



LCIE

Release July, 2017

TEST REPORT

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Version : 01

Subject Electromagnetic compatibility tests according to the standards:
FCC CFR 47 Part 15, Subpart C
RSS-210 Issue 9

Issued to **MARKEM IMAJE INDUSTRIES**
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FRANCE

Apparatus under test

↻ Product	Industrial Printer
↻ Trade mark	MARKEM IMAJE
↻ Manufacturer	MARKEM IMAJE INDUSTRIES
↻ Model under test	9450
↻ Serial number	FR17180153
↻ FCCID	2AAW8-MI9450
↻ IC	11372A-MI9450

Conclusion See Test Program chapter

Test date August 24, 2018 to August 31, 2018

Test location FONTENAY AUX ROSES

IC Test site 6230B-1

Composition of document 31 pages

Document issued on September 19, 2018

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	September 19, 2018	Majid MOURZAGH	Creation of the document



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1. TEST PROGRAM

Standard:

- FCC Part 15, Subpart C
- ANSI C63.10 (2013)
- RSS-210 Issue 9
- RSS-Gen Issue 4

EMISSION TEST	LIMITS			RESULTS (Comments)
	Frequency	Quasi-peak value (dB μ V)	Average value (dB μ V)	
Limits for conducted disturbance at mains ports 150kHz-30MHz <i>CFR 47 §15.207</i>	150-500kHz	66 to 56	56 to 46	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz <i>CFR 47 §15.209 (a)</i> <i>CFR 47 §15.225</i> <i>RSS-Gen §4.9</i>	Measure at 300m 9kHz-490kHz : 67.6dB μ V/m /F(kHz)			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
	Measure at 30m 490kHz-1.705MHz : 87.6dB μ V/m /F(kHz) 1.705MHz-30MHz : 29.5 dB μ V/m			
Radiated emissions 30MHz-25GHz* <i>CFR 47 §15.209 (a)</i> <i>CFR 47 §15.225</i> <i>RSS-Gen §4.9</i> <i>Highest frequency :</i> <i>(Declaration of provider)</i>	Measure at 3m 30MHz-88MHz : 40 dB μ V/m 88MHz-216MHz : 43.5 dB μ V/m 216MHz-960MHz : 46.0 dB μ V/m Above 960MHz : 54.0 dB μ V/m			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Fundamental field strength limit <i>CFR 47 §15.225</i> <i>RSS-210 §B.6</i>	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Fundamental frequency tolerance <i>CFR 47 §15.225</i> <i>RSS-210 §B.6</i>	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Band edge compliance <i>CFR 47 §15.225</i> <i>RSS-210 §B.6</i>	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Occupied bandwidth <i>RSS-Gen Issue 5 §6.7</i>	No limit			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Receiver Spurious Emission** <i>RSS-Gen Issue 5 §7.3</i>	See RSS-Gen §7.3			<input type="checkbox"/> PASS <input type="checkbox"/> FAIL <input checked="" type="checkbox"/> NA <input type="checkbox"/> NP

*§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.

**Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.

2. SYSTEM TEST CONFIGURATION

2.1. JUSTIFICATION

Due to endlife of screen part, a new component has been tested following to FCC Part15C requirements, none others modifications have been done on the product.

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):

9450

Serial Number: FR17180153



Photography of EUT

Power supply:

During all the tests, EUT is supplied by V_{nom} : 110VAC

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

Name	Type	Rating	Reference / Sn	Comments
Supply1	<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC <input type="checkbox"/> Battery	100-240VAC 50-60HZ	-	-



Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	3 wires	2	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Tachymeter input	-	5	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Proximity cell input	-	6	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Status beacon input	-	5	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Printing head	-	3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

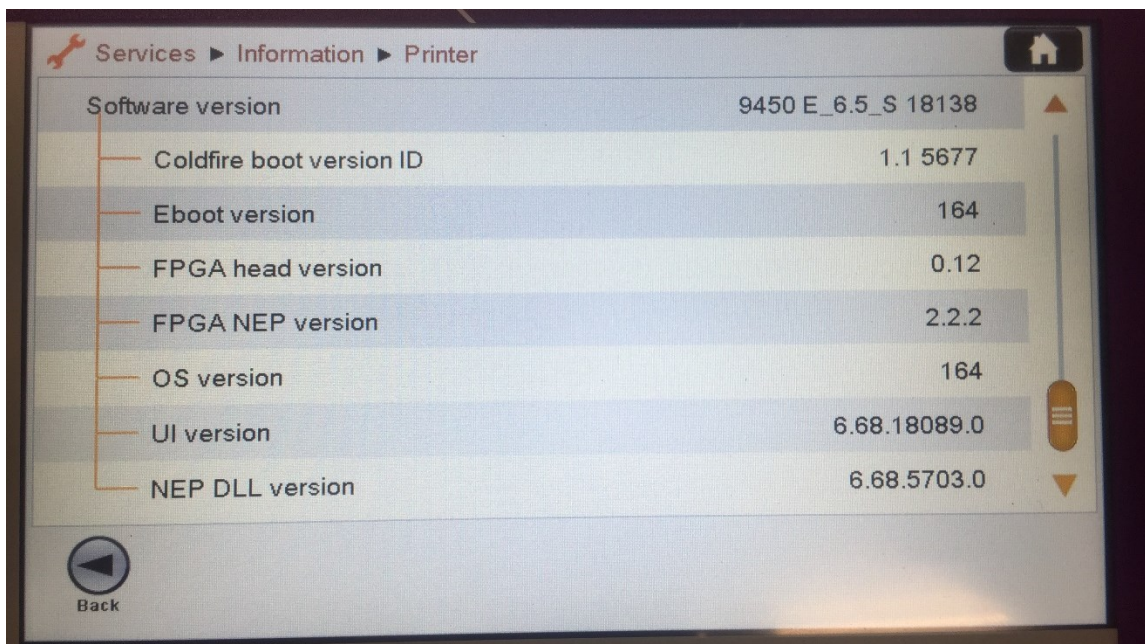
Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Proximity cells	A35355/B	-	-
Beacon PATLITE	FB194	-	Model MP-02C
Tachymeter	A35356	B11140B404	-

Equipment information:

Frequency band:	<input checked="" type="checkbox"/> [13.553–13.567]MHz	<input type="checkbox"/> [125]kHz	<input type="checkbox"/> [-] MHz
Sub-band REC7003:	<input checked="" type="checkbox"/> Annex 9 (j)	<input type="checkbox"/> Annex 9 (a3)	<input type="checkbox"/> Annex ()
RF mode:	<input type="checkbox"/> Transmitter	<input checked="" type="checkbox"/> Transceiver	<input type="checkbox"/> Receiver <input type="checkbox"/> Standby
Type:	<input checked="" type="checkbox"/> RFID	<input type="checkbox"/> EAS	<input type="checkbox"/> Other:
Bandwidth:	<input type="checkbox"/> Narrowband (ISO15693, ISO18000-3...)		<input checked="" type="checkbox"/> Wideband (ISO14443, NFC...)
Product class – Annex B.2	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4
Channelized system:	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes, channel spacing: kHz	
Equipment intended for use as a	<input checked="" type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input type="checkbox"/> Portable
Type of equipment:	<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in	<input type="checkbox"/> Combined
Antenna Type:	<input type="checkbox"/> External		<input checked="" type="checkbox"/> Internal
Antenna connector:	<input type="checkbox"/> Permanent external	<input checked="" type="checkbox"/> Permanent internal	<input type="checkbox"/> None <input type="checkbox"/> Temporary (only for tests)
Antenna Gain:	NC dBi		
Duty cycle:	<input checked="" type="checkbox"/> Continuous duty	<input type="checkbox"/> Intermittent duty	<input type="checkbox"/> Continuous operation
Equipment type:	<input checked="" type="checkbox"/> Production model		<input type="checkbox"/> Prototype
Temperature range:	Tmin:	<input type="checkbox"/> -20°C	<input type="checkbox"/> 0°C <input checked="" type="checkbox"/> +5 °C
	Tnom:	20°C	
	Tmax:	<input type="checkbox"/> 35°C	<input type="checkbox"/> 55°C <input checked="" type="checkbox"/> +45 °C
Type of power source:	<input checked="" type="checkbox"/> AC power supply	<input type="checkbox"/> DC power supply	<input type="checkbox"/> Battery (Select type)
Test source voltage:	Vmin:	<input checked="" type="checkbox"/> 93.5V/60Hz	<input type="checkbox"/> VDC
	Vnom:	<input checked="" type="checkbox"/> 110V/60Hz	<input type="checkbox"/> VDC
	Vmax:	<input checked="" type="checkbox"/> 126V/60Hz	<input type="checkbox"/> VDC

2.3. EUT CONFIGURATION



2.4. EQUIPMENT MODIFICATIONS

None Modification:

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 52.5dB 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.

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

2.6. 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. CONDUCTED EMISSION DATA

3.1. ENVIRONMENTAL CONDITIONS

Date of test : August 28, 2018
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 1001
Relative humidity (%) : 35
Ambient temperature (°C) : 23

3.2. TEST SETUP

Mains terminals

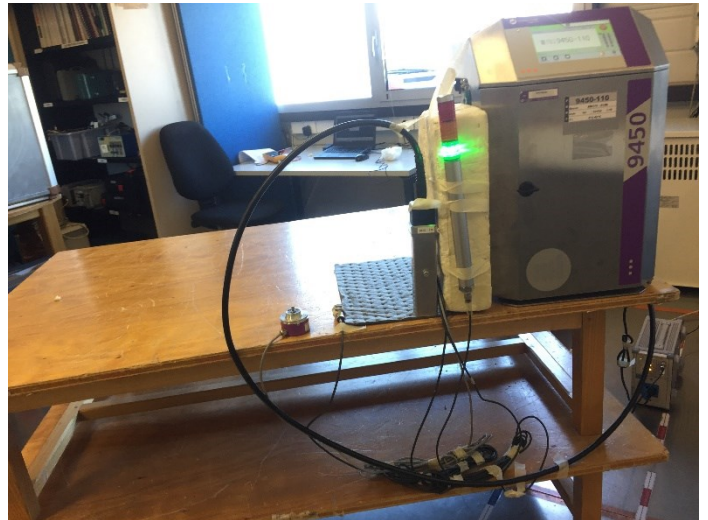
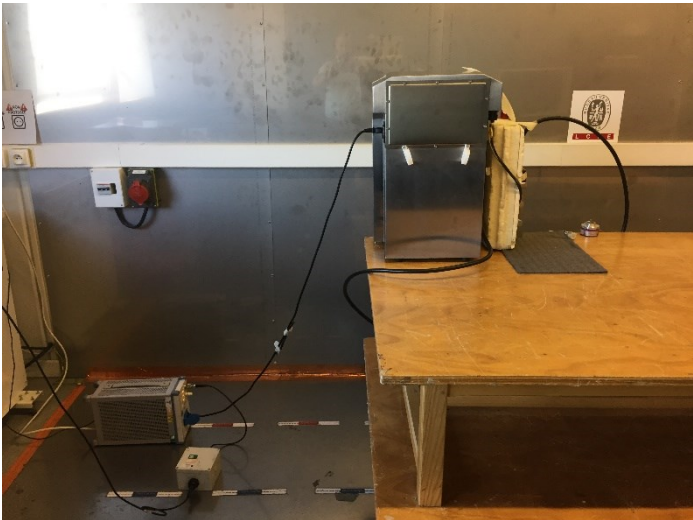
The EUT and auxiliaries are set:

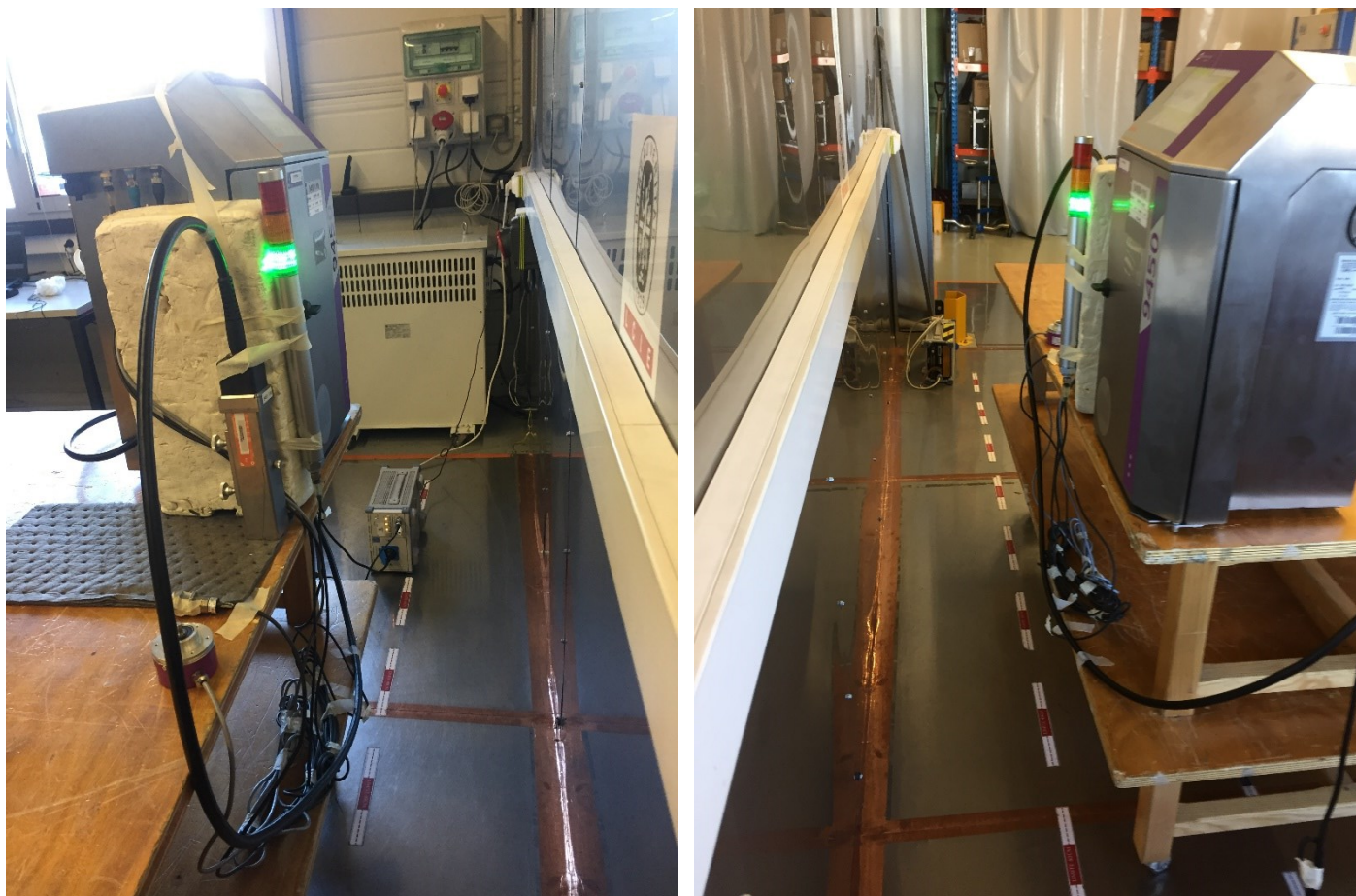
- 80cm above the ground on the non-conducting table (Table-top equipment)
- 10cm above the ground on isolating support (Floor standing equipment)

The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane.

The EUT is powered by V_{nom} .

The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.





Test setup

3.3. TEST METHOD

The product has been tested according to ANSI C63.10 and FCC Part 15 subpart C. The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 limits. Measurement bandwidth was 9kHz from 150kHz to 30MHz. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. The LISN (measure) is $50\Omega / 50\mu\text{H}$. The Peak data are shown on plots in annex 1. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured. Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

Measurements are performed on the phase (L1) and neutral (N) of power line voltage. Graphs are obtained in PEAK detection. Measures are also performed in Quasi-Peak and Average for any strong signal.



3.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + self	-	-	A5329585	07/17	07/18
EMC comb generator	LCIE SUD EST	-	A3169098	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320291	12/17	12/18
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	12/18
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/16	08/18
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204	02/18	02/19
CALIFORNIA System: 5kVA TRI	SCHAFFNER	NSG 1007	A7043026	-	-

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

3.6. TEST RESULTS

Mains terminals:

Supply1

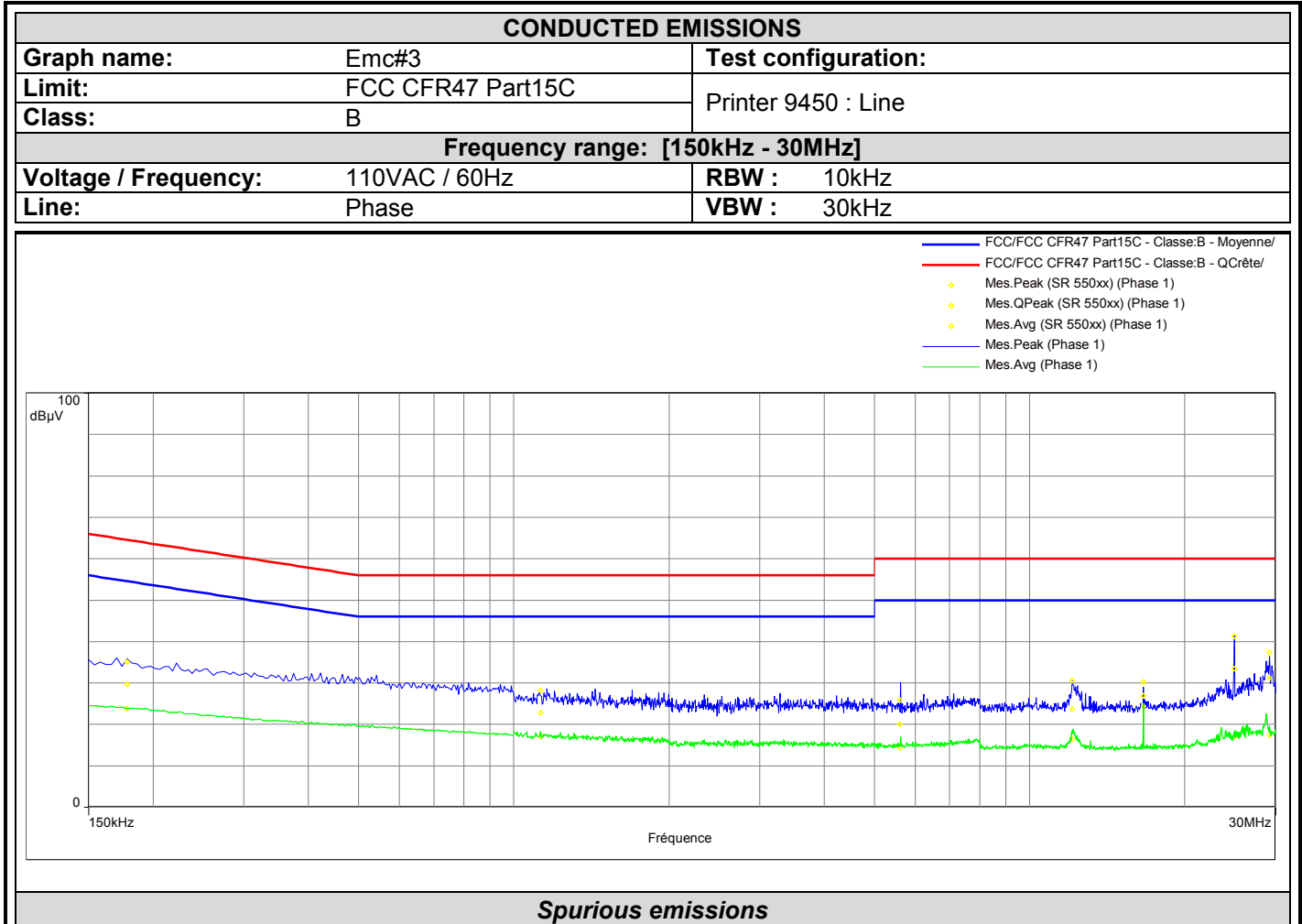
Measurements are performed on the phase (L1) and neutral (N) of the power line.

Results: (PEAK detection)

Graph identifier	Line	Comments
Emc# 1	Phase	- See annex 1
Emc# 2	Neutral	- See annex 1



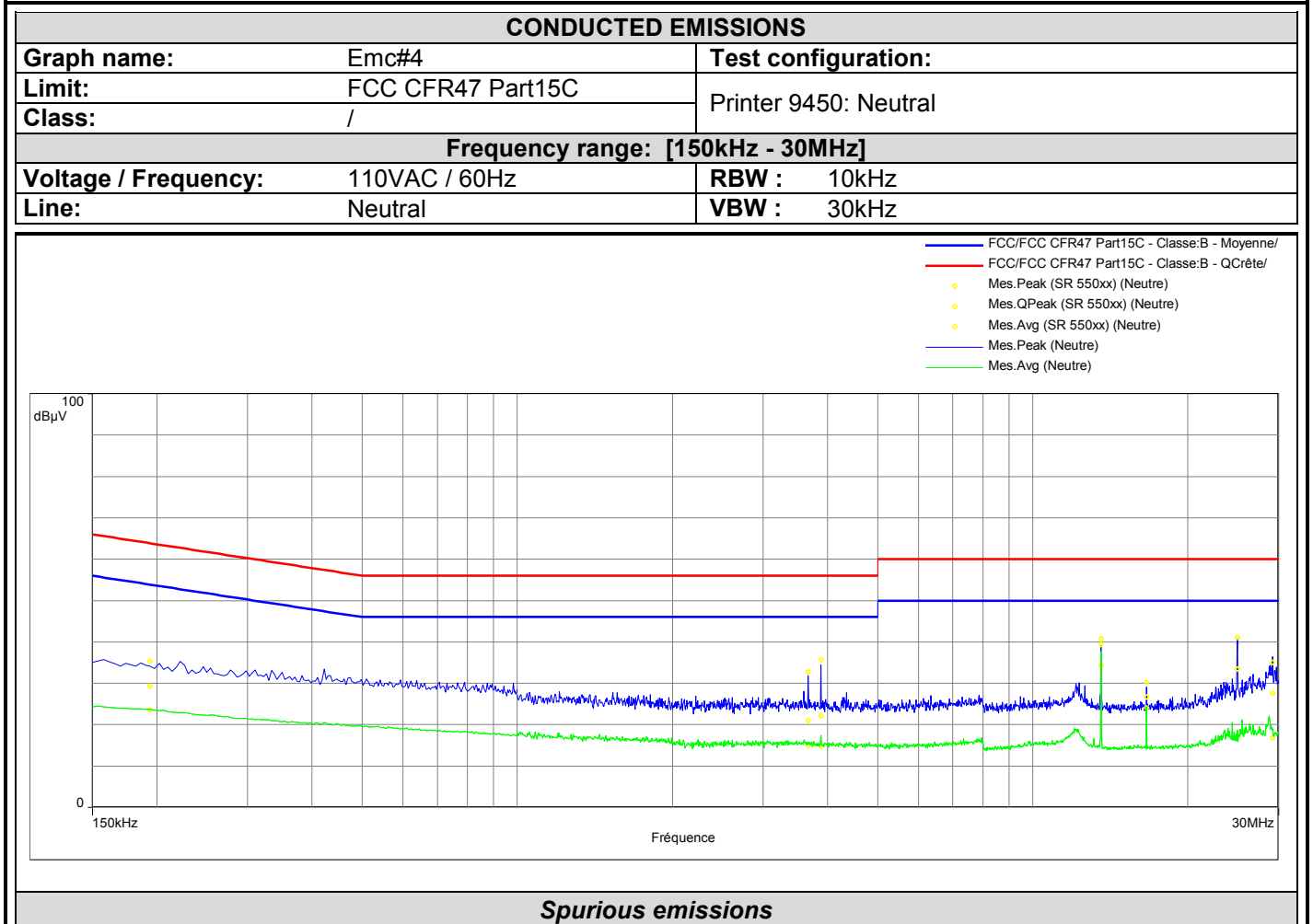
L C I E



Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line	Correction (dB)
0.178	35.0	29.6	64.6	-34.9	23.8	54.6	-30.8	Phase 1	19.5
1.128	28.2	22.8	56.0	-33.2	17.1	46.0	-28.9	Phase 1	19.5
5.596	25.9	20.1	60.0	-39.9	14.3	50.0	-35.7	Phase 1	19.8
12.108	30.6	23.7	60.0	-36.3	16.4	50.0	-33.6	Phase 1	20.3
16.624	30.3	26.9	60.0	-33.1	24.4	50.0	-25.6	Phase 1	20.5
24.940	41.2	33.4	60.0	-26.6	17.1	50.0	-32.9	Phase 1	21.0
29.220	37.3	31.2	60.0	-28.8	17.4	50.0	-32.6	Phase 1	21.2



L C I E



Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line	Correction (dB)
0.194	35.4	29.4	63.9	-34.5	23.6	53.9	-30.3	Neutre	19.5
3.664	32.8	21.0	56.0	-35.0	14.9	46.0	-31.1	Neutre	19.7
3.880	35.7	22.1	56.0	-33.9	14.8	46.0	-31.2	Neutre	19.7
13.560	40.8	39.4	60.0	-20.6	34.3	50.0	-15.7	Neutre	20.4
16.624	30.2	26.6	60.0	-33.4	24.1	50.0	-25.9	Neutre	20.5
24.940	41.2	33.4	60.0	-26.6	17.2	50.0	-32.8	Neutre	21.0
29.216	35.1	27.6	60.0	-32.4	16.8	50.0	-33.2	Neutre	21.2

3.7. CONCLUSION

The sample of the equipment 9450, Sn: FR17180153, tested in the configuration presented in this test report **satisfies** to requirements limits of the standard FCC Part 15 Subpart C, for conducted emissions.

4. RADIATED EMISSION DATA (15.209)

4.1. ENVIRONMENTAL CONDITIONS

Date of test	: August 24, 2018	August 27, 2018
Test performed by	: Majid Mourzagh	Majid Mourzagh
Atmospheric pressure (hPa)	: 1000	1001
Relative humidity (%)	: 39	33
Ambient temperature (°C)	: 22	24

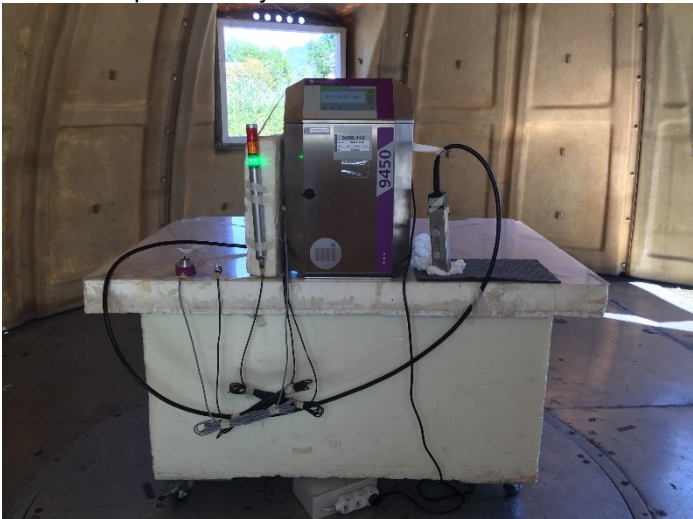
4.2. TEST SETUP

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.

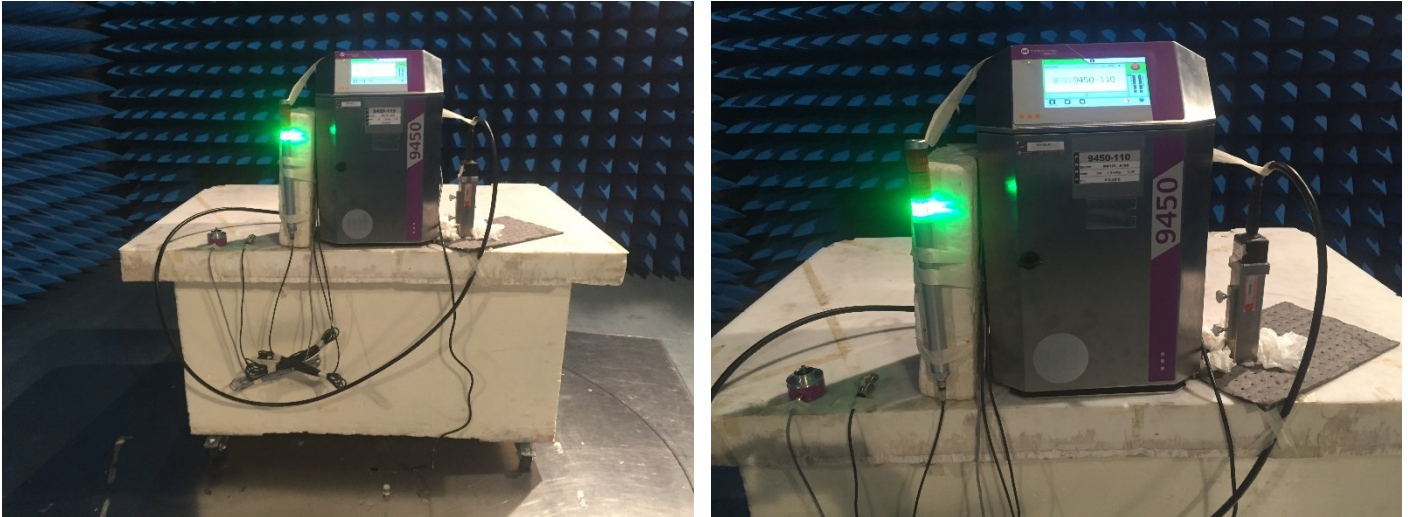
The EUT and auxiliaries are set:

- 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 on OATS



Test setup in anechoic chamber

4.3. TEST METHOD

The product has been tested according to ANSI C63.10, FCC Part 15 Subpart C.

Pre-characterisation measurement: (9kHz – 2GHz)

A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz to 2GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated 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.

The pre-characterization graphs are obtained in PEAK detection and PEAK/AVERAGE from 1GHz to 2GHz.

Characterization on 10 meters open site from 9kHz to 1GHz:

Radiated Emissions were measured on an open area test site. A description of the facility is on file with the FCC. The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC Part 15 Subpart C limits. Measurement bandwidth was 9kHz below 30MHz and 120kHz from 30 MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated during the test for maximized the emission measurement. The height antenna is varied from 1m to 4m. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement 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.

Frequency list has been created with anechoic chamber pre-scan results.

Characterization on 3 meters full anechoic chamber from 1GHz to 2GHz:

The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC Part 15 Subpart C limits. Measurement bandwidth was 1MHz from 1GHz to 2GHz. Test is performed in horizontal (H) and vertical (V) polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement 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. The height antenna is

On mast, varied from 1m to 4m

Fixed and centered on the EUT (EUT smaller than the beamwidth of the measurement antenna, ANSI C63.10 §6.6.5)

Frequency list has been created with anechoic chamber pre-scan results.



4.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/17	11/19
Antenna Bi-Log	AH System	SAS-521-7	C2040180	07/16	07/18
Cable	-	6GHz	A5329191	06/17	06/18
Emission Cable	MICRO-COAX	18GHz	A5329657	06/17	06/18
Emission Cable	MICRO-COAX	18GHz	A5329658	03/18	03/19
Semi-Anechoic chamber #1	SIEPEL	-	D3044016	09/17	09/18
Radiated emission comb generator	BARDET	-	A3169050	-	-
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088	-	-
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	12/18
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A4060049	11/17	11/19
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Thermo-hygrometer (C1)	OREGON	WMR 80	B4206013	06/18	06/20
Turntable chamber (Cage#1)	MATURO Gmbh	TT 2.0 SI	F2000406	-	-
Antenna mast (Cage#1)	MATURO Gmbh	AM 4.0	F2000407	-	-
Turntable controller (Cage#1)	MATURO Gmbh	Control Unit	F2000408	-	-
Table C1/OATS	LCIE	-	F2000445	-	-
Antenna Bi-log	CHASE	CBL6111A	C2040051	01/18	01/19
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/17	11/19
Emission Cable	SUCOFLEX	6GHz	A5329061	03/18	03/19
Cable (OATS)	-	1GHz	A5329623	03/18	03/19
OATS	-	-	F2000409	10/17	10/18

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

4.6. TEST RESULTS

4.6.1. Pre-characterization at 3 meters [9kHz-30MHz]

See graph for 9kHz-30MHz band:

Graph identifier	Polarization	EUT position	Comments
Emr# 1	0°/90°	Axis XY	See annex 1
Emr# 2	180°	Axis XY	See annex 1

4.6.2. Pre-characterization at 3 meters [30MHz-1GHz]

See graphs for 30MHz-1GHz:

Graph identifier	Polarization	EUT position	Comments
Emr# 3	Horizontal /Vertical	Axis XY	See annex 1

4.6.3. Pre-characterization at 3 meters [1GHz-2GHz]

See graphs for 1GHz-2GHz:

Graph identifier	Polarization	EUT position	Comments
Emr# 4	Horizontal /Vertical	Axis XY	See annex 1



4.6.4. Characterization on 10 meters open site below 30 MHz

Worst case final data result:

Frequency list has been created with semi-anechoic chamber pre-scan results.
Measurements are performed using a QUASI-PEAK detection.

No	Frequency (MHz)	QPeak Limit (dB μ V/m) @ 30m	Qpeak (dB μ V/m) @ 30m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
1	13.56	84	15.5	68.5	0	0	100	35.1	/

Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e) ($M@30m = M@10m - 19.1dB$)

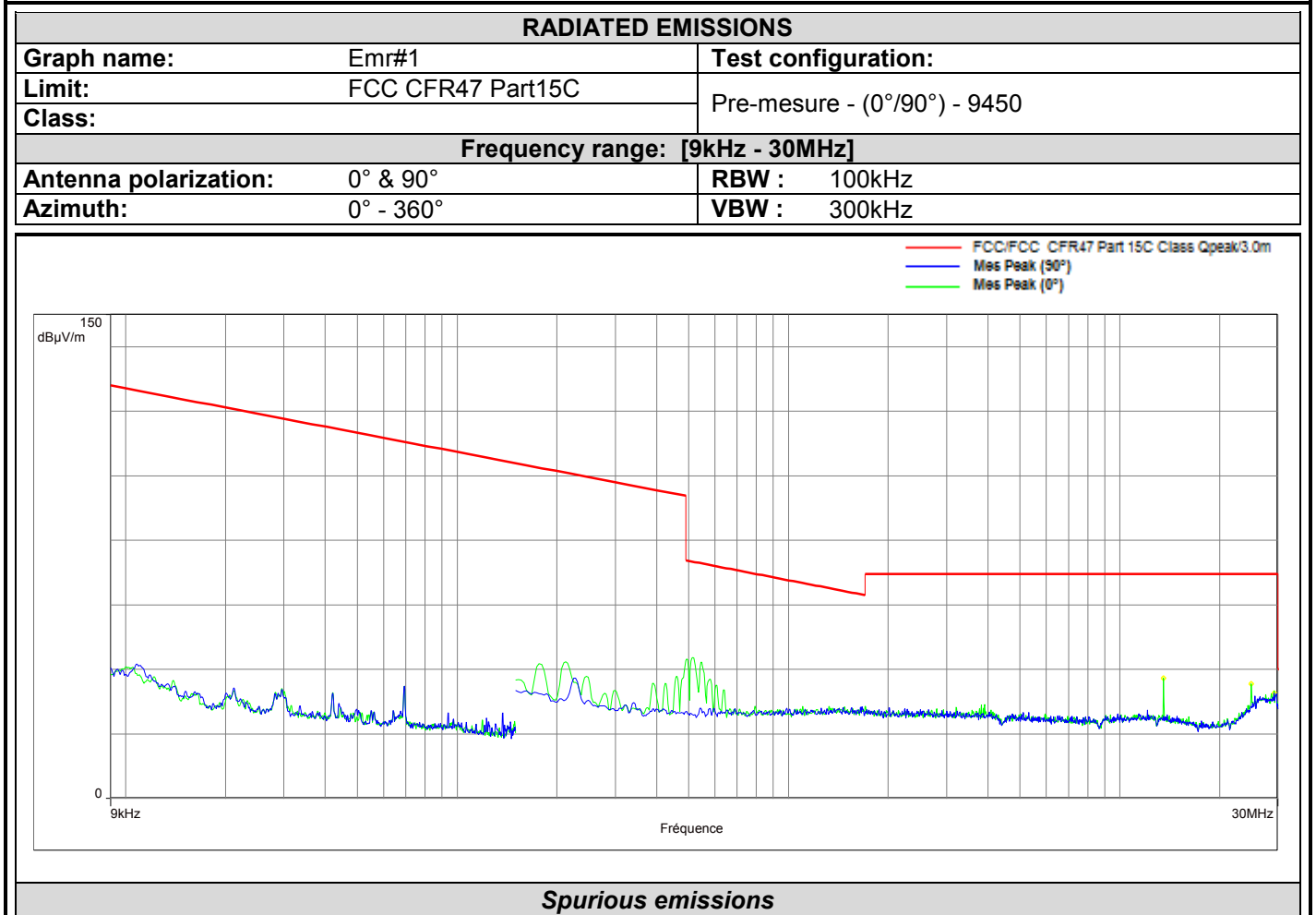
Limits Sub clause §15.225

Frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
13.553-13.567	15 848 84 dB μ V/m	30
13.410-13.553 13.567-13.710	334 50.5 dB μ V/m	30
13.110-13.410 13.710-14.010	106 40.5 dB μ V/m	30

See following chapter of this test report for band edge measurements.



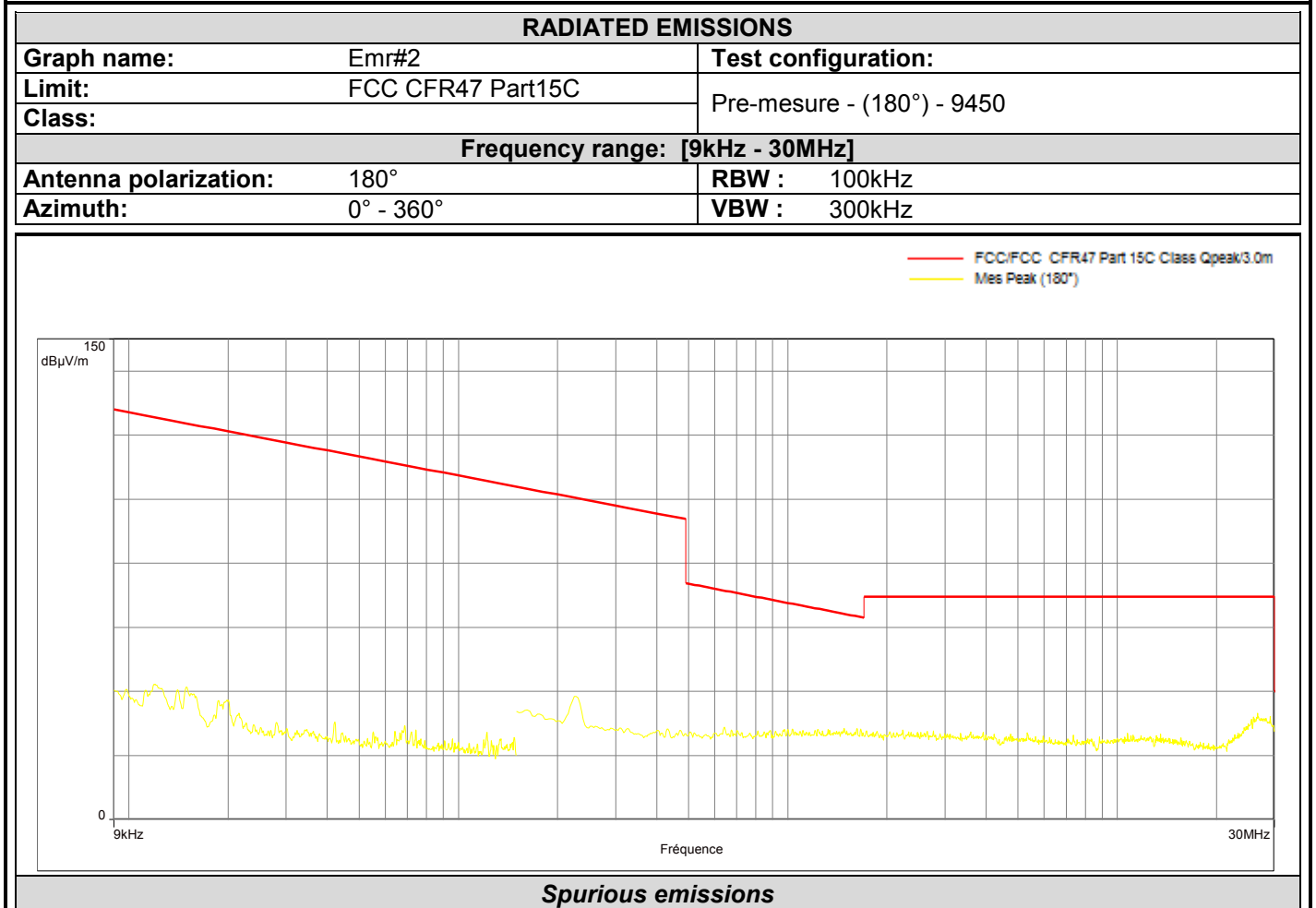
L C I E



Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Polarization	Correction (dB)
29.221	32.7	69.5	-36.8	Horizontal	10.6
13.559	37.2	69.5	-32.3	Vertical	5.6
24.931	35.5	69.5	-34.0	Vertical	10.1



L C I E



No significant frequency observed



L C I E

4.6.5. Characterization on 10 meters open site from 30MHz to 1GHz

Worst case final data result:

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)	Transducer Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
41.700	21.5	QP	V	130	130	14.9	36.4	40.0	-3.6
45.400	27.3	QP	V	250	120	12.3	39.6	40.0	-0.4
54.300	28.1	QP	V	0	130	8.8	36.9	40.0	-3.1
62.000	30.1	QP	V	0	115	7.8	37.9	40.0	-2.1
68.000	26.5	QP	V	0	130	8.4	34.9	40.0	-5.1
70.100	26.1	QP	V	250	120	8.7	34.8	40.0	-5.2
71.000	30.4	QP	V	0	130	8.7	39.1	40.0	-0.9
78.700	30.1	QP	V	0	130	9.5	39.6	40.0	-0.4
83.100	10.5	QP	V	75	125	10.1	20.6	40.0	-19.4
87.300	10.5	QP	V	250	125	10.6	21.1	40.0	-18.9
95.300	10.5	QP	V	250	125	11.8	22.3	43.5	-21.2
104.200	10.5	QP	V	250	130	13.0	23.5	43.5	-20.0
128.900	23.2	QP	V	120	130	14.6	37.8	43.5	-5.7
145.000	23.5	QP	V	90	140	14.1	37.6	43.5	-5.9
149.600	25.7	QP	V	200	130	14.1	39.8	43.5	-3.7
154.200	20.4	QP	V	230	130	13.5	33.9	43.5	-9.6
170.800	20.5	QP	V	270	130	12.4	32.9	43.5	-10.6
182.900	27.1	QP	V	180	130	11.8	38.9	43.5	-4.6
216.200	23.9	QP	H	0	300	13.4	37.3	46.0	-8.7
666.700	16.2	QP	V	230	150	25.8	42.0	46.0	-4.0
698.200	19.1	QP	V	0	150	26.4	45.5	46.0	-0.5
748.100	12.5	QP	V	0	150	27.4	39.9	46.0	-6.1

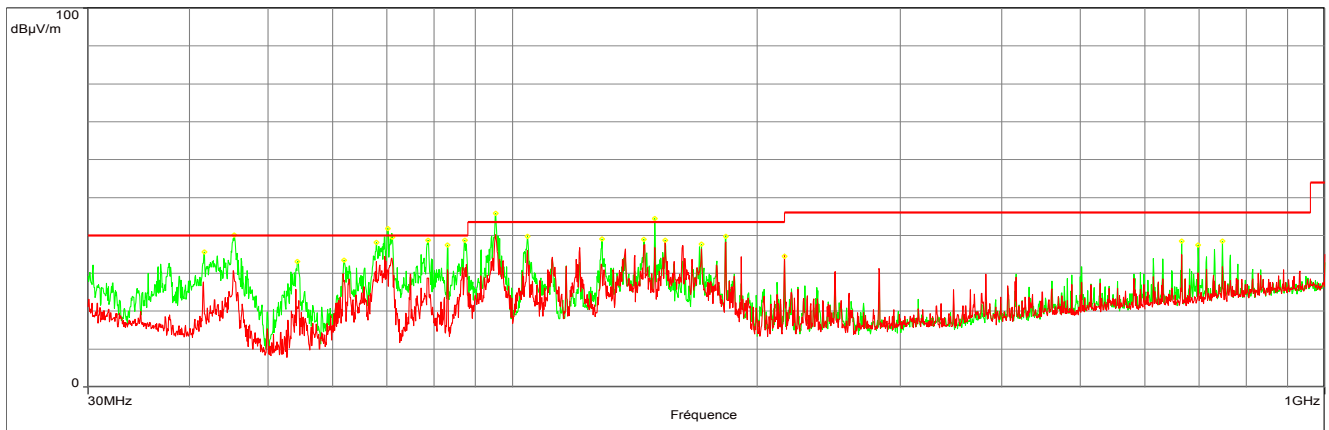
Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
($M@3m = M@10m+10.5dB$)



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RADIATED EMISSIONS		
Graph name:	Emr#3	Test configuration:
Limit:	FCC CFR47 Part15C	C1-(H+V) - 9450 <1GHz Part15C
Class:		
Frequency range: [30MHz - 1GHz]		
Antenna polarization:	Horizontal & Vertical	RBW : 100kHz
Azimuth:	0° - 360°	VBW : 300kHz

- FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
- Niveau (Suspect Manuel) (Horizontale)
- Niveau (Suspect Manuel) (Verticale)
- Mes.Peak (Horizontale)
- Mes.Peak (Verticale)



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Hauteur (m)	Polarization
216.160	34.5	1.6	Horizontal
41.696	35.6	1.6	Vertical
45.385	40.1	1.6	Vertical
54.327	33.1	1.6	Vertical
62.011	33.4	1.6	Vertical
67.978	38.2	1.6	Vertical
70.171	41.8	1.6	Vertical
71.055	39.5	1.6	Vertical
78.671	38.7	1.6	Vertical
83.125	37.5	1.6	Vertical
87.307	38.8	1.6	Vertical
95.280	45.8	1.6	Vertical
104.256	39.7	1.6	Vertical
128.872	39.1	1.6	Vertical
145.073	39.0	1.6	Vertical
149.629	44.4	1.6	Vertical
154.185	38.7	1.6	Vertical
170.845	37.8	1.6	Vertical
182.881	39.7	1.6	Vertical
666.680	38.5	1.6	Vertical
698.240	37.4	1.6	Vertical
748.120	38.5	1.6	Vertical



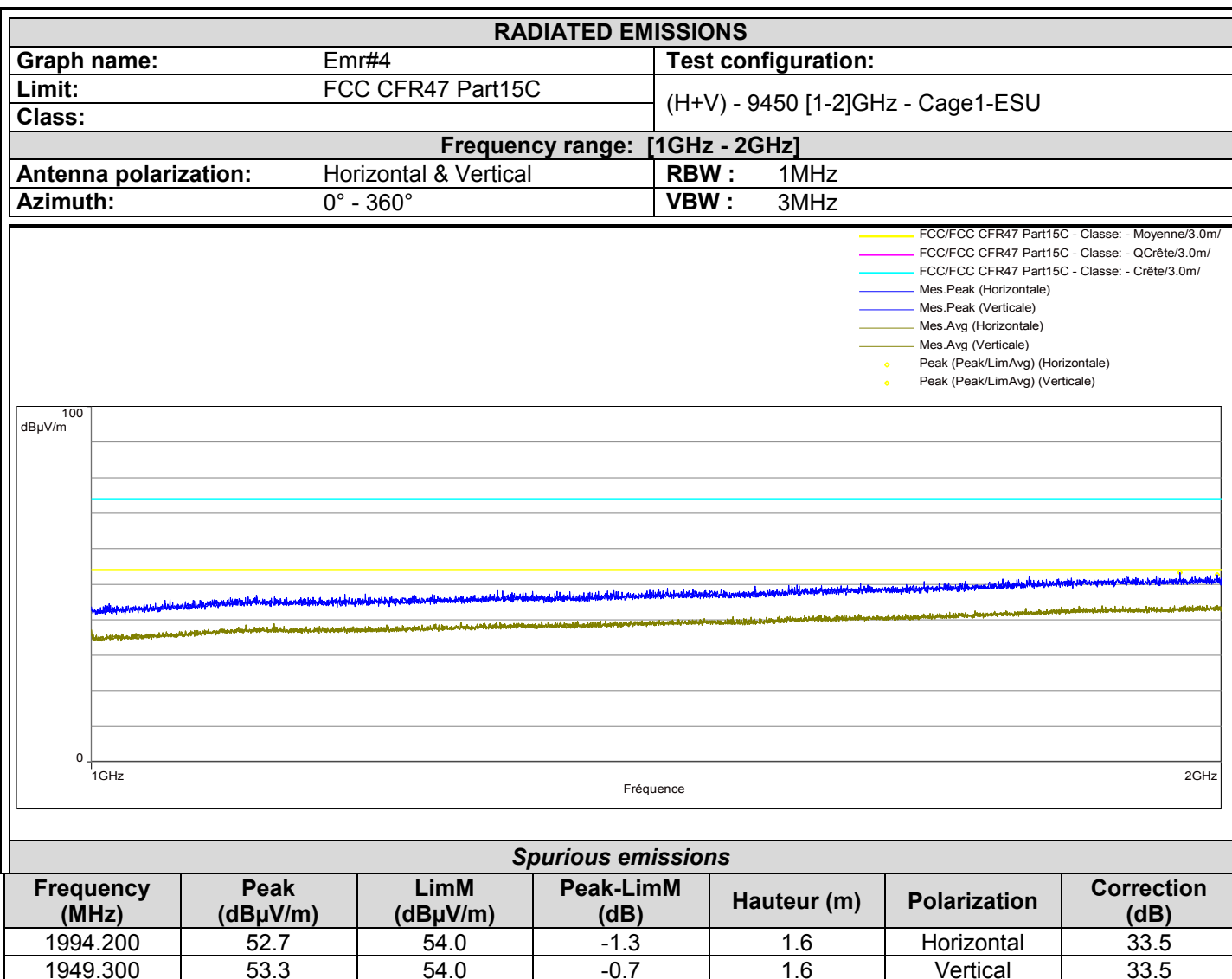
4.6.6. Characterization on 3meters anechoic chamber from 1GHz to 2GHz

Worst case final data result:

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.

Frequency (MHz)	Limit QPeak (dBµV/m)	Measure QPeak (dBµV/m)	Margin QPeak (dB)	Angle Table (°)	Pol. Ant.	Ht. Ant. (cm)	FC (dB)
No signifiant frequency observed							

Note: Measures have been done at 3m distance.





4.7. CONCLUSION

The sample of the equipment 9450 , Sn: FR17180153, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part 15 Subpart C, for radiated emissions.

5. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)

5.1. ENVIRONMENTAL CONDITIONS

Date of test : August 30, 2018
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 998
Relative humidity (%) : 40
Ambient temperature (°C) : 22

5.2. TEST SETUP

Frequency of carrier: 13.56 MHz

Upper limit: 13.561356 MHz

Lower limit: 13.558644 MHz

The equipment (RF box) is set in a climatic chamber. Measure is performed on one channel of RF module.



Test setup



5.3. TEST METHOD

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency when the temperature is varied from 5°C to +45°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.

5.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	18GHz	A7122206	02/18	02/19
Antenna Loop	LCIE	-	-	-	-
Cable SMA	-	18G	A5329373	12/17	12/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	02/18	02/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/18	03/19
Thermometer (radio)	FLUKE	52 II	B4043150	04/18	04/19
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/18	04/19
Thermo-hygrometer	OREGON	BAR916	B4206011	10/16	10/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	02/18	02/20
HAR + Imped. Net + Output switch TRI	CALIFORNIA INSTRUM.	-	A2089002	-	-
CALIFORNIA System: 5kVA TRI	SCHAFFNER	NSG 1007	A7043026	-	-

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

5.6. TEST RESULTS

Temperature	+5°C	20°C	+45°C
Voltage			
Mains voltage: 110V/60Hz			
Frequency Drift (MHz)	+ 0.000029		- 0.000063
Carrier level (dBc)	+ 3.80		- 0.50
Mains voltage: 93,5V/60Hz			
Frequency Drift (MHz)	+ 0.000027	+ 0.000000	- 0.000065
Carrier level (dBc)	+ 3.53	+ 0.06	- 0.43
Mains voltage: 126V/60Hz			
Frequency Drift (MHz)	+ 0.000031	- 0.000001	- 0.000065
Carrier level (dBc)	+ 3.77	+ 0.05	- 0.46

Frequency drift measured is -65Hz when the temperature is varied from 5°C to +45°C and voltage is varied.

5.1. CONCLUSION

The sample of the equipment 9450 , Sn: FR17180153, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C, for fundamental frequency tolerance.

6. BAND-EDGE COMPLIANCE §15.209

6.1. ENVIRONMENTAL CONDITIONS

Date of test : August 30, 2018
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 998
Relative humidity (%) : 40
Ambient temperature (°C) : 22

6.2. TEST SETUP

For measurement, the power level calibration of the spectrum analyzer is related to the field strength measured in chapter radiated emission data.



Test setup



6.3. TEST METHOD

Frequency band 13.110-14.010MHz

Following plots show radiated emission level in the frequency band 13.110-14.010MHz with a RBW of 9kHz and a quasi-peak detector. The graphs are obtained with a measuring receiver.

Frequency band 13.553-13.567MHz

Following plots show radiated emission level in the frequency band 13.55.-13.567MHz with a RBW of 1kHz. The graphs are obtained with a measuring receiver.

6.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	18GHz	A7122206	02/18	02/19
Antenna Loop	LCIE	-	-	-	-
Cable SMA	-	18G	A5329373	12/17	12/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	02/18	02/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/18	03/19
Thermometer (radio)	FLUKE	52 II	B4043150	04/18	04/19
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/18	04/19
Thermo-hygrometer	OREGON	BAR916	B4206011	10/16	10/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	02/18	02/20
CALIFORNIA System: 5kVA TRI	SCHAFFNER	NSG 1007	A7043026	-	-

6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:



7. OCCUPIED BANDWIDTH

7.1. ENVIRONMENTAL CONDITIONS

Date of test : August 30, 2018
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 998
Relative humidity (%) : 40
Ambient temperature (°C) : 22

7.2. TEST SETUP

Conducted measurement:

The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

Offset: Attenuator+cable 10.3dB

Radiated measurement:

The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

Measurement Procedure:

1. RBW used in the range of 1% to 5% of the anticipated emission bandwidth
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = Max Hold.
5. Sweep = Auto couple.
6. Allow the trace to stabilize.
7. OBW 99% function of spectrum analyzer used



7.3. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	18GHz	A7122206	02/18	02/19
Antenna Loop	LCIE	-	-	-	-
Cable SMA	-	18G	A5329373	12/17	12/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	02/18	02/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/18	03/19
Thermometer (radio)	FLUKE	52 II	B4043150	04/18	04/19
Thermocouple K (radio)	FLUKE	Type K	B4045004	04/18	04/19
Thermo-hygrometer	OREGON	BAR916	B4206011	10/16	10/18
Climatic chamber	BIA CLIMATIC	CL 6-25	D1024032	02/18	02/20
CALIFORNIA System: 5kVA TRI	SCHAFFNER	NSG 1007	A7043026	-	-

7.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

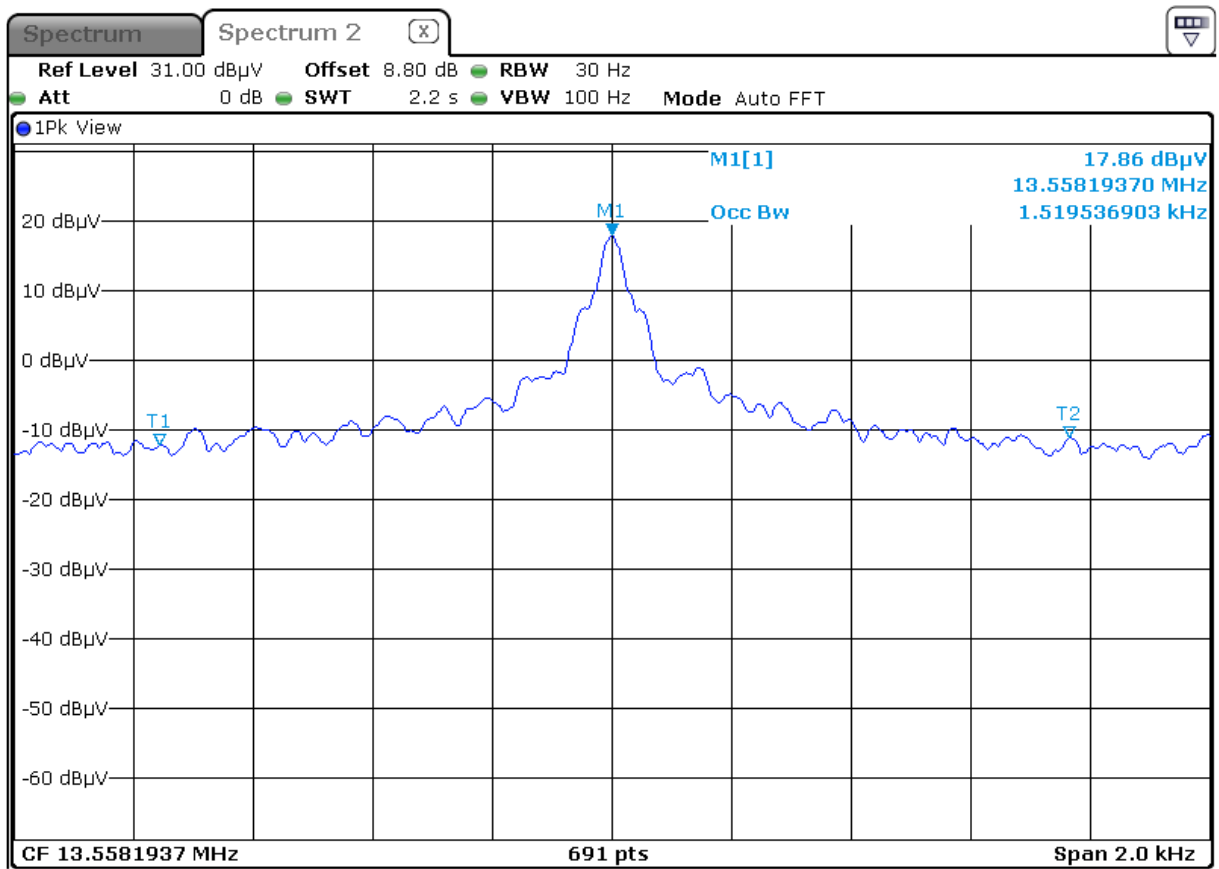
None Divergence:



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7.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (kHz)
Nom	13.5581937	1.51953369





8. 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 <i>Measurement of conducted disturbances in voltage on the power port</i>	3.51 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication <i>Measurement of conducted disturbances in voltage on the telecommunication port.</i>	3.26 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension <i>Measurement of discontinuous conducted disturbances in voltage</i>	3.45 dB	3.6 dB
Mesure des perturbations conduites en courant <i>Measurement of conducted disturbances in current</i>	3.09 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Moirans <i>Measurement of radiated electric field on the Moirans open area test site</i>	5.20 dB	6.3 dB

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.