

## MEASUREMENT/TECHNICAL REPORT

### FCC Part 15 Sections 15.109,15.209 & 15.225

#### Honeywell

Via Tintoretto, 15 – I-21012 Cassano Magnago (VA)

#### FCC ID: HS9-RTU-K12

December, 11<sup>th</sup>, 2006

This report concerns (check one): Original grant ☒ Class II change ☐

Equipment type: PROXIMITY READER (ex.: computer, printer, modem, etc.)

Deferred grant request per 47 CFR 0.457(d)(1)(ii)? yes ☐ no ☒

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.  
Via Montalenghe 12  
10010 Scarmagno ( TO ) Italy

Phone : 0125 - 636911  
Fax : 0125 - 636999

<b>Table of Contents</b>	<b>Page</b>
1 GENERAL INFORMATION .....	3
1.1 Product Description .....	3
1.2 Related Submittal(s)/Grant(s) .....	3
1.3 Tested System Details .....	4
1.4 Test Methodology.....	5
1.5 Test Facility .....	5
1.6 Test Equipment List .....	5
2 PRODUCT LABELING .....	6
Figure 2.1 FCC ID Label .....	6
Figure 2.2 Location of the Label on EUT.....	7
3 SYSTEM TEST CONFIGURATION .....	8
3.1 Justification .....	8
3.2 EUT Exercise Software .....	8
3.3 Special Accessories .....	9
3.4 Equipment Modifications .....	9
3.5 Configuration of the Tested System .....	10
Figure 3.1 Configuration of the Tested System.....	10
4 BLOCK DIAGRAM(S) OF THE EUT.. .....	11
4.1 Block Diagram Description .....	11
Figure 4.1 Block Diagram of the EUT.....	12
5 CONDUCTED AND RADIATED MEASUREMENT PHOTOS .....	13
6 CONDUCTED EMISSION DATA .....	14
7 RADIATED EMISSION DATA .....	15
7.2 Field strength calculation .....	18
7.3 Frequency stability 15.225(e).....	19
8 PHOTOS OF TESTED EUT .....	20
User Manual .....	21

## 1 GENERAL INFORMATION

### 1.1 Product Description

The RTU-K12 is proximity reader for access control and time & attendance applications. The module is based on a 10MHz FT3150 Neuron Chip + FTX1 transformer & the MFRC531 philips chip; the module also provides:

- 1 Display 16x2 lines
  - 1 Keyboard 4x4
  - 2 balanced input lines
  - 1 Power open drain output for electro lock
  - 1 Power open drain 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: depends on the card – usually 5cm

The RTU-K12 terminal has a multi-color LED and a buzzer to signal messages to the user. The RTU-K12 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 RTUK12: TKC12

From an FCC point of view the EUT is an intentional radiator (13.56MHz transceiver) 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 placed 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
<b>RTU-K12 (1) s/n EMC06-230</b>	<b>HS9-RTU-K12</b>	<b>Proximity reader</b>	<b>Unshielded power cord Unshielded signal cables</b>
RTU-Q01 S/n 061200431500074 GBU	Verified	Power supply	Unshielded power cord Unshielded signal cables
CTU-A04 S/n none	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. 3 – Semi-anechoic chamber

The semi-anechoic chamber 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 05, 2006 submitted to your office, and accepted in a letter dated May 16, 2006 (registration Number: 90860)

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

This decision is effective from 20 September 2002.

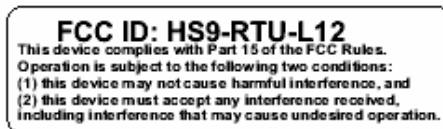
### 1.6 Test equipment list:

Description	Model	serial No.	Cal due date
Test receiver	Rohde & Schwarz ESH3	s/n 881364/012	03/07
Test receiver	Rohde & Schwarz ESVS30	s/n 829007/004	05/07
Spectrum Analyzer	Hewlett Packard HP 8568B	s/n 2601A02134	04/07
LISN	Schwarzbeck NNLK 8121	s/n 8121-219	03/07
Biconical Antenna	EMCO 3110B	s/n 9408-1910	05/07
Log-Periodic Antenna	Electro-metrix LPA-25	s/n 1117	05/08

## 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**

Test Report No. EMI 06/202  
Date December, 11th, 2006

FCC ID: HS9-RTU-K12

**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 (from the same antenna coil) any modulation on the transmitted carrier. If a card with a RF-TAG is placed near the RTU-K12 antenna, the 13,56MHz wave on the coil energises the TAG. The TAG then modulate the 13,56MHz 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-K12 in order to switch on the output that opens the door. Meanwhile, a specific message is sent to the RTU-K12 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.

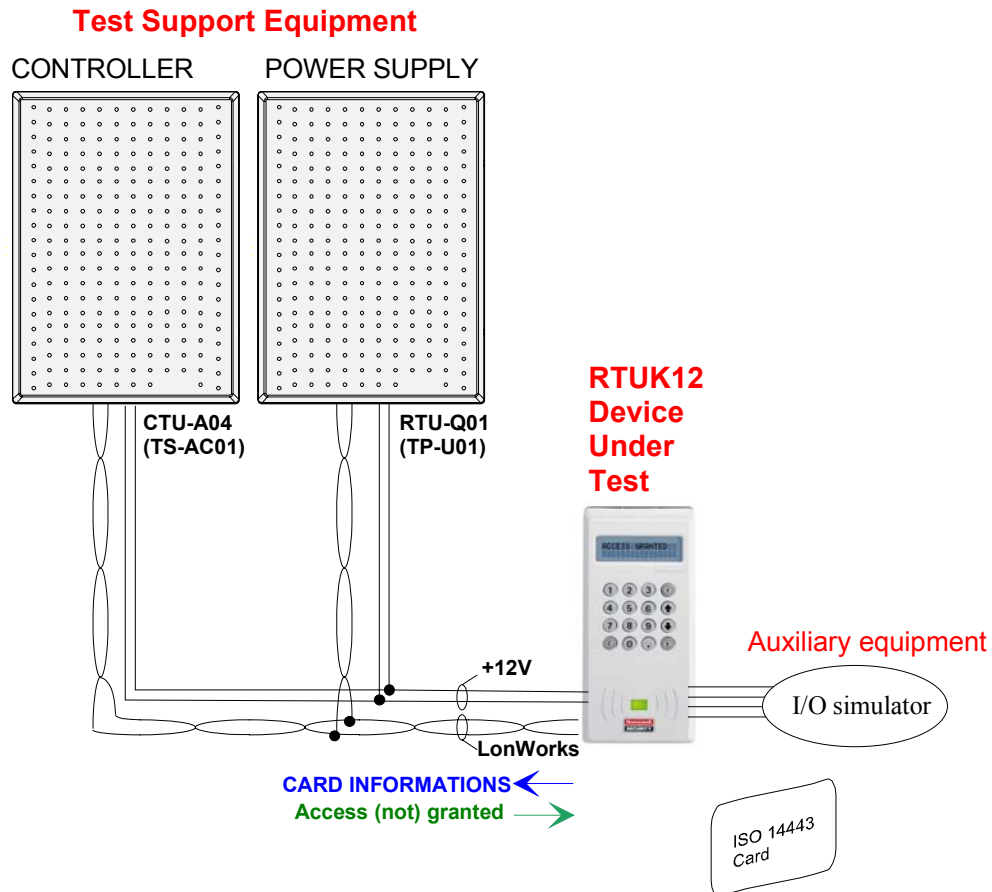
As shown in Figure 3.1 all interface cables used for compliance testing are unshielded as readily available on the market.

### **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 **RTU-K12 connection board** is provided with:

#### **RF suppression devices:**

##### **VDC EMI Filters:**

FL2 Schaffner RN102-0,6-02

##### **Signal EMI Filters:**

FL1 Schaffner RN102-1-02

L1 INDUCTOR BLM21AH102SN1

L2 INDUCTOR BLM21AH102SN1

L3 INDUCTOR BLM21AH102SN1

L4 INDUCTOR BLM21AH102SN1

The **Main Board** of EUT is provided with:

#### **Crystals and oscillators:**

10 MHz CPU

#### **RF suppression devices:**

##### **VDC EMI Filters:**

FL1: Würth WE-SL2 744221

##### **Signal EMI Filter**

L1 Murata BLM21B222S

L2 Murata BLM21B222S

FL2 Würth WE-SL2 744221

FL3 Würth 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

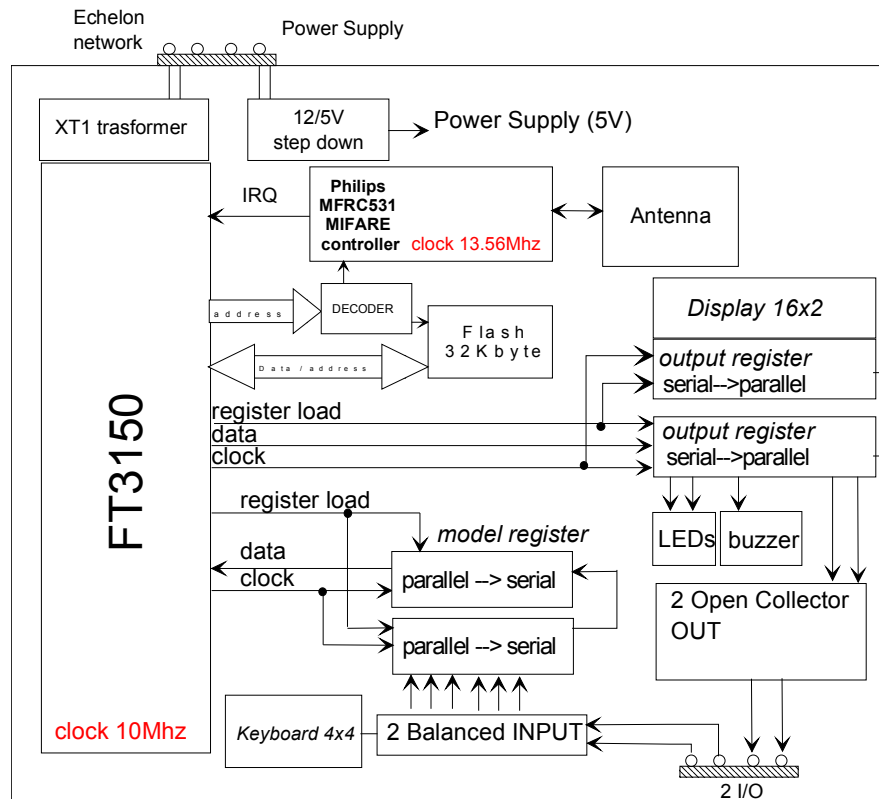
**Signal EMI Filters:**

L3	Ind 1uH SMD 1206 LQH1N1R0K04
L4	Ind 1uH SMD 1206 LQH1N1R0K04
C37	22pF 50V 5% C0G 0603 MURATA
C42	22pF 50V 5% C0G 0603 MURATA
C35	47pF 50V 5% NP0 0603
C43	47pF 50V 5% NP0 0603

Antenna board

**EMI Shield:** On bottom layer of antenna board

**Fig. 4.1 - Block Diagram of the EUT**



Test Report No. EMI 06/202  
Date December, 11th, 2006

FCC ID: HS9-RTU-K12

## **5 CONDUCTED AND RADIATED MEASUREMENT PHOTOS**

See attached files : TestSetup\_photos



Italia

## 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* (dB $\mu$ V)	QP limit (dB $\mu$ V)	AV Limit (dB $\mu$ V)
Neutral	0.15	34	66	56
	2.6	26	56	46
	3.6	29	56	46
	5.4	34	60	50
	13.56	59 qp 30 av	60	50
	20	44	60	50
Line	0.15	33	66	56
	2.6	27	56	46
	3.6	29	56	46
	5.4	33	60	50
	13.56	58 qp 29 av	60	50
	20	43	60	50

\* All readings are quasi-peak

Test Personnel:

Tester Signature *G. Meccia* Date November 17, 2006

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 strength 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 (dB $\mu$ V/m)	30 Meter Limit (dB $\mu$ V/m)
13.56	26	84
27.12	13	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	26	20	15,848	15,828	Yes



### Extrapolation data

Measurements were taken at the fundamental frequency of the intentional radiator with the Rohde & Schwarz loop antenna at the distances of 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 rotated 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 3.7 dB

Frequency (MHz)	Polarity (V/H)	Receiver* Reading (dB $\mu$ V)	Correction Factor (dB/m)	Corrected Reading (dB $\mu$ V/m)	3 Meter Limit (dB $\mu$ V/m)
60	V	20.1	10.1	30.2	40
80	V	19.5	10.2	29.7	40
130	V	22.1	13.8	35.9	43.5
350	H	19.7	20.2	39.9	46
410	H	19.5	20.3	39.8	46
640	V	16.3	26	42.3	46

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

Test Personnel:

Tester Signature *G. Mecchia* Date November 17, 2006

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 20.1 dB $\mu$ V is obtained. The Antenna and Cable Factor of 10.1 is added, giving a field strength of 30.2 dB $\mu$ V/m. The 30.2 dB $\mu$ V/m value was mathematically converted to its corresponding level in  $\mu$ V/m.

$$FS = 20.1 + 10.1 = 30.2 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(30.2 \text{ dB}\mu\text{V/m})/20] = 32.4 \mu\text{V/m}$$

7.3 Frequency stability – section 15.225(e)

Fundamental: frequency 13.56243 MHz (standard conditions 20°C 12V)

Temperatura variation

Temperature [°C]	Voltage [V]	Frequency [MHz]	Deviation [MHz]
-20	12.0	13.56233	0.00010
-10	12.0	13.56240	0.00003
0	12.0	13.56237	0.00006
10	12.0	13.56243	0.00000
20	12.0	13.56243	-----
30	12.0	13.56237	0.00006
40	12.0	13.56237	0.00006
50	12.0	13.56233	0.00010

Voltage variation

Temperature [°C]	Voltage [V]	Frequency [MHz]	Deviation [MHz]
20	10.2	13.56243	0.00000
20	12.0	13.56243	-----
20	13.8	13.56243	0.00000

Max deviation [MHz]: 0.00010

Max deviation [%]: 0.00074

Test Passed

## 8 PHOTOS OF TESTED EUT

- Fig. 8.1 Front view
- Fig. 8.2 Rear view
- Fig. 8.3 Assembled boards
- Fig. 8.4 EUT Partially disassembled
- Fig. 8.5 CPU board – Components side
- Fig. 8.6 CPU board – Foil side
- Fig. 8.7 I/O board – Components side
- Fig. 8.8 I/O board – Foil side
- 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