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ERA
TECHNOLOGY

RADIOCOMMUNICATIONS TESTING DEPARTMENT

**RADIO PERFORMANCE MEASUREMENTS
ON THE REILOR DOG FLAP TRANSMITTER**

N A Coote

ERA Test Report 4211/540

Report approved by:



A J Maddocks

EMC Division Manager



September 1998
32/NAC/smi/lss-R3850.doc

Applicant:

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Applicant's Representative:

Ms Julie Jones

Applicant's Purchase Order:

4723

Description of Equipment Under Test: Transmitter for use with associated Dog Flap product

Serial Number

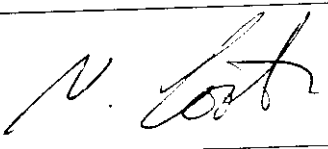
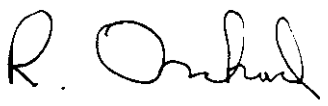
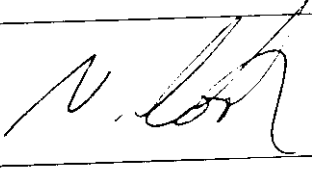
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Test Specification:

FCC Part 15, Subpart C

Test Dates:

9 September 1998

Test Engineer(s):	N A Coote	
Checked by Group Leader:	R Orchard	
Report written by:	N A Coote	

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Annex 1

List of Test Equipment

Annex 1 : List of Test Equipment

Description of Test Equipment	Plant Number	Calibration Due Date
Spectrum Analyser, HP8566B	B640B	1/12/98
Spectrum Analyser, Advantest R3271	B160B	26/5/99
Antenna, ERA Miniature Biconical	A424A	ClassD
Environmental Sensor	C101C	16/6/2000
Receiver, Chase UHR4000	A753A	5/2/99
Antenna, Chase Bilog	B626B	23/6/99
Cable, N Type	B885B	23/10/98
PreAmp, Marconi	B657B	5/12/98
Antenna, Emco horn	B106B	16/2/2000
Cable, N type Rosenburger	B540B	11/11/98
Cable, N type Rosenburger	B959B	12/11/98
Receiver, Rhode & Schwarz ESS	B941B	25/9/98
Antenna, Emco loop	B744B	17/6/2000

Annex 2

Photographs of EUT

FEATURES

- MINIATURE MODULE (7.5 x 11.5 X 4.5mm)
- SAW CONTROLLED FREQUENCY STABILITY
- NO ADJUSTABLE COMPONENTS.
- TRANSMITTING RANGE UP TO 100 METRES.
- CMOS/TTL COMPATIBLE INPUT.
- CURRENT CONSUMPTION 2.5mA (typ).
- SINGLE SUPPLY VOLTAGE 2.5 -12V.
- COMPATIBLE WITH R.F. SOLUTIONS AM RECEIVER.
- MPT1340 LICENCE EXEMPT.
- AVAILABLE AS EITHER 418MHz OR 433MHz.



APPLICATIONS

- CAR ALARM KEYFOBS
- REMOTE TRANSMITTER ENCODERS
- GARAGE DOOR OPENERS
- REMOTE GATE SYSTEMS

DESCRIPTION

The R.F. Solutions AM Transmitter module offers a miniature hybrid modular RF transmitter providing on-off keyed modulation, which can be used to transmit data from any standard CMOS/TTL source up to 1200 baud.

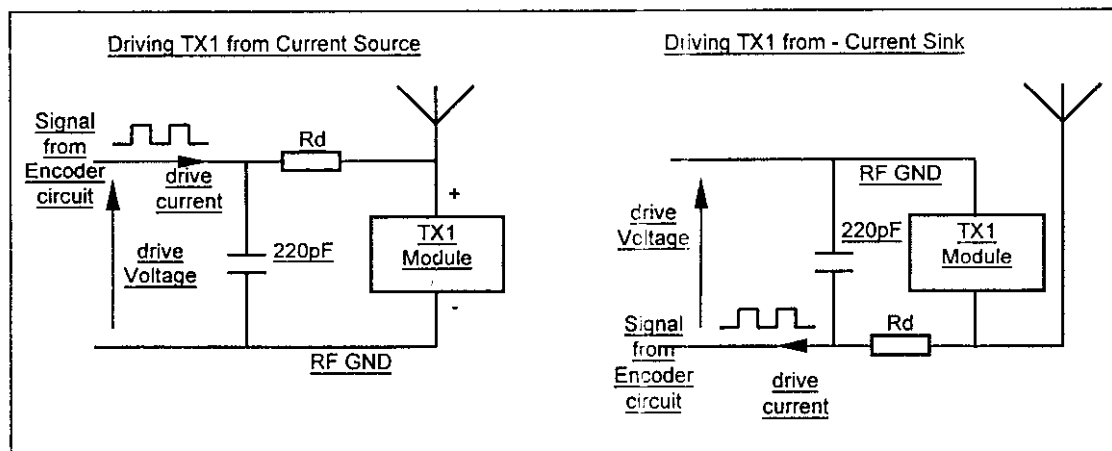
The module is very simple to operate, requiring only two connections (see application circuit below). The module is also very efficient, using only 2.3mA (typ) which means that it may be driven directly from an encoder I/C or microcontroller. The output impedance has been designed to give optimum performance when coupled with a small antenna such as a tuned loop or short whip.

The modules are compatible with the AM Receiver module (AM -HRX3-XXX).

The transmitter module is type approved to MPT1340 for use in general telemetry and telecommunications products, when used with the antenna as listed overleaf.

APPLICATION CIRCUIT

FCC ID: N2YNO51



The Micro TX is a Type Approved AM radio transmitter module operating at UHF frequencies. It is compatible with both low cost super-regenerative and AM superhet receivers. By providing excellent RF performance in a Type Approved module, the Micro TX minimises design costs and delays. The sub-miniature two-pin package ensures that the module can be fitted into any convenient space on the user's board. This makes it ideally suited to keyfob designs, where space is often limited due to the demand for ever more compact designs.

The unique design (Patent Pending) of this module allows operation on any supply voltage between 2.5 and 13V, simply by changing one external resistor. Users requiring high performance from a compact transmitter will appreciate the efficient operation of the module when driving a tuned loop or short whip antenna. Up to -6 dBm radiated power can be achieved with a 90 mm whip, just over half the length of the usual 1/4 wave antenna. It is compatible with most encoding ICs operating from 3V to 12V.

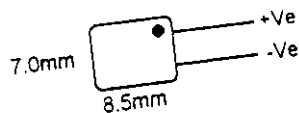
Features

Type Approved to MPT 1340
Ultra-compact two pin package
Wide supply voltage 2.5 to 13 V

Applications

Low cost key-fob designs
Car alarm "blippers"
Garage door openers
Lighting controls

Package Dimensions



Technical Specification

Ambient Temperature 20 ° C

Parameter	Min	Typical	Max	Units
Frequency (UK)	417.925	418.000	418.075	MHz
Frequency (Europe)	433.845	433.920	433.995	MHz
Module voltage	2.2		3.0	Volts
Supply voltage (RD = 100 ohms)	2.5		3.5	Volts
Supply voltage (RD = 2200 ohms)	8.8		13.1	Volts
Input current (mark)	3.0		4.6	mA
Input current (space)		0 mA		
Effective Radiated Power (ERP)		-6dBm		
Maximum baud rate		100	1200	bps
Range (with suitable receiver)		8.5 x 7.0 x 4.2	+/- 10%	Metres
Dimensions		5.08		mm
Pin Pitch	-10		+40	deg. C
Operating temperature	-40		+85	deg. C
Storage Temperature				
Patent Pending				

Antenna

Fig. 1 shows a typical circuit for a design using a printed circuit board (PCB) loop antenna. A 1 to 5pF ceramic trimmer is used to tune the loop for maximum output. Fig. 2 shows a typical board layout for a key fob style transmitter. The dimensions of the loop are not critical, but excessively small or large loops should be avoided, as these will affect antenna tuning and efficiency. The loop should enclose an area of about 700mm² using a PCB track width of 1.5-2.5mm. Alternatively 1-1.5mm tinned copper wire may be used to form the loop.

The module can also drive a short whip antenna by using the matching network as shown in the circuit diagrams. The whip can be a wire rod or PCB track of about 90mm length. The inductor can be a 15nH surface mount inductor or an air cored solenoid of 0.8mm ID, close wound with 9 turns of 0.56mm enamel covered wire. A trimming capacitor of 1.5-5pF will generally be adequate.

When using a printed antenna on the PCB, always specify a good quality fibreglass base material. Lower cost materials such as SRBP (paper) will cause excessive losses at UHF. For printed circuit board aerials the variable trimmer capacitor can be replaced with two fixed value capacitors in series allowing intermediate values of capacitance to be obtained. The aerial should then be tuned for resonance to determine the values of the capacitors. However the variable capacitor is preferable if maximum output power and therefore range is required for all production transmitters.

Circuit Board Layout and Decoupling

In order to achieve satisfactory RF performance, good PCB layout practice should be observed. The loop antenna should be free of any components or tracks except for the module and the tuning capacitor. All aerials radiate more efficiently against ground planes and the PCB should therefore be "flooded" with copper in the areas not being used for the aerial. Double sided PCBs can provide extra area for ground planes and the top and bottom ground plane layers should be generously connected with vias. Always use ceramic capacitors to decouple the supply at RF.

CMOS ICs can be susceptible to local RF fields and the use of the above techniques minimises this possibility. Do not use stripboard for prototypes as results may be misleading.

Power Supply

The Micro Tx can be matched to any power supply voltage by varying the resistor in series with the module. The module typically requires an operating current of 4mA and drops 2.5V across it. The required series resistor can thus be easily calculated by Ohms Law, alternatively the following table can be used. As it is a two pin device it can be driven from either a current source or a current sink. However, ensure that the encoding device can source or sink sufficient current, and be aware that if "sinking" current the transmitter is "on" when the output is low, thus inverting the data if using standard encoders.

Supply Voltage		Resistor Value
Min	Max	
-1.0	0.5	Off
2.5	3.5	100
2.8	4.0	220
3.2	4.5	330
3.6	5.2	470
4.2	6.1	680
5.2	7.6	1k
6.7	9.9	1k5
8.8	13.1	2k2

For operation at low voltages (<3V) a 100uH RF choke should be placed in series with Rd. This minimises RF energy being absorbed by low impedance drive circuitry.

Fig.1 Application Circuits

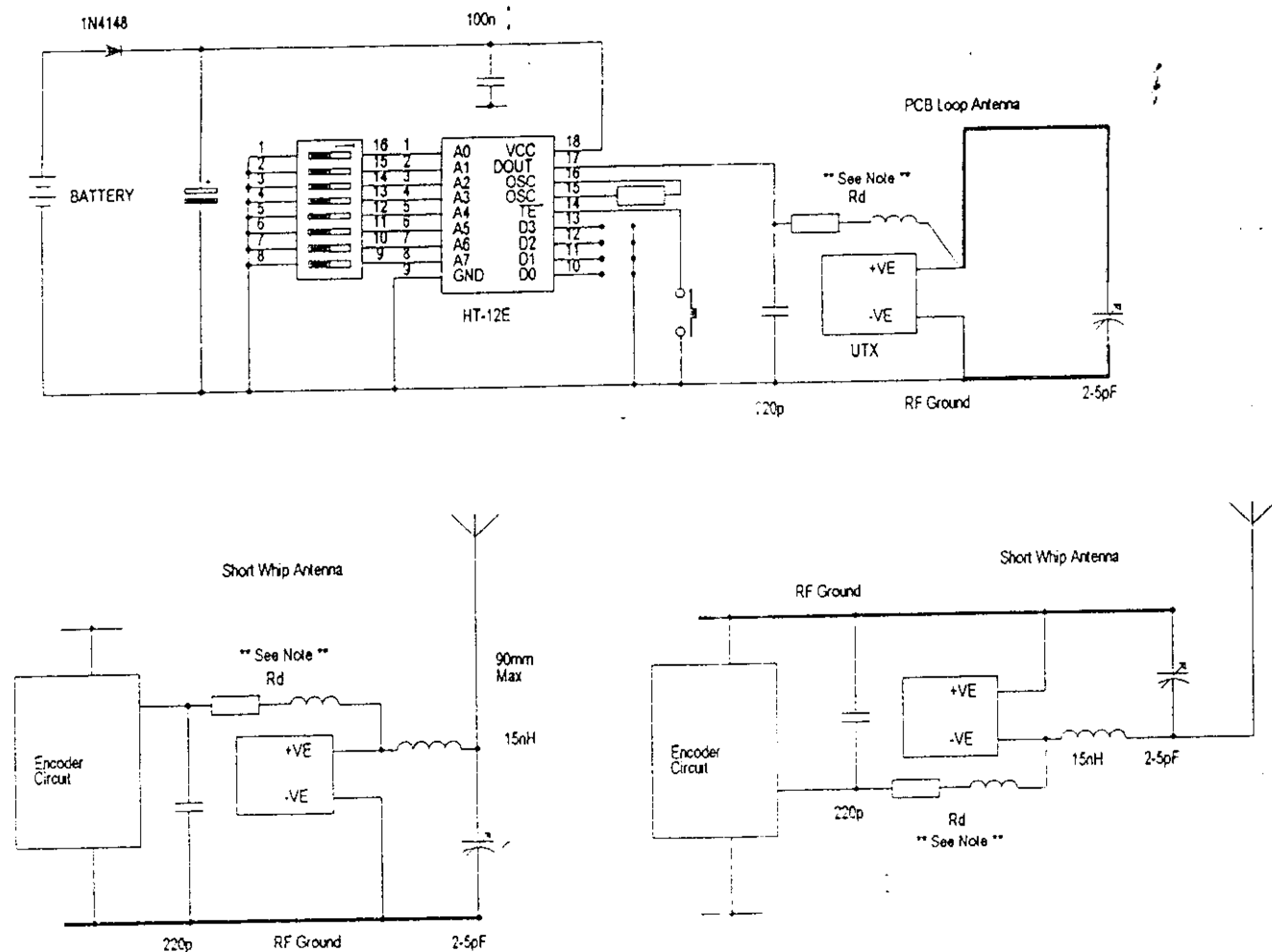
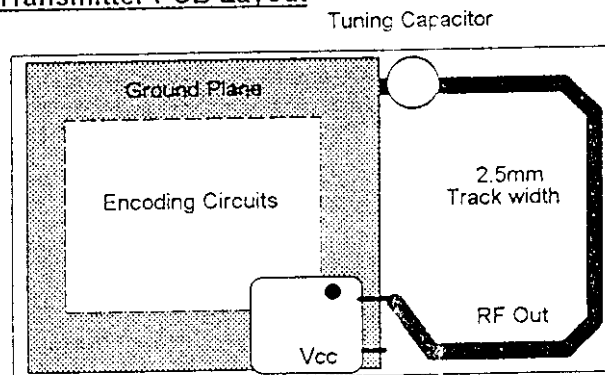


Fig.2 Typical Tuned Loop Transmitter PCB Layout



Notes

The Transmitter module should ideally be placed over the ground plane as shown. The loop aerial should be completely clear of the ground plane and all other components. Do not place other components within the loop area.

For operation at low voltages (<3V) a 100uH RF choke should be placed in series with Rd. This minimises RF energy being absorbed by low impedance drive circuitry.

A variable tuning capacitor is preferable to one, or two fixed capacitors in series, if maximum output power is required for all production transmitters. This allows for various tolerances in the device.

MPT 1340 Requirements (UK only)

MPT 1340 is the appropriate Type Approval specification issued by the Radio Agency (DTI) and copies may be obtained from the RA's library service on 0171 211 0211.

The Type Approval number for this device is : **12321**

Users should be aware of the following requirement:

"The equipment in which the module is used must carry an inspection mark located on the outside of the equipment and be clearly visible. The minimum dimensions of the inspection mark shall be 10 x 15 mm and the letter and figure height must be no less than 2mm. The wording shall read " MPT 1340 W.T. LICENCE EXEMPT ".

Example Label:

<p>MPT 1340 W.T. Licence Exempt Type Approval No: 12321</p>

MPT1340 also states that: *"All transmitters shall use integral antennas only. In this specification an integral antenna is defined as one which is designed to be connected **permanently** to the transmitter or receiver without the use of an external feeder. Receivers may use an external antenna or an integral antenna.*

RADIO PERFORMANCE MEASUREMENTS ON THE REILOR DOG FLAP TRANSMITTER

1 INTRODUCTION

The transmitter has been tested by ERA Technology on behalf of Reilor Ltd. The sample was tested to the relevant performance specification published by the FCC. This report contains the results of these tests.

1.1 Test Environment

The tests were performed in the Radiocommunications Testing Department at ERA Technology's laboratories in Leatherhead. The sample was subjected to the ambient conditions in the laboratory. The temperature and relative humidity recorded during the period of each test are given in the results.

1.2 Test Equipment

A list of test equipment is given in Section 4 together with calibration dates. The equipment is regularly calibrated to comply with NAMAS requirements for traceability to National Standards.

1.3 Configuration of Test Sample

The sample consisted of a transmitter which is activated by a motion sensor. This is operated by the movement of the dog. For the purposes of testing the motion sensor was disabled, thus allowing the transmitter to operate continuously.

In normal operation the transmitter stops transmitting after 4.5 seconds.

The transmitter timing is such that it transmits for 67 ms every 1.12 s. Each transmitted burst contains an identity code.

1.4 Test Power Sources

The transmitter was powered by two internal 3 V batteries.

1.5 Measurement Uncertainty

All measurement uncertainties stated in this report are estimated to a 95% confidence level.

Product Order Codes

Part No	Description
LQ-TX418A-S	Transmitter Module 418MHz
LQ-TX433A-S	Transmitter Module 433MHz

Document History

Issue	Date	Revision
1.0	Nov 96	Preliminary
1.1	Jan 97	Minor corrections
1.2	Mar 97	Package dimensions modified
1.3	Aug 97	Application circuits clarified
1.4	Apr 98	Change of address, font size increased.
1.5	Apr 98	Series choke & notes added

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Fig.1 Application Circuits

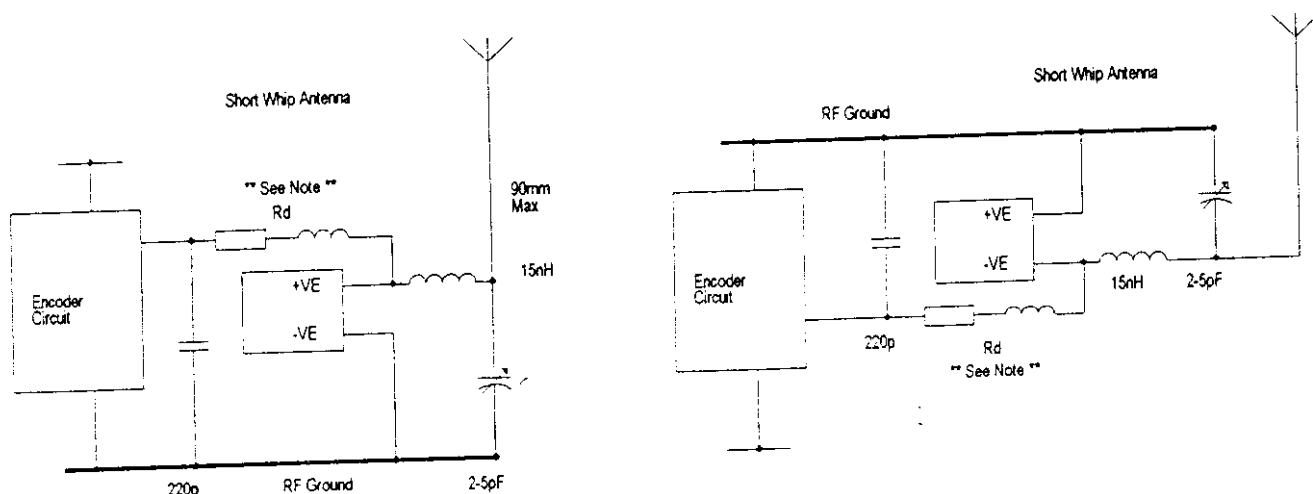
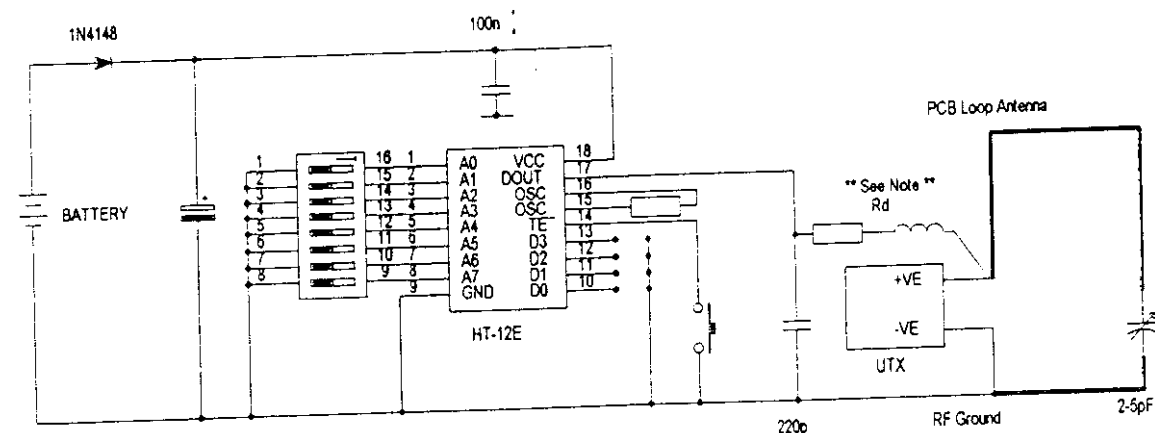
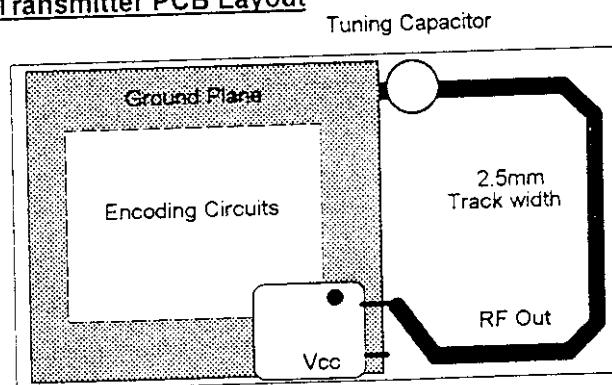


Fig.2 Typical Tuned Loop Transmitter PCB Layout



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A variable tuning capacitor is preferable to one, or two fixed capacitors in series, if maximum output power is required for all production transmitters. This allows for various tolerances in the device.

2 EMISSION MEASUREMENT RESULTS

2.1 Radiated Spurious Emissions

Reference Paragraph 15.231

All measurements made at 3m, using a peak detector.

Open area site conditions: temperature 23°C; relative humidity 62%

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)
867.8	38.8	62
Measurement uncertainty ± 4.5 dB		

Anechoic Chamber conditions: 21°C; relative humidity 58%

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)
1301.8	35.1	62
1735.4	38.8	62
2169.3	30.3	62
2603.2	52.7	62
Measurement uncertainty ± 4 dB		

2.2 Radiated Carrier Field Strength

Open area site conditions: temperature 21°C; relative humidity 45%

Frequency (MHz)	Carrier Field Strength (dBuV/m)	Limit (dBuV/m)
433.9	55.1	80.8
Measurement uncertainty ± 4.5 dB		

2.3 Bandwidth

The bandwidth was measured in accordance with section 15.231(c) and was recorded as 19.6 kHz.
The limit is 1.08 MHz.