Report On

Limited FCC Testing of the
Funk-Electronic Piciorgros GmbH F.E.P TMO-100
In accordance with FCC CFR 47 Part 15B

COMMERCIAL-IN-CONFIDENCE

FCC ID: TO9TMO100

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REPORT ON

Limited FCC Testing of the
Funk-Electronic Piciorgros GmbH F.E.P TMO-100
In accordance with FCC CFR 47 Part 15B

Document 75915769 Report 01 Issue 2

January 2013

PREPARED FOR

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PREPARED BY

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APPROVED BY

Mark Jenkins
Authorised Signatory

DATED 14 January 2013

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 15B. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

G Lawler

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Product Service

SECTION 1

REPORT SUMMARY

Limited FCC Testing of the
Funk-Electronic Piciorgros GmbH F.E.P TMO-100
In accordance with FCC CFR 47 Part 15B

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1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Limited FCC Testing of the Funk-Electronic Piciorgros GmbH F.E.P TMO-100 to the requirements of FCC CFR 47 Part 15B.

Objective	To perform Limited FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Funk-Electronic Piciorgros GmbH
Model Number(s)	TMO-100
Serial Number(s)	219
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 15B (2010) Although the testing was performed to 2010 issue we have checked and there is no additional testing required and so the testing can be considered to be compliant with the current 2012 issue.
Incoming Release Date	Application Form 28 January 2013
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	N/A – Paid upfront N/A
Start of Test	22 January 2012
Finish of Test	09 January 2013
Name of Engineer(s)	R Henley G Lawler

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1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 15B is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
Receiver				
2.1	15.107	AC Line Conducted Emissions	Pass	
2.2	15.109	Radiated Emissions	Pass	

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1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	TMO-100
Part Number	
Technical Description (Please provide a brief description of the intended use of the equipment)	TETRA modem for Data and Voice applications

POWER SOURCE					
☐	AC mains	State voltage			
AC supply frequency	(Hz)				
	VAC				
	Max Current				
	Hz				
☐	Single phase	☐	Three phase		
And / Or					
☒	External DC supply				
	Nominal voltage	12-24 V	Max Current	2	A
	Extreme upper voltage	30 V			
	Extreme lower voltage	9,6 V			
Battery					
☐	Nickel Cadmium	☐	Lead acid (Vehicle regulated)		
☐	Alkaline	☐	Leclanche		
☐	Lithium	☐	Other Details :		
	Volts nominal.				
End point voltage as quoted by equipment manufacturer		V			

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FREQUENCY INFORMATION				
Frequency Range	456 to470	MHz		
Channel Spacing (where applicable)	25kHz			
Test Frequencies*	Bottom	456	MHz	Channel Number (if applicable)
	Middle	463	MHz	Channel Number (if applicable)
	Top	470	MHz	Channel Number (if applicable)
If alternate test modes are available resulting in different test frequencies please specify which mode is applicable:				
POWER CHARACTERISTICS				
Maximum TX power	3W	W		
Minimum TX power		W (if variable)		
Is transmitter intended for :				
Continuous duty			☐ Yes	☐ No
Intermittent duty			☐ Yes	☐ No
If intermittent state DUTY CYCLE				
Transmitter ON	seconds			
Transmitter OFF	seconds			

ANTENNA CHARACTERISTICS				
☒	Antenna connector	State impedance	50	Ohm
☐	Temporary antenna connector	State impedance		Ohm
☐	Integral antenna	Gain		dBi

MODULATION CHARACTERISTICS			
☐	Amplitude	☐	Frequency
☐	Phase	☐	Other (please provide details):
Can the transmitter operate un-modulated?			☐ Yes ☐ No

CLASS OF EMISSION USED	
ITU designation or Class of Emission:	
	1
	(if applicable) 2
	(if applicable) 3
If more than three classes of emission, list separately:	

EXTREME CONDITIONS					
Extreme test voltages (Max)	30	V	Extreme test voltages (Min)	10	V
Nominal DC Voltage	12-24	V	DC Maximum Current	2	A
Maximum temperature	+70	°C	Minimum temperature	-20	°C

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature: Held on file at TUV Name: Michael Piciorgros

Position held: Company Officer Date: 28 January 2013

Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Funk-Electronic Piciorgros GmbH F.E.P TMO-100. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 18 V DC supply.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable standards or test plan were made during testing.

1.7 MODIFICATION RECORD

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: 219			
0	As supplied by manufacturer.	Not Applicable	Not Applicable
1	Software update. Zip file and test instructions sent by Marco Jakobs by email on 24/01/2012 at 15:21 to Maggie. Graeme followed email instructions to perform software update.	Graeme Lawler	24 January 2012

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

Product Service

SECTION 2

TEST DETAILS

Limited FCC Testing of the
Funk-Electronic Piciorgros GmbH F.E.P TMO-100
In accordance with FCC CFR 47 Part 15B

2.1 AC LINE CONDUCTED EMISSIONS

2.1.1 Specification Reference

FCC CFR 47 Part 15B, Clause 15.107

2.1.2 Equipment Under Test and Modification State

TMO-100 S/N: 219 - Modification State 1

2.1.3 Date of Test

9 January 2013

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

The EUT is set up on a test table 800mm above a horizontal ground plane. A vertical ground plane is also required and is placed 400mm from the EUT. Where a EUT is floor standing it will be stood on but insulated from the ground plane by up to 12mm.

The EUT is powered through a Line Impedance Stabilisation Network (LISN) which is bonded to the ground plane. The EUT is located so that the distance between the EUT and the LISN is no less than 800mm. Where possible the cable between the mains input of the EUT and the LISN is 1m. Where this is not possible the cable is non inductively bundled with the bundle not exceeding 400mm in length.

A preliminary profile of the Conducted Emissions is obtained over the frequency range 150kHz to 30MHz. Any points of interest are noted for formal measurements.

During formal measurements, the measuring receiver is tuned to the emission of interest where Quasi – Peak and Average measurements are performed in a 9kHz Video and Resolution Bandwidth.

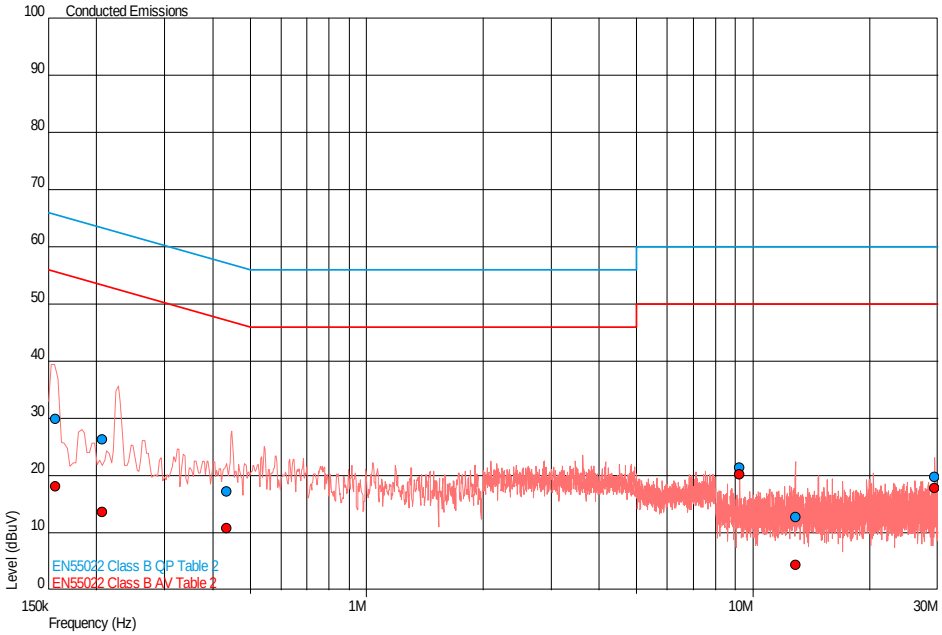
2.1.6 Environmental Conditions

Ambient Temperature	19.7°C
Relative Humidity	41.0%

Product Service

2.1.7 Test Results

Live Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.156	29.9	65.7	-35.7	18.2	55.7	-37.5
0.207	26.4	63.3	-36.9	13.6	53.3	-39.7
0.434	17.3	57.2	-39.9	10.8	47.2	-36.4
9.215	21.5	60.0	-38.5	20.2	50.0	-29.8
12.857	12.8	60.0	-47.2	4.4	50.0	-45.6
29.491	19.8	60.0	-40.2	17.8	50.0	-32.2

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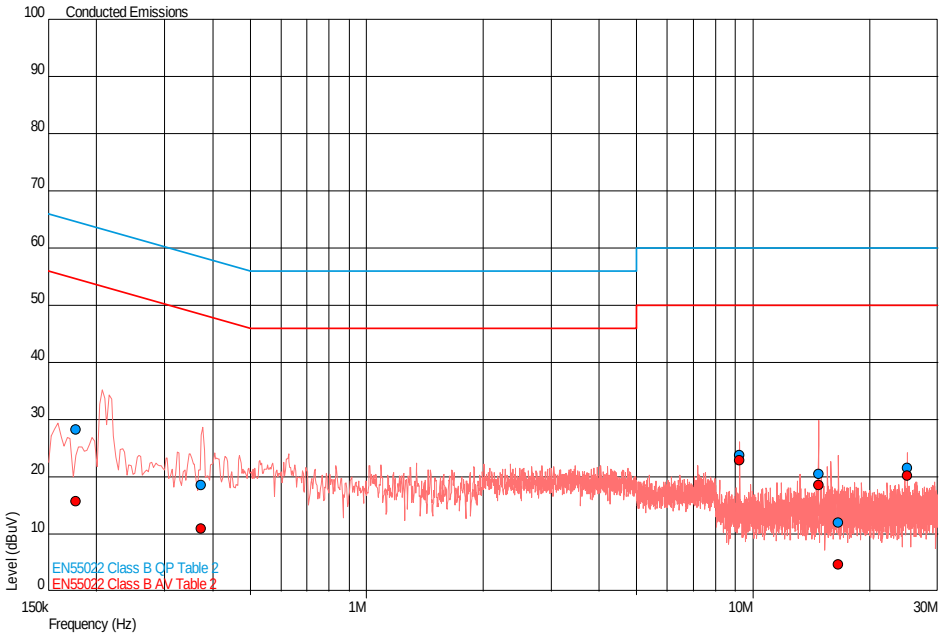
Neutral Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.177	28.3	64.6	-36.3	15.8	54.6	-38.8
0.373	18.6	58.4	-39.9	11.0	48.4	-37.4
9.215	23.8	60.0	-36.2	22.9	50.0	-27.1
14.747	20.5	60.0	-39.5	18.5	50.0	-31.5
16.640	12.0	60.0	-48.0	4.7	50.0	-45.3
24.999	21.6	60.0	-38.4	20.2	50.0	-29.8

Product Service

2.2 RADIATED EMISSIONS

2.2.1 Specification Reference

FCC CFR 47 Part 15B, Clause 15.109

2.2.2 Equipment Under Test and Modification State

TMO-100 S/N: 219 - Modification State 1

2.2.3 Date of Test

22 January 2012 & 24 January 2012

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

A preliminary profile of the Spurious Radiated Emissions is obtained up to the 5th harmonic of the EUT's highest internally generated fundamental frequency. For frequencies from 30MHz to 18GHz the EUT is placed on a test table 800mm above the ground plane. For frequencies above 18GHz, the EUT height is increased by 200mm to a height of 1000mm. This is to ensure the beam width of the measuring antenna gives sufficient vertical coverage of the EUT.

During characterisation the turntable azimuth is adjusted from 0 to 360 degrees with the measuring antenna in one polarity. It is then repeated for the other polarity. Any frequencies of interest are noted for formal measuring later. The distance from the measuring antenna to the boundary of the EUT is 3m. Above 18GHz this distance may be reduced to 1m.

During formal measurement the spectrum analyser is tuned to the frequency of the emission. The turntable azimuth is adjusted from 0 to 360 degrees to determine the point at which the maximum emission level occurs. Then the height of the measuring antenna is adjusted from a height of 1m to 4m to determine the height at which the maximum emission level occurs. Once the point of maximum emission has been determined the emission is measured. Emissions in the 30MHz to 1GHz range are measured using a CISPR Quasi – Peak detector function in a 120kHz bandwidth. Emissions in the range 1GHz to 40GHz require Peak and Average measurements. The Peak measurements are made using a peak detector with 1MHz Resolution and Video bandwidths. The average measurements employ a peak detector with a Resolution bandwidth of 1MHz and a Video bandwidth of 10Hz. If measurements are made at a 1m measuring distance, then 10dB is added to the specification limit.

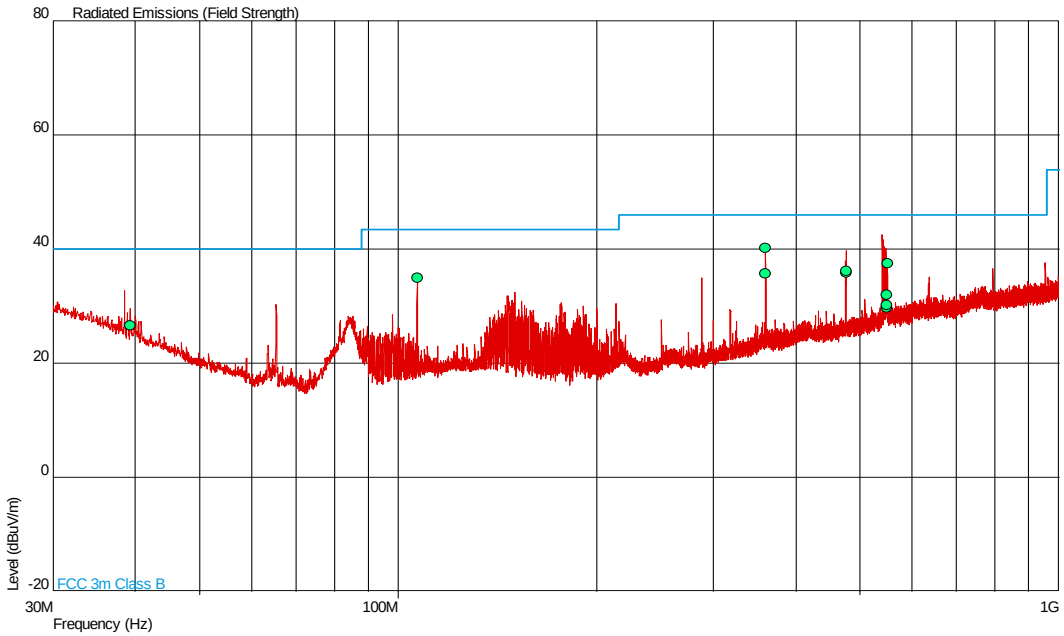
2.2.6 Environmental Conditions

Ambient Temperature	21.3°C
Relative Humidity	30.0 - 38.0%

Product Service

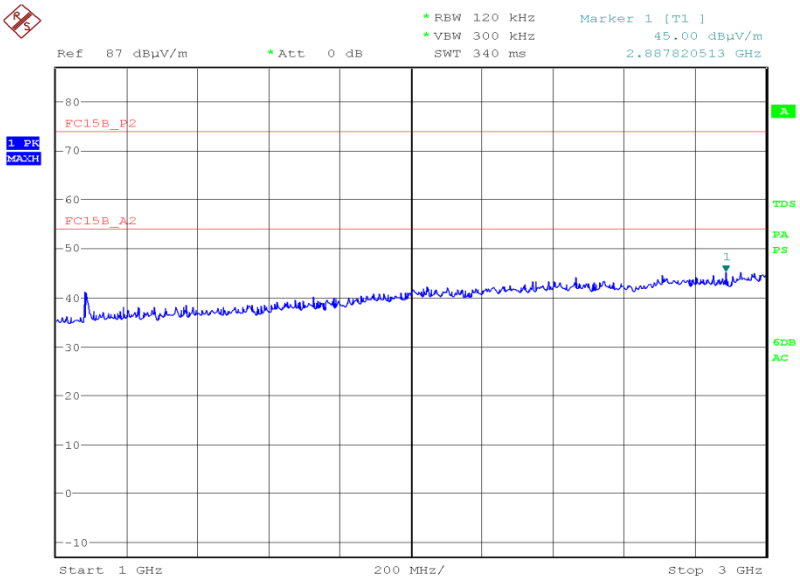
2.2.7 Test Results

30 MHz to 1 GHz



Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
39.326	26.7	21.6	40.0	100	-13.3	78.4	20	1.00	Vertical
106.890	35.0	56.2	43.5	150	-8.5	93.8	60	1.00	Vertical
359.990	40.2	102.3	46.0	200	-5.8	97.7	250	1.00	Horizontal
360.002	35.8	61.7	46.0	200	-10.2	138.3	172	1.03	Vertical
476.332	36.1	63.8	46.0	200	-9.9	136.2	147	1.00	Vertical
476.584	35.9	62.4	46.0	200	-10.1	137.6	321	2.54	Horizontal
549.012	29.8	30.9	46.0	200	-16.2	169.1	18	3.00	Vertical
549.610	32.1	40.3	46.0	200	-13.9	159.7	79	1.00	Horizontal
549.936	30.2	32.4	46.0	200	-15.8	167.6	295	1.00	Horizontal
550.010	37.5	75.0	46.0	200	-8.5	125.0	360	1.03	Vertical

1 GHz to 3 GHz



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SECTION 3

TEST EQUIPMENT USED

Product Service

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 – Conducted Emissions					
LISN (1 Phase)	Chase	MN 2050	336	12	23-Mar-2013
Transient Limiter	Hewlett Packard	11947A	1032	12	28-Jun-2013
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
Section 2.2 - Radiated Emissions					
Screened Room (5)	Rainford	Rainford	1545	36	3-Feb-2014
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	12-May-2013
Antenna (DRG Horn)	ETS-LINDGREN	3115	3125	12	27-Apr-2012
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	29-Sep-2012
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3703	-	TU
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	12	26-Aug-2012
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU

TU – Traceability Unscheduled

Product Service

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
Radiated Emissions	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB
AC Line Conducted Emissions	±3.2 dB

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SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Product Service

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

UKAS TESTING 0141

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).