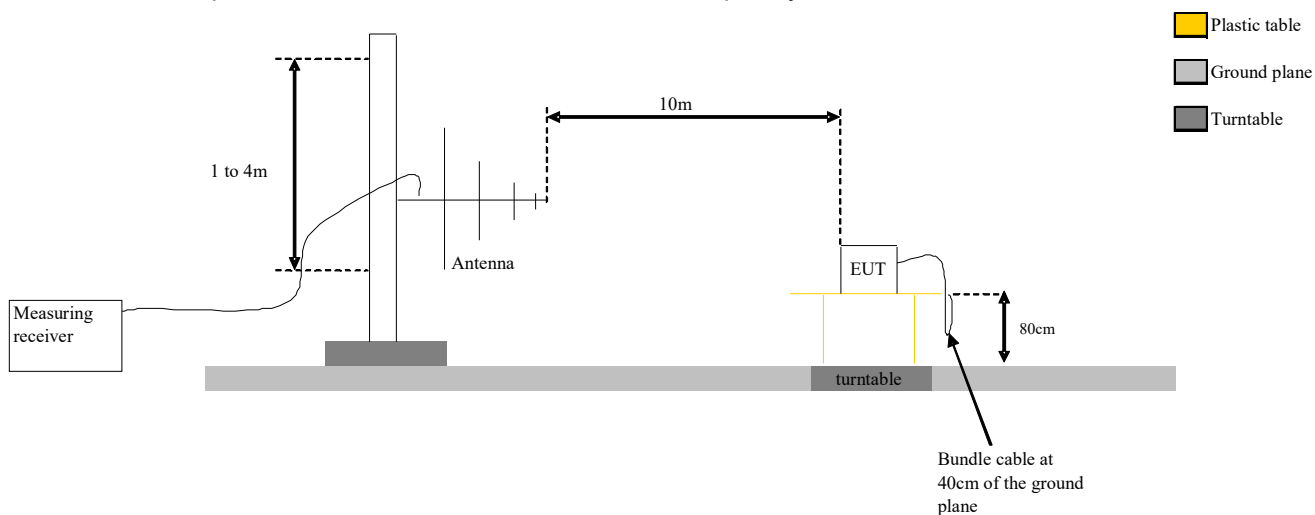
Test is performed in horizontal (H) and vertical (V) polarization with **bilog** between 30MHz & 1GHz and with a horn antenna above 1GHz. Measurement bandwidth was 120kHz below 1GHz and 1MHz above 1GHz. The level has been maximised by the turntable rotation of 360 degrees range on all axis of EUT used in normal configuration. The EUT is placed at 1.5m high above 1GHz and at 0.8m high under 1GHz. The EUT is placed **in a full anechoic chamber** above 1GHz and **on an open area test site** from 30MHz to 1GHz. Distance between measuring antenna and the EUT is **3m**. The height antenna is varied from 1m to 4m from 30MHz to 1GHz and above 1GHz is:

- On mast, varied from 1m to 4m
- Fixed and centered on the EUT (Worst case position tested)

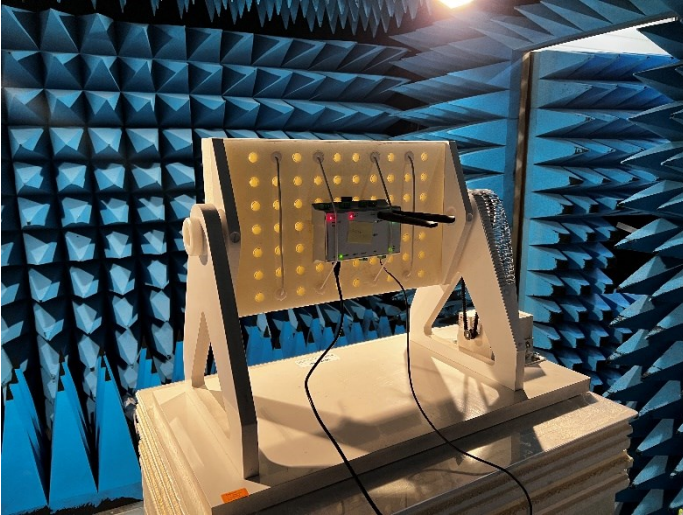




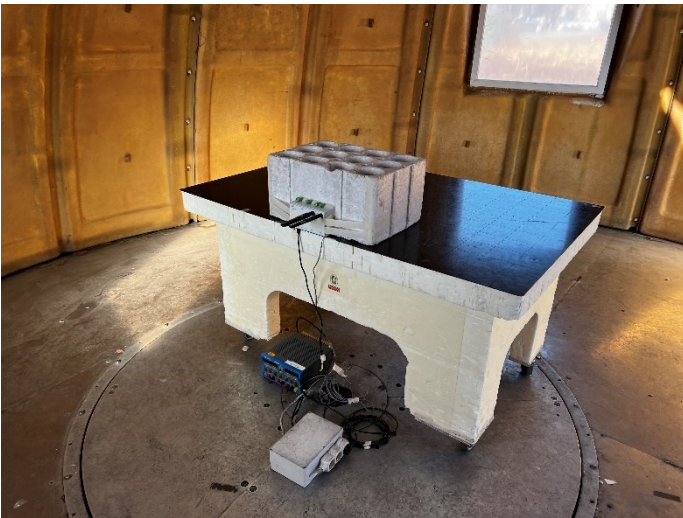
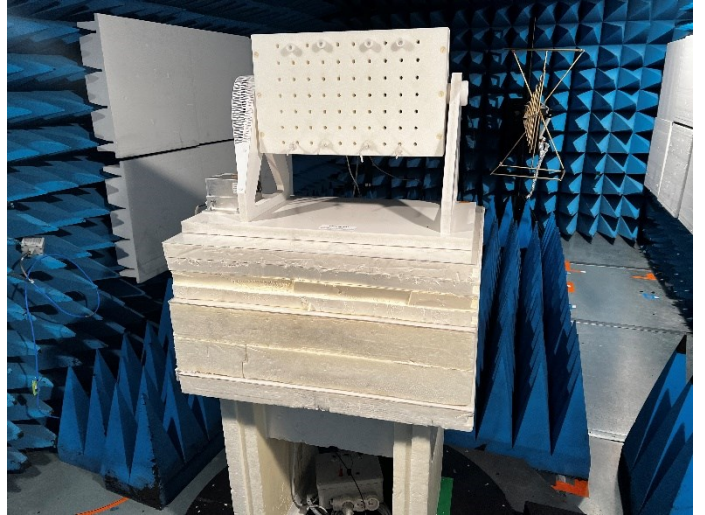
Test set up of Unwanted Emissions in Restricted Frequency Bands in semi anechoic chamber



Test Set up for radiated measurement in open area test site



Worst case position tested (FAR test setup)



Worst case position tested (OATS test setup)



Photograph for Unwanted Emission in restricted frequency bands



L C I E

3.3. LIMIT

Measure at 300m		
Frequency range	Level	Detector
9kHz-490kHz	67.6dB μ V/m /F(kHz)	QPeak
Measure at 30m		
Frequency range	Level	Detector
490kHz-1.705MHz	87.6dB μ V/m /F(kHz)	QPeak
1.705MHz-30MHz	29.5dB μ V/m	QPeak
Measure at 10m		
Frequency range	Level	Detector
30MHz to 88MHz	29.5dB μ V/m	QPeak
88MHz to 216MHz	33dB μ V/m	QPeak
216MHz to 960MHz	35.5B μ V/m	QPeak
960MHz to 1000MHz	43.5dB μ V/m	QPeak
Above 1000MHz	63.5dB μ V/m	Peak
	43.5dB μ V/m	Average
Measure at 3m		
Frequency range	Level	Detector
30MHz to 88MHz	40dB μ V/m	QPeak
88MHz to 216MHz	43.5dB μ V/m	QPeak
216MHz to 960MHz	46B μ V/m	QPeak
960MHz to 1000MHz	54dB μ V/m	QPeak
Above 1000MHz	74dB μ V/m	Peak
	54dB μ V/m	Average



L C I E

3.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Amplifier 9kHz - 40GHz	LCIE SUD EST	-	A7102082	06/20	06/22
Antenna Bi-log	AH System	SAS-521-7	C2040180	02/21	02/23
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	06/19	06/22
BAT EMC	NEXIO	v3.21.0.27	L1000115		
Cable SMA 40GHz 40cm	WITHWAVE	W101-SM1-0.4M	A5329979	04/21	04/22
Comb EMR HF	YORK	CGE01	A3169114		
CONTROLLER	INNCO	CO3000	D3044034		
Emission Cable <1GHz (Ampl <-> Cage)	-	18GHz	A5329907	08/21	08/22
Filter Matrice	LCIE SUD EST	Combined filters	A7484078	09/20	09/22
Multimeter - CEM	FLUKE	87	A1240251	03/21	03/23
Power supply DC	METRIX	AX503	A7042308		
Rehausse Table C3	LCIE	-	F2000511		
Semi-Anechoic chamber #3 (BF)	SIEPEL	-	D3044017_BF	12/19	12/22
Semi-Anechoic chamber #3 (VSWR)	SIEPEL	-	D3044017_VSWR	12/19	12/22
Spare C3 Cable Measure	TELEDYNE	26GHz	A5329681	09/20	09/22
Spare C3 Cable Measure	TELEDYNE	26GHz	A5329680	09/20	09/22
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/21	09/23
Table C3	LCIE	-	F2000461		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	01/21	01/23
TILT	INNCO	TILT	D3044033		
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371		
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444		
Antenna horn 18GHz	EMCO	3115	C2042029	09/18	01/22
Emission Cable (SMA 1m)	TELEDYNE	26GHz	A5329874	10/20	02/22
Emission Cable (SMA 3.3m)	TELEDYNE	26GHz	A5329875	10/20	02/22
Rehausse Table C3	LCIE	-	F2000507		
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	02/21	02/23
Antenna Bi-log	CHASE	CBL6111A	C2040051	07/20	07/22
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	-	6GHz	A5329069	04/21	04/22
OATS	-	-	F2000409	04/21	04/22
Rehausse Table C1/OATS	LCIE	-	F2000512		
Table C1/OATS	LCIE	-	F2000445		
Turntable (OATS)	ETS Lingren	Model 2187	F2000403		
Turntable / Mast controller (OATS)	ETS Lingren	Model 2066	F2000372		

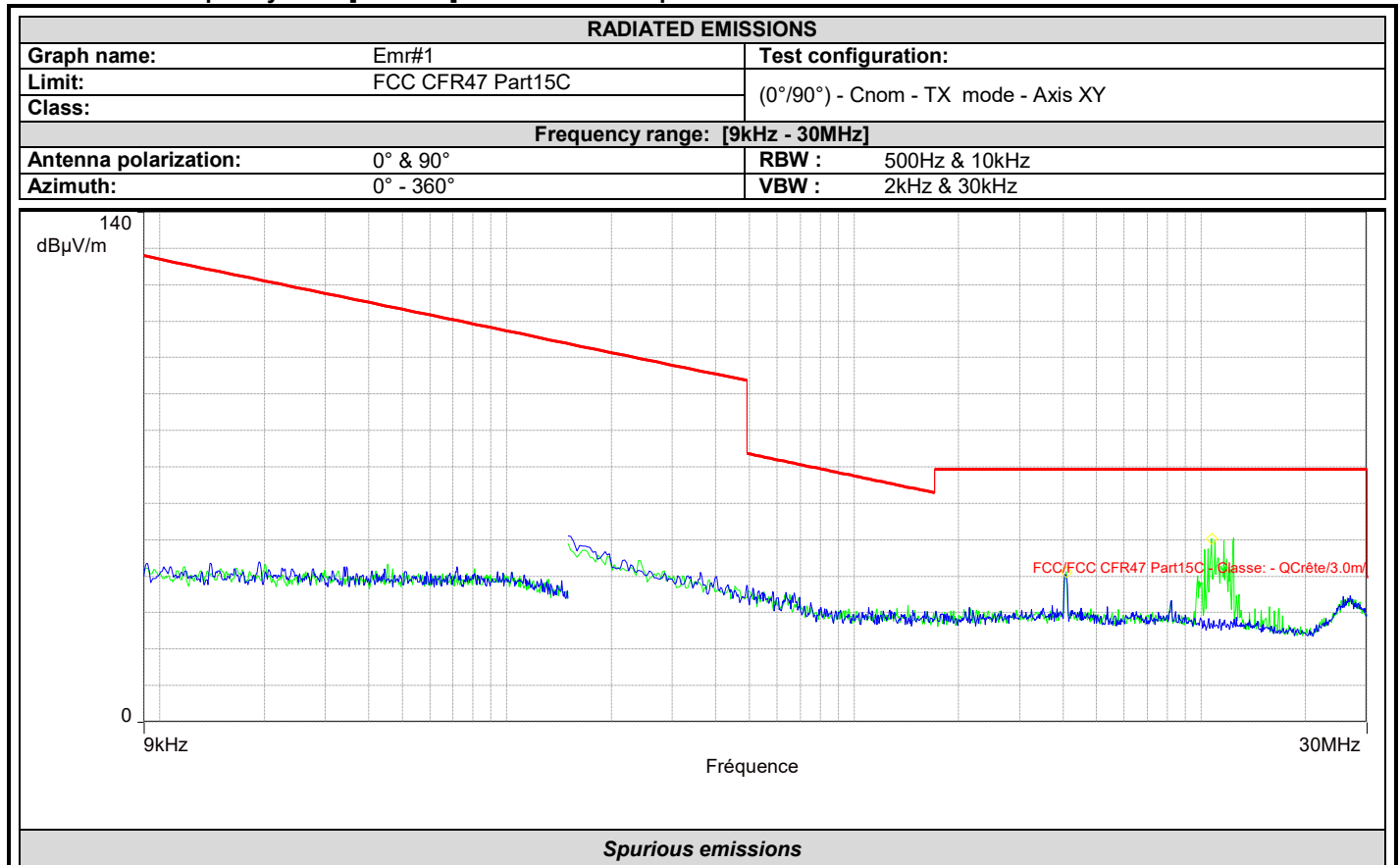
Note: In our quality system, the test equipment calibration due is more & less 2 months

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

3.6. RESULTS

Results in the frequency band [0.009-30] MHz: Worst case presented

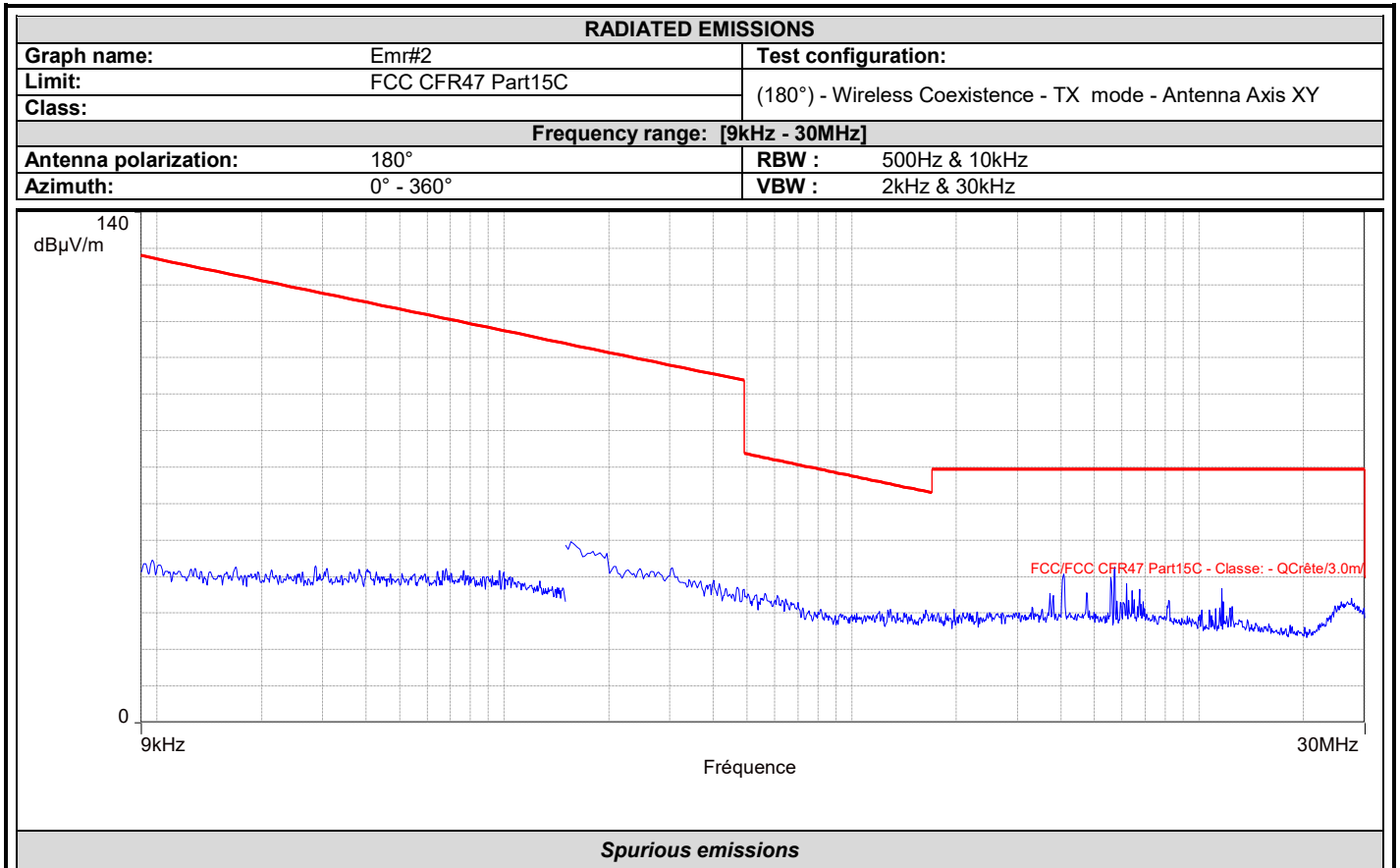


Frequency (MHz)	Peak (dBµV/m)	Lim.Q-Peak (dBµV/m)	Polarization	Correction (dB)
4.078*	41.2	69.5	Vertical	36.8
10.699*	50.3	69.5	Vertical	35.7

* Not due to RF module



L C I E

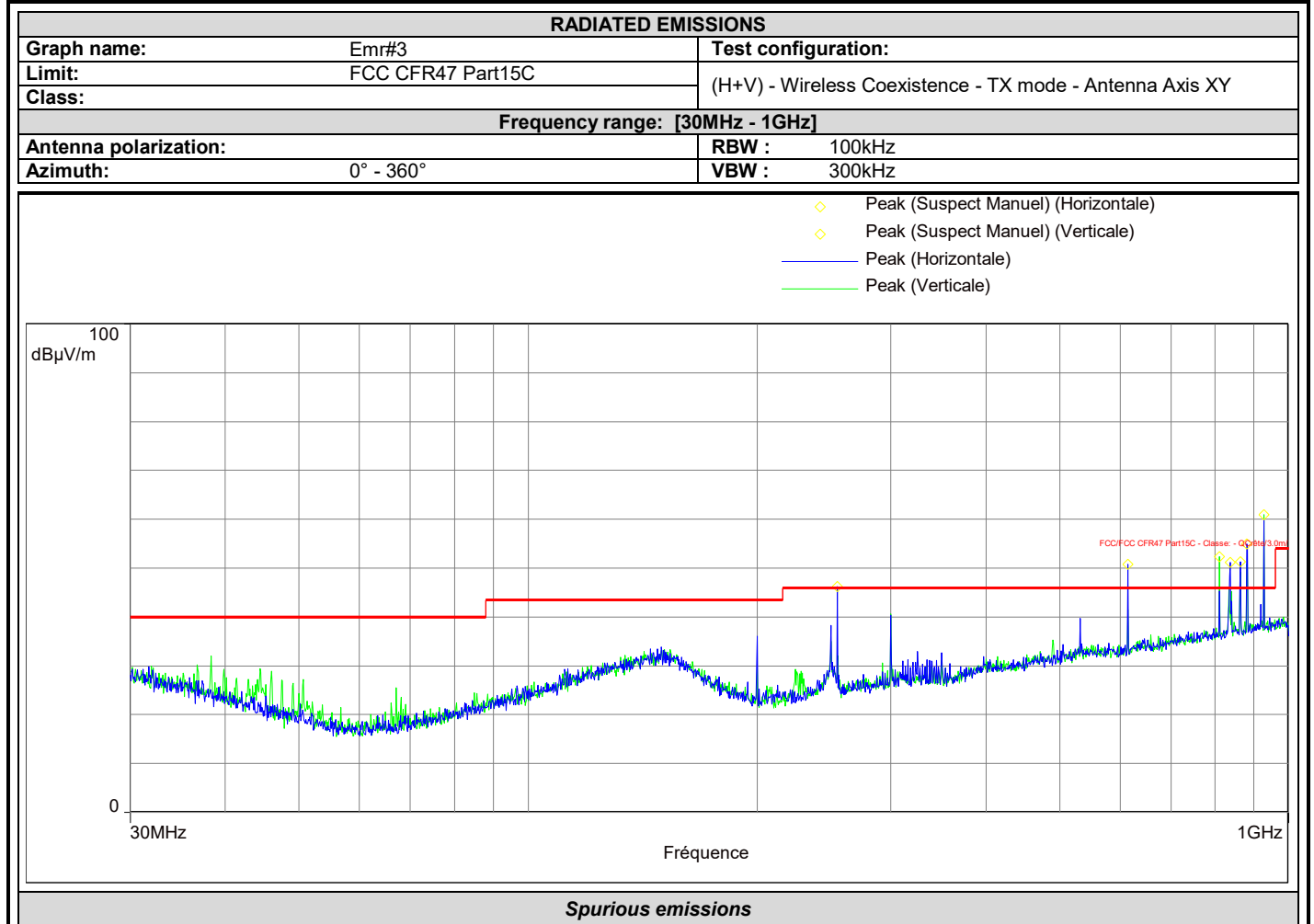


No significant frequency observed due to RF module



L C I E

Results in the frequency band [30-1000] MHz: Worst case presented



Frequency (MHz)	Peak (dBµV/m)	Lim.Q-Peak (dBµV/m)	Polarization	Correction (dB)
255.088	46.2	46.0	Horizontal	15.0
614.522	50.8	46.0	Horizontal	21.4
837.574*	51.2	46.0	Horizontal	25.0
863.182	51.3	46.0	Horizontal	25.3
881.563**	55.0	46.0	Horizontal	25.6
811.238	52.3	46.0	Vertical	24.5
927.590***	60.9	46.0	Vertical	25.8

*GSM850 frequency observed (EUT)

**Cellular network frequency observed (generator auxiliary)

***Lora frequency observed (EUT)



QUALIFICATION (30MHz-1GHz): 10 meters measurement on the Open Area Test Site.
 Frequency list has been created with semi-anechoic chamber pre-scan results.
 Measurements are performed using a QUASI-PEAK detection.

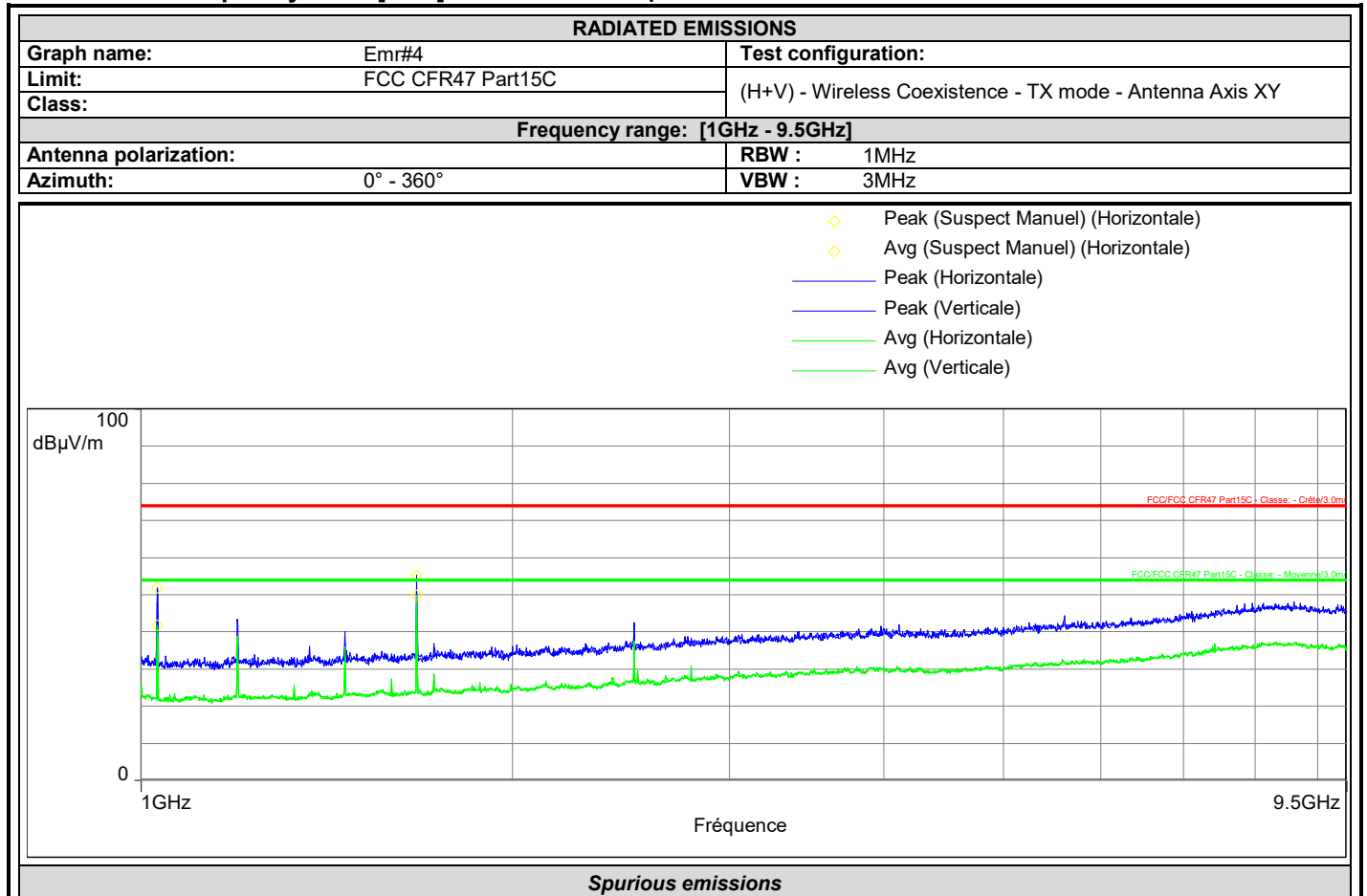
Test Frequency (MHz)	Meter Reading dB(μV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Gain/Loss Factor (dB)	Transducer Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
255.088	1.6	QP	H	0	250	-	17.0	18.6	46.0	-27.4
614.556	9.8	QP	H	0	100	-	26.7	36.5	46.0	-9.5
811.563	5.4	QP	V	359	100	-	30.1	35.5	46.0	-10.5
863.182	3.4	QP	H	359	100	-	31.2	34.6	46.0	-11.4

*Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
 (M@3m = M@10m+10.5dB)*



L C I E

Results in the frequency band [1-25] GHz: Worst case presented



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Lim.Peak (dBµV/m)	Avg (dBµV/m)	Lim.Avg (dBµV/m)	Lim.Q-Peak (dBµV/m)	Polarization	Correction (dB)
1030.600	51.8	74.0	41.7	54.0		Horizontal	-35.0
1673.200	55.3	74.0	49.8	54.0		Horizontal	-33.7

QUALIFICATION (1GHz- 25GHz): The frequency list is created from the results obtained during the pre-characterization in anechoic chamber.

Measurements are performed using a PEAK and AVERAGE 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)
1030.600	89.5	Pk	H	120	165	35.0	54.5	74.0	19.5
1030.600	54.3	QP	H	120	165	35.0	19.3	54.0	34.7
1673.200	89.9	Pk	H	3	165	33.7	56.2	74.0	17.8
1673.200	58.4	QP	H	3	165	33.7	24.7	54.0	29.3

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
Measurement of conducted disturbances in voltage on the power port	3.29dB	3.4 dB
Measurement of conducted disturbances in voltage on the telecommunication port.	3.26 dB	5dB
Measurement of discontinuous conducted disturbances in voltage	3.33 dB	3.4 dB
Measurement of conducted disturbances in current	2.67 dB	2.9dB
Spurious emission, radiated (Semi anechoic chamber & open test site)	5.60 dB	6 dB
Spurious emission, radiated (Full anechoic chamber above 1GHz)	±3.8 dB	±6 dB
Occupied Channel Bandwidth	±2.8 %	±5 %
RF power, conducted	±1.2 dB	±1.5 dB
Power Spectral Density, Conducted	±1.7 dB	±3 dB
Spurious emission, conducted	±2.3 dB	±3 dB
Temperature	±0.75 °C	±3 °C
Supply Voltages	±1.7 %	±3 %

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limits values.