

## E.M.C Test Report

According to the standard:  
FCC PART 15 Edition 2002

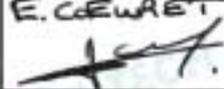
Equipment under test:  
AQUA'FM TX PRO

Company:  
TFE

DISTRIBUTION: Mr. BRISEBOIS

(Company: TFE)

Number of pages: 15 + 2 annexes

Ed.	Date	Modified pages	Prepared By		Reviewed By		Approved By	
			Name	Signature	Name	signature	Name	signature
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**TEST CERTIFICATION FOR:** FCC Certification

**NAME OF THE EQUIPMENT UNDER TEST:** AQUA'FM TX PRO

Type: ABL005A00P5000

Serial number: 02-41 007

**NAME OF THE MANUFACTURER:** TFE

Z.I. du Canal

31450 MONTGISCARD

FRANCE

**ADDRESS OF THE COMPANY INTRODUCING THE EQUIPMENT:**

**Company:** AMPHICOM

**Address:** La Briquetterie – RN 113  
31450 MONTGISCARD  
FRANCE

**Person in charge:** M. MACKERN

**Present person during the tests:** M. DOMERG

**DATE OF TESTS:** The 16<sup>th</sup> October 2002

**TESTS LOCATION:** EMITECH open area test site in Aunainville (28)

**TESTS OPERATOR:** T. COLARD

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*Antenna factors, insertion losses and amplifier values.*

## **1. INTRODUCTION**

This document submits the results of Electromagnetic Compatibility tests performed on the equipment " **AQUA'FM TX PRO** " herein referred to as the EUT, according to the document listed below.

## **2. REFERENCE DOCUMENT**

### ***FCC PART 15 Edition 2002***

Code of Federal Regulations  
Title 47- Telecommunication  
Chapter 1- Federal Communication Commission  
Part 15- Radio frequency devices  
Subpart C- Intentional Radiators

## **3. EQUIPMENT UNDER TEST (EUT) CONFIGURATION**

See photographs next page.

See customer's questionnaire in annex.

See antenna factors, insertion losses and amplifier values in annex.

Modification of the equipment during the tests: No

*Photographs of the equipment under test (EUT)*



#### 4. SUMMARY OF TEST RESULTS

The following table summarizes test results of the EUT.

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
Intentional radiated emissions in the band 49.82 MHz - 49.90 MHz	✓				Section 15.235
Modulation bandwidth in the band 49.82 MHz - 49.90 MHz	✓				Section 15.235
Unintentional radiated emissions in the band 30 MHz - 1 GHz	✓				Section 15.209
Conducted emissions on AC mains ports			✓		Section 15.207

N.A.: Not Applicable

N.P.: Not Performed

The tested sample " **AQUA'FM TX PRO** " complies with the requirements of the standard:

- FCC PART 15 Edition 2002

according to the limits specified in the present report.

## 5. INTENTIONAL RADIATED EMISSIONS IN THE BAND 49.82 MHZ - 49.90 MHZ

**Standard:** FCC PART 15 Edition 2002

**Test method:** Section 15.235

### **Equipment under test arrangement**

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1m and 4m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the table on the next page. Only the highest level is recorded.

### **Test configuration photographs:**





**Frequency range:** 49.82 MHz - 49.82 MHz

**Detection mode:** Average

**Resolution bandwidth:** 120 kHz

**Measurement distance:** 10 meters.

**Limit:**

10.000  $\mu\text{V/m}$  or 80  $\text{dB}\mu\text{V/m}$  at 3 meters corresponding to 70  $\text{dB}\mu\text{V/m}$  at 10meters.

**Operating mode during the test:**

The transmitter is in permanent emission without modulation.

**Instrumentation test list:**

Meter	NrEmitech	Category	Mark	Type
187	3/16/12/004	OATS	Emitech	Site champ libre
317	3/24/18/051	Biconical antenna	Schwarzbeck	30/300 MHz
1057	1/02/18/045	Receiver	Rohde & Schwarz	ESVP
2341	4/19/00/018	Antenna mast	HD GmbH	MA 240
2342	4/19/00/019	Mast controller	HD GmbH	HD 100

**Results:**

FREQUENCY (MHz)	ANTENNA POLARIZATION	ANTENNA HEIGHT (cm)	AZIMUTH (degrees)	MEASURE MENT (dB $\mu$ V/m)	LIMIT (dB $\mu$ V/m)	MARGIN (dB)
49.86	Vertical	100	0	68.5	70.0	1.5

**Observation during the test:**

The equipment complies with the requirements of the standard FCC PART 15.235 Edition 2002

## 6. MODULATION BANDWIDTH IN THE BAND 49.82 MHZ - 49.90 MHZ

**Standard:** FCC PART 15 Edition 2002

**Test method:** Section 15.235

### **Equipment under test arrangement:**

The equipment under test (EUT) is placed near an antenna which is connected to a spectrum analyzer.

**Frequency range:** 49.82 MHz - 49.82 MHz

**Detection mode:** Peak

**Resolution bandwidth:** 100 Hz

### **Limit:**

The modulation bandwidth at 26 dB under the level of the unmodulated carrier must be contained in the frequency band allowed.

### **Operating mode during the test:**

The transmitter is in permanent emission with a musical modulation because it is the worst case for this measurement.

### **Instrumentation test list:**

Meter	Nr Emitech	Category	Mark	Type
187	3/16/12/004	OATS	Emitech	Site champ libre
317	3/24/18/051	Biconical antenna	Schwarzbeck	30/300 MHz
2205	1/02/18/068	Spectrum analyzer	Agilent	E7405A

**Results:**

The modulation bandwidth at 26 dB under the level of the unmodulated carrier is occupying the frequency band 49.8424 MHz - 49.8769 MHz.

**Observation during the test:**

Results of these measurements show that the EUT is in compliance with the requirements of the standard FCC Part 15.235 Edition 2002

## **7. UNINTENTIONAL RADIATED EMISSIONS IN THE BAND 30 MHZ - 1 GHZ**

**Standard:** FCC PART 15 Edition 2002

**Test method:** Section 15.209

### **Equipment under test arrangement:**

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the tables on the next pages.

### **Test configuration photographs:**

Same as chapter 5

**Frequency range:** 30 MHz - 1 GHz

**Detection mode:** Quasi-peak

**Resolution bandwidth:** 120 kHz

**Measurement distance:** 10 meters

**Limit:** The EUT must satisfy emission requirements of the standard 15.209 as shown in table below.

Frequency range (MHz)	Quasi-peak (dB $\mu$ V/m)
30 to 88	30.0
88 to 216	33.5
216 to 960	36.0
Above 960	44.0

**Operating mode during the test:**

The transmitter is in permanent emission without modulation.

**Instrumentation test list:**

Meter	NrEmitech	Category	Mark	Type
187	3/16/12/004	OATS	Emitech	Site champ libre
317	3/24/18/051	Biconical antenna	Schwarzbeck	30/300 MHz
1057	1/02/18/045	Receiver	Rohde & Schwarz	ESVP
1282	3/24/18/224	Log-periodic antenna	Schwarzbeck	UHALP 9107
2341	4/19/00/018	Antenna mast	HD GmbH	MA 240
2342	4/19/00/019	Mast controller	HD GmbH	HD 100

**Results:**

Table reference	Comments
Table 1	Measurement in vertical polarization
Table 2	Measurement in horizontal polarization

**Observation during the test:**

Results of these measurements show that the EUT is in compliance with the requirements of the standard FCC Part 15.209 Edition 2002

TEST SITE: Open area test site

**TABLE 1**

RADIATED EMISSION: Electric field

STANDARD: FCC Part 15 Edition 2002

TEST DISTANCE: 10 m

POLARIZATION: Vertical

MODEL: AQUA'FM TX PRO

<b>FREQUENCY (MHz)</b>	<b>ANTENNA HEIGHT (cm)</b>	<b>AZIMUTH (degrees)</b>	<b>MEASUREMENT (dB<math>\mu</math>V/m)</b>	<b>LIMIT (dB<math>\mu</math>V/m)</b>	<b>MARGIN (dB)</b>
46.74	100	300	20.3	30.0	9.7
648.16	360	210	31.9	36.0	4.1

No significant frequency has been found other than those given above between 30 MHz and 1 GHz.

TABLE 2

TEST SITE: Open area test site

RADIATED EMISSION: Electric field

STANDARD: FCC Part 15 Edition 2002

TEST DISTANCE: 10 m

POLARIZATION: Horizontal

MODEL: AQUA'FM TX PRO

<b>FREQUENCY (MHz)</b>	<b>ANTENNA HEIGHT (cm)</b>	<b>AZIMUTH (degrees)</b>	<b>MEASUREMENT (dB<math>\mu</math>V/m)</b>	<b>LIMIT (dB<math>\mu</math>V/m)</b>	<b>MARGIN (dB)</b>
648.16	220	290	30.4	36.0	5.6

No significant frequency has been found other than those given above between 30 MHz and 1 GHz.

# *ANNEX 1*

## *Customer's questionnaire*

*(2 pages)*

### Section 1 - Equipment under test:

Designation : AQUA' FM TX PRO .....

Type (or commercial reference): ABL005A00P5000 .....

Serial number : 02-41 007 .....

Manufacturer: TFE .....

Address: ZI du Canal .....

31450 MONTGISCARD - FRANCE.....

Company introducing the equipment: AMPHICOM .....

Address: 'La Briqueterie' RN113.....

31450 MONTGISCARD.....

FRANCE.....

Name of the Person in charge of the Product: K MACKERN .....

State of development:  prototype  pre-serial  serial

Power Supply : (If several types , indicate each of them)

single phase Voltage: ..... Vac

three phases Voltage: ..... Vac

continuous Voltage: 6..... Vdc

AC/DC adapter Voltage: ..... Vac / ..... Vdc

Power  greater than 1kW

less than 1kW

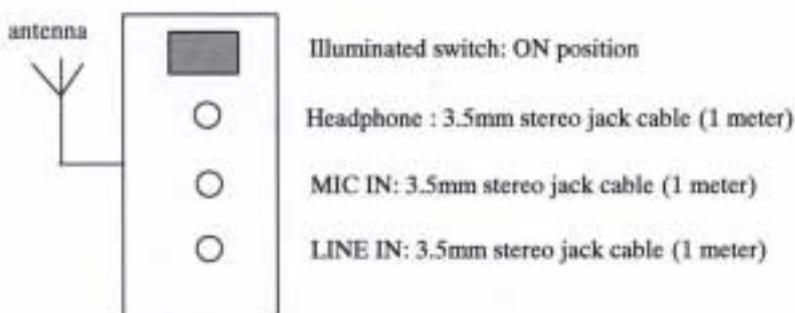
Equipment for professional use only

Equipment other than lighting appliances with power < 75W

Dimensions : (height x length x width in cm) : 15 x 20 x 3.5cm without antenna – antenna length 40cm ..

### Section 2 – Schematic of the configuration & Interconnection cables:

Please draw the product configuration with all cables that might be connected to it, and indicate cables length :



Please list all interconnection cables <sup>(1)</sup> and their characteristics (recommended max. length, type ... ) :

See list above .....

(1) Cables likely to be connected to the equipment ( not only those provided by the manufacturer )

**Section 3 : Control procedure to be used during immunity tests**

This section describes how it's possible to verify if the equipment is working correctly during the tests.

Procedure (description of the implementation of control means):

- 1. Check if the led is flashing. If not, put the switch in ON position.....
- 2. Connect an audio source (walkman for example) in LINE IN input. With a FM receiver (49.86MHz), check the audio signal received.

.....  
.....  
.....

List of equipment used to realize the control according to the procedure above (except adverse information, equipments allowing to verify the acceptance criteria are dependent on the customer )

Audio source

FM receiver.....  
.....  
.....  
.....

**Important:** During immunity tests, it might be necessary to protect the control equipments from the disturbances applied during the test. Accordingly, interconnection cables length should be at least 5 m. In case of impossibility, contact us about this.

---

**Section 4 : Susceptibility criteria**

In this section, please indicate which function(s) must not be damaged (or which is the maximum allowed level in terms of loss of performances ) when the equipment is disturbed:

By a continuous disturbance (electrical field, radiated or conducted, for example)

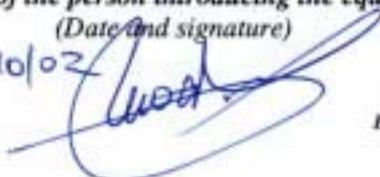
No operation change during disturbance applying.....  
.....  
.....  
.....

By a transient disturbance (electrostatic discharge for example)

After disturbance applying, no operation change  
.....  
.....  
.....

I assess that the informations included in this questionnaire are right.

**Signature of the person introducing the equipment:**  
(Date and signature)

24/10/02 

# *ANNEX 2*

*Antenna factors, insertion losses and amplifier values*

*(3 pages)*

## BILL OF MATERIAL

The test antenna used for the radiated emission between 9 kHz and 30 MHz is the active loop antenna n°315 referenced 3/24/18/049. Antenna factors are given in table 1.

The test antenna used for the radiated emission between 30 MHz and 300 MHz is the biconical antenna n°317 referenced 3/24/18/051. Antenna factors are given in table 2.

The test antenna used for the radiated emission between 300 MHz and 1 GHz is the log-periodic antenna n°1282 referenced 3/24/18/224. Antenna factors are given in table 3.

The measuring receiver n°1057 referenced 1/02/12/045 used in the frequency range 30 MHz to 1 GHz has an integrated preamplifier.

The test cable used between 9 kHz and 1 GHz to connect the antennas to the receiver/analyzer for measurements at a distance of 10 meters has losses given in table 4.

The test antenna used for the radiated emission between 1 GHz and 12 GHz is the horn antenna n°941 referenced 3/24/18/149. Antenna factors are given in table 5.

The amplifier n°1960 referenced 3/01/12/092 and its cable used to connect the spectrum analyzer to the test cable has gain values given in the table 6.

The test cable used between 1 GHz and 12 GHz to connect the horn antenna to the amplifier for measurements at a distance of 3 meters has losses given in table 7.

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
0.01	21.5	1	20.4
0.015	20.9	1.5	20.7
0.02	20.4	2	20.5
0.03	20.7	3	20.2
0.05	20.1	5	19.9
0.075	19.8	8	19.9
0.1	19.9	10	19.6
0.15	19.7	15	19.1
0.2	20.3	20	20.1
0.3	20.8	25	20.8
0.5	20.8	30	22.3
0.75	20.3	/	/

TABLE 1 : ACTIVE LOOP ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
30	19.3	120	13.7
35	15.9	125	14.1
40	14.5	140	14.2
45	14.3	150	14.1
50	10.5	160	15.7
60	9.2	175	16.5
70	6.5	180	17.3
80	7.8	200	17.2
90	8.5	250	18.3
100	9.7	300	20.2

TABLE 2 : BICONICAL ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
300	16.0	700	21.9
400	16.8	800	21.9
500	19.1	900	23.2
600	21.6	1000	24.4

TABLE 3 : LOG-PERIODIC ANTENNA

Frequency (MHz)	loss (dB)	Frequency (MHz)	loss (dB)
0.01	0.2	125	1.3
0.1	0.4	140	1.3
1	0.5	150	1.2
10	0.6	160	1.6
30	0.7	180	1.6
35	0.8	200	1.6
40	0.8	250	1.8
45	0.9	300	2.1
50	0.8	400	2.4
60	1.0	500	2.7
70	1.0	600	3.1
80	1.1	700	3.5
90	1.2	800	3.7
100	1.3	900	3.9
120	1.2	1000	4.3

TABLE 4 : TEST CABLE FOR 10M MEASUREMENT

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
1.0	24.5	7.0	37.3
1.5	26.9	7.5	38.1
2.0	29.1	8.0	38.3
2.5	30.1	8.5	38.7
3.0	31.9	9.0	39.1
3.5	32.5	9.5	39.2
4.0	33.7	10.0	39.4
4.5	33.6	10.5	39.5
5.0	34.9	11.0	39.7
5.5	35.7	11.5	40.1
6.0	36.0	12.0	40.1
6.5	36.2	/	/

TABLE 5 : HORN ANTENNA

Frequency (GHz)	Gain value (dB)	Frequency (GHz)	Gain value (dB)
1.0	43.9	7.0	34.7
1.5	44.7	7.5	34.2
2.0	45.3	8.0	35.2
2.0	34.6	8.0	30.5
2.5	36.3	8.5	30.8
3.0	34.1	9.0	31.3
3.5	34.6	9.5	31.1
4.0	35.4	10.0	30.7
4.5	34.8	10.5	29.5
5.0	35.3	11.0	30.3
5.5	35.2	11.5	31.0
6.0	35.3	12.0	29.8
6.5	34.9	/	/

TABLE 6 : AMPLIFIER (1-2GHz/2-8GHz/8-12GHz) + 2M CABLE

Frequency (GHz)	loss (dB)	Frequency (GHz)	loss (dB)
1.0	5.3	4.5	11.2
1.5	6.4	5.0	12.0
2.0	7.4	6.0	12.8
2.5	8.3	8.0	15.8
3.0	9.0	10.0	17.6
3.5	9.2	12.0	18.9
4.0	10.5	/	/

TABLE 7 : TEST CABLE FOR 3M MEASUREMENT