MEASUREMENT/TECHNICAL REPORT

FCC Part 15 Sections 15.109,15.209 & 15.225

Honeywell

FCC ID: HS9-RTU-L12

October, 19th, 2005

This report concerns (check one): Original grant __X__ Class II change____

Equipment type: ACCESS CONTROL TERMINAL (ex.: computer, printer, modem, etc.)

Deferred grant request per 47 CFR 0.457(d)(1)(ii)? yes _____ no __X__

If yes, defer until: _____
date

Company Name agrees to notify the Commission by _____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by: Giuseppe MECCHIA

TÜV ITALIA S.R.L.
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1 GENERAL INFORMATION

1.1 Product Description

The RTU-L12 is a mono antenna proximity reader for access control and time & attendance applications.

The module is based on a 10MHz FT3150 Neuron Chip + FTX1 trasformer & the MFRC531 philips chip; the module also provides:

- 2 balanced input lines
- 1 Open collector output for electro lock
- 1 Open collector output for lamp
- 1 buzzer
- 1 led Tricolor (green / red / yellow)
- 1 reed contact (service LED)
- 1 anti-removal & anti-opening contact

- Working temperature: -20 to +60 °C
- IP = 55
- Card reading: ISO14443A & B
- Card distance reading: 4,0cm for Type ISO14443-A / 3,0cm for Type ISO14443-B

The RTU-L12 terminal has a couple of multi-color LED and a buzzer to signal messages to the user.
The RTU-L12 terminal communicates with the controller (CTU-A04) via an Echelon LonWorks™ network at a speed of 78 Kbps. The RTU-L19 terminal is powered by a DC 12V (+/-2V) power supply (provided by RTU-Q01).

Note1: LonWorks™ is a registered trademark of Echelon™ Corporation
Note2: A specific sales name is assigned to RTUL12: TKL012

From an FCC point of view the EUT in an intentional radiator (13.56MHz tranceiver) mounted inside a class B verified equipment. According to customer request this approval will cover the complete unit and therefore the FCC ID code will be place directly on case of the terminal.

1.2 Related Submittal(s)/Grant(s)

None

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

Model & Serial No.	FCC ID	Description	Cable Descriptions
RTU-L12 (1) s/n EMC-2005-284	**HS9-RTU-L12**	**Access control Terminal**	**Unshielded power cord Unshielded signal cables**
RTU-Q01 S/n EMC-2001-286	Verified	Power supply	Unshielded power cord Unshielded signal cables
CTU-A04 S/n 1520096CA	Verified	Controller	Unshielded power cord Unshielded signal cables
I/O simulator s/n none	n.a.	I/O Simulator	Unshielded signal cables

(1) EUT submitted for grant.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the ANSI C63.4-2003 test procedures . Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

TÜV ITALIA test site No. 2 – Open field

The open field test site and conducted measurement facility used to collect the radiated data are located at Via Montalenghe 12, Scarmagno, Italy. This site has been fully described in a report dated May 14, 2003 submitted to your office, and accepted in a letter dated May 16, 2003 (registration Number: 90860)

By a decision of the Joint Committee of the EU-US Mutual Recognition Agreement, TUV ITALIA has been listed under the Sectoral Annex on Electromagnetic Compatibility as Conformity Assessment Body (CAB)

This decision is effective from 20 September 2002.

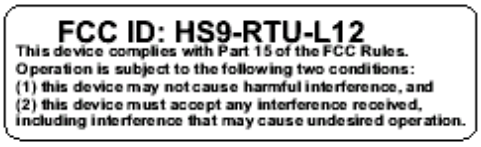
1.6 Test equipment list:

Description	Model	serial No.	Cal due date
Test receiver	Rohde & Sch. ESH3	s/n 881364/012	03/06
Test receiver	Rohde & Sch. ESVS 30	s/n 829007/004	05/06
LISN	Schwarzb.NNLK 8121	s/n 8121-219	03/06
Loop antenna	Rohde & Schwarz HFH2-Z2	s/n 881058/6	09/06
Biconical Antenna	EMCO 3110	s/n 1735	06/06
Log-Periodic Antenna	EMCO 3146	s/n 3678	06/06

2 PRODUCT LABELING

Figure 2.1 FCC ID Label

See attached file: Label.pdf



Dimension 42x12mm
angle radius 2mm

Material: 3M Adhesive white Polyester with black indelible ink

Figure 2.2 Location of the Label on EUT

See attached file: label_location.jpg

3 SYSTEM TEST CONFIGURATION

3.1 Justification

The EUT was configured for testing in a typical fashion (as a customer would normally use it).
In order to simulate a real application , the EUT has been connected to a power supply, and a controller and operated according to normal use. (see Figure 3.1).

The EUT has been tested in both vertical and horizontal position simulating real operating placement:
- vertical on walls and doors and
- horizontal on turnstiles and pedestal surfaces.

Worst case for transmitter emissions has been determined to be the vertical position.

Conducted emission testing was performed on the power mains cord of the power supply RTU-Q01.

3.2 EUT Exercise Software

The Philips chip MFRC531 continuously sends bursts at 13,56Mhz to the antenna and acquires back (form the same antenna coil) any modulation on the transmitted carrier. If a card with a RF-TAG is placed near the RTU-L12 antenna, the 13,56MHz wave on the coil energises the TAG. The TAG then modulate the 13,56KHz with an encoded frame that include the identification code. That frame is then decoded by the MFRC531 chip that sends the information via a parallel interface.
The informations are then sent to the controller (CTU-A04) via the LonWorks™ network message. When the controller receives that message, it verifies the access rights of the user. If the cardholder has the correct access rights, it sends a message to the RTU-L12 in order to switch on the output that opens the door. Meanwhile, a specific message is sent to the RTU-L12 in order to provide a specific message (i.e. Green=”Access granted”, Red long=”Access forbidden”, Red short=”Invalid card”, etc) and turn on the LEDs (green/red) and buzzer accordingly.

Note: LonWorks™ is a registered trademark of Echelon™ Corporation

3.3 Special Accessories

None.

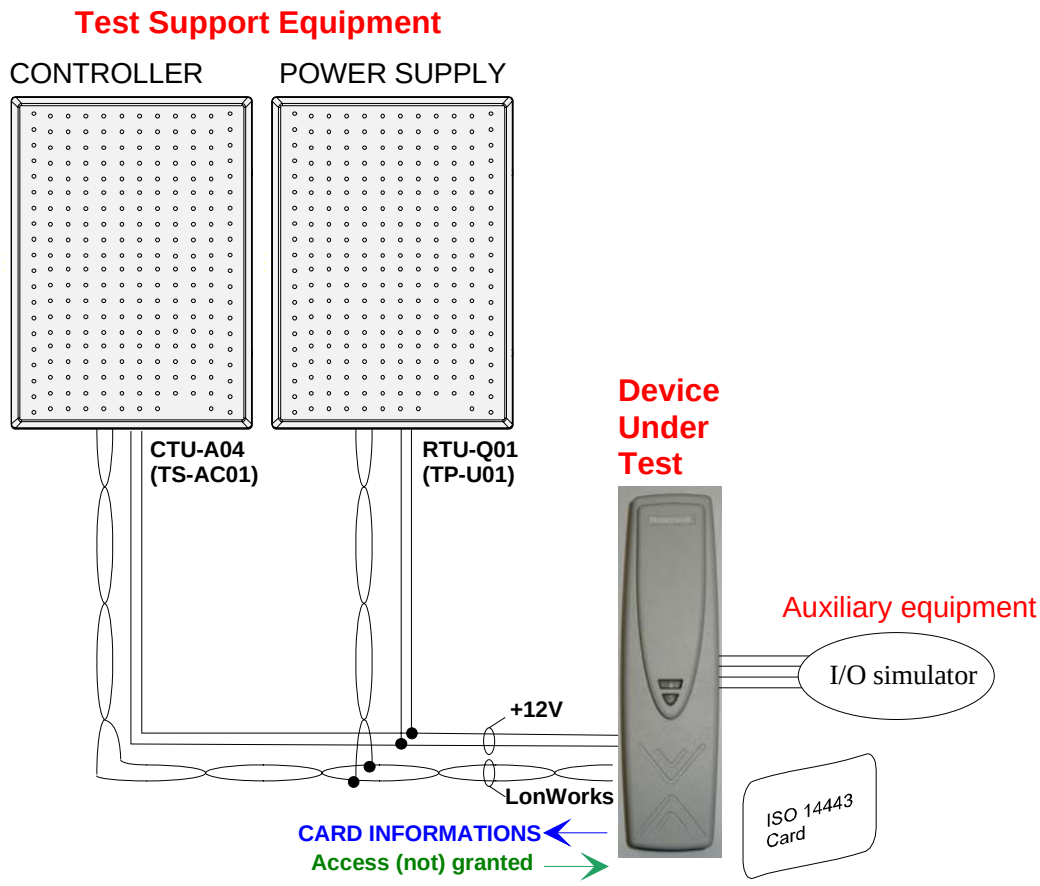
As shown in Figure 3.1 all interface cables used for compliance testing are unshielded as readily available on the market.

3.4 Equipment Modifications

To achieve compliance to Class B levels, no changes were made during compliance testing.

3.5 Configuration of the Tested System

Figure 3.1 Configuration of the Tested System



Note:
Both the power supply, the I/O and the LonWorks™ cables are not shielded. The LonWorks™ cable is a twisted pair. LonWorks™ is a registered trademark of Echelon™ Corporation

4 BLOCK DIAGRAM(S) OF THE EUT

4.1 Block Diagram Description

The **Main Board o**f EUT is provided with:

Crystals and oscillators:

10 MHz	CPU

RF suppression devices:

VDC EMI Filters:

FL1:	Wurth WE-SL2 744221

Signal EMI Filter

L3	Murata BLM21B222S
L4	Murata BLM21B222S
L5	Murata BLM21B222S
L6	Murata BLM21B222S
FL2	Wurth WE-SL2 744221

The MFRC531 chip is provided with:

Crystals and oscillators:

13.56 MHz

VDC EMI Filters:

LCL1	NFE31PT222Z1E9K 1206
LF1	BLM21BD222SN1D MURATA 0805

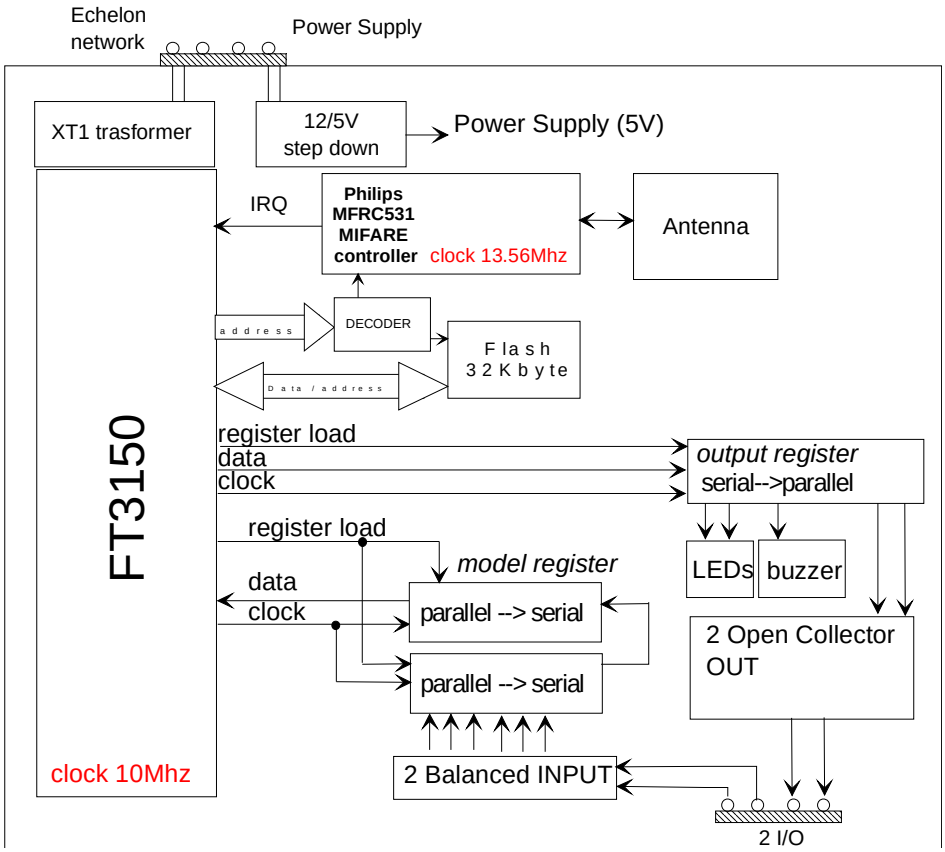
Signal EMI Filters:

L1	Ind 1uH SMD 1206 LQH1N1R0K04
L2	Ind 1uH SMD 1206 LQH1N1R0K04
C36	22pF 50V 5%C0G 0603 MURATA
C41	22pF 50V 5%C0G 0603 MURATA
C35	47pF 50V 5% NP0 0603
C42	47pF 50V 5% NP0 0603

Antenna board

EMI Shield:	On bottom layer of antenna board

Fig. 4.1 - Block Diagram of the EUT



5 CONDUCTED AND RADIATED MEASUREMENT PHOTOS

See attached files : TestSetup_photos

6 CONDUCTED EMISSION DATA

6.1 Tests of the worst case configuration.

The conducted tests are performed with a receiver in quasi-peak mode.

	Frequency (MHz)	Measured* (dBμV)	QP limit (dBμV)	AV Limit (dBμV)
Neutral	0.157	41	65.6	55.6
	2.9	29	56	46
	5.4	31	60	50
	13.56	56 qp	60	
		42 av		50
	20	45	60	50
	27.12	55 qp	60	
		41 av		50
Line	0.157	41	65.6	55.6
	2.9	30	56	46
	5.4	32	60	50
	13.56	55 qp	60	
		41 av		50
	20	46	60	50
	27.12	55 qp	60	
		41 av		50

* All readings are quasi-peak

Test Personnel:

Tester Signature  Date October 13, 2005

Typed/Printed Name Giuseppe MECCHIA .

7 RADIATED EMISSION DATA

- **frequency range 125 kHz – 1 GHz**
- **(from the lowest frequency generated to 1GHz: it includes a digital device)**

7.1 Tests of the worst case configuration

The following data list the significant emission frequencies, measured levels, correction factors (including cable and antenna corrections), the corrected reading, plus the limit. Field strenght calculation is given in paragraph 7.2.

Magnetic emissions (limits according to section 15.225(a) and (d)).

Judgement: Passed by 14.7 dB

Frequency (MHz)	Receiver* Corrected Reading (dBμV/m)	30 Meter Limit (dBμV/m)
13.56	30.5	94
27.12	14.8	29.5

* below 30 MHz readings are quasi-peak with an IF bandwidth of 9 kHz,

Radiated RF power output

Channel	Field strength dBuV/m	Calculated fundamental emission uV/m	Field strength limit dBuV/m	Margin uV/m	Complies
RFID	30.5	33.5	15,848	15,814.5	Yes

Extrapolation data

Measurements were taken at the fundamental frequency of the intentional radiator with the Rohde & Schwarz loop antenna at the distances od 10 and 3 meters. The antenna was placed at a fixed height of 1 meter. **Measurements were taken in the three orthogonal orientation to find the maximum emission, vertical was observed to be worst case.** The turntable was rotate to maximize the emission. The first measurement was taken at 3 meters, then the antenna was moved to 10 meters and the emission was measured. These readings were then plotted to extrapolate the correct reading at a distance of 30 meters.
The emission was then calculated using precisely the falloff rate which has been measured to be:

- 18dB/decade at 13.56MHz and
- 10dB/decade at 27.12MHz.

This emission levels were then plotted on the graph to extrapolate the correct value at 30 meters.
Reference measurements standards Part 15 section 15.31(f)(2).

Spurious emissions (limits according to section 15.209).

Judgement: Passed by 5.5 dB

Frequency (MHz)	Polarity (V/H)	Receiver* Reading (dBμV)	Correction Factor (dB/m)	Corrected Reading (dBμV/m)	3 Meter Limit (dBμV/m)
108.4	V	24.5	12.5	37	43.5
120	V	24	13	37	43.5
180	V	19.3	18.7	38	43.5
216.9	V	22.1	15.9	38	46
280	H	22	18	40	46
730	H	12.5	26.5	39	46

* above 30 MHz readings are quasi-peak, with an IF bandwidth of 120 kHz,

Test Personnel:

Tester Signature  Date October 12, 2005

Typed/Printed Name Giuseppe MECCHIA .

7.2 Field Strength Calculation

7.2.1 The field strength is calculated by adding the Antenna and Cable Factor to the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF

where

FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 24.5 dBμV is obtained. The Antenna and Cable Factor of 12.5 is added, giving a field strength of 37 dBμV/m. The 37 dBμV/m value was mathematically converted to its corresponding level in μV/m.

FS = 24.5 + 12.5 = 37 dBμV/m

Level in μV/m = Common Antilogarithm [(37 dBμV/m)/20]= 70.8 μV/m

7.3 Frequency stability – section 15.225(e)

Fundamental: nominal frequency 13.560 MHz

Temperatura variation

Temperature [°C]	Voltage [V]	Frequency [MHz]	Deviation [MHz]
-20	12.0	13.56033	0.00033
-10	12.0	13.56027	0.00027
0	12.0	13.56023	0.00023
10	12.0	13.56017	0.00027
20	12.0	13.56027	0.00027
30	12.0	13.56017	0.00017
40	12.0	13.56017	0.00017
50	12.0	13.56013	0.00013

Voltage variation

Temperature [°C]	Voltage [V]	Frequency [MHz]	Deviation [MHz]
20	10.2	13.56020	0.00020
20	12.0	13.56027	0.00027
20	13.8	13.56017	0.00017

Max deviation [MHz]: 0.00033
Max deviation [%]: 0.00243

Test Passed

8 PHOTOS OF TESTED EUT

Fig. 8.1 Front view
Fig. 8.2 Rear view
Fig. 8.3 Assembled boards – view 1
Fig. 8.4 Assembled boards – view 2
Fig. 8.5 Main board - side 1
Fig. 8.6 Main board - side 2
Fig. 8.7 FTT10 support board – side 1
Fig. 8.8 FTT10 support board – side 2
Fig. 8.9 Antenna board - side 1
Fig. 8.10 Antenna board - side 2

See attached files: internal_photos and external_photos

User Manual

See attached file : user_manual