



SCF 303 Series

Secured Compact Flash RFiD Coupler

LOW TEMPERATURE

Reference Manual

Rev C

At the time of going to press, this guide is as thorough and correct as possible; however, information herein contained may have been updated after this date. AMESYS reserves the right to change the functions and specifications of its products at any time without prior notice.

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1 ABOUT THIS DOCUMENTATION

This manual provides technical information about the Compact Flash SCF 303 coupler to use the product into your RFiD solution. It provides in particular information about the hardware specifications of the product, including electronic and mechanical characteristics.

The software description of the product is given in the other documents listed in the paragraph *1.2 For more information*.

1.1 Audience

This manual is intended for electronics engineers.

1.2 For more information

For additional information about the Compact Flash SCF 303 coupler and its software interface, refer to the following document:

- *Stel'Host Application Programming Interface Specification*

For additional information about the associated standards and technology, refer to the following specifications:

- *ISO/IEC 14443 – Identification cards – Contactless integrated Circuit cards – Proximity Cards*
- *ISO/IEC 15693 – Identification cards – Contactless integrated Circuit cards – Vicinity Cards*
- *ISO/IEC 7816-3 – Identification cards – Integrated Circuit cards with contacts – Part 3 Electronics signals and transmission protocols.*
- *VBTP Specification – Reference 960613/SE/PMO/ProtBdgSP32*
- *Compact Flash Specification version 3.0*

1.3 Contact for comments

We welcome your feedback to help us provide high quality documentation. For technical and documentation comments, contact AMESYS at:

E-mail: stella.support@amesys.fr
Telephone : +33 (0) 4 42 60 70 00
Fax: +33 (0) 4 42 60 00 26

1.4 Terminology

API	Application Programming Interface
ASK	Amplitude Shift Keying
BPS	Bits Per Second
EF	Elementary File
LED	Luminescent Electronic Diode
MF	Master File
N/A	Non applicable
NC	Not Connected
PDA	Personnal Digital Assistant
RH	Relatif Humidity
REQA	Request A command
RFID	Radio Frequency Identification
RFU	Reserved for Future Used
SAM	Secured Authentication Module
SIM	Subscriber Identity Module
TBD	To Be Defined
VBTP	Validator Baterryless Tag Protocol

2 OVERVIEW

2.1 General Description

The Stella Compact Flash SCF 303 coupler is an universal RFID contactless reader/writer providing efficient and secure interface for your 13,56 Mhz contactless applications. Its form factor is a Compact Flash type I Extended Card. The electronic board includes :

- The controller
It manages all the exchanges between the terminal and the antenna through a 50 pin Compact Flash interface. It contains also 2 SAM slots. A Stella application firmware is embedded providing a unique independent platform software thanks to the Stel'Host Application Programming Interface (see §1.2 *For more information* for detailed reference documentation).
- The active antenna
It provides the RF link between the cards and the controller at 13.56 Mhz frequency.



Figure 1 : Stella Compact Flash SCF 303 product

The Stella Compact Flash SCF 303 coupler is able to drive a various of contactless cards, including **Mifare®**¹ and **Calypso®** cards, based on 13.56Mhz RFID technology (ISO/IEC 14443 A & B and ISO/IEC 15693 standards) using 10% or 100% ASK modulation.

The Stella Compact Flash SCF 303 coupler also manages the 5V electrical interface and communication for two ISO 7816 contact cards, also called Secured Access Module (SAM).

The Stella Compact Flash SCF 303 coupler use an active 45mm x 32mm antenna embedded inside the board. It offers a low cost and useful communication range up to 4 cm².

The Stella Compact Flash coupler has a bi-color green-red LED driven by the terminal application layer.

¹ Mifare Classic 1K and Mifare Classic 4K

² Characteristics may variant depending contact less card technology. See §4.2 Radio frequency acquisition distance for detailed performances description.

2.2 Architecture

The Stella Compact Flash SCF 303 coupler is designed with the following architecture splitted in four main blocks:

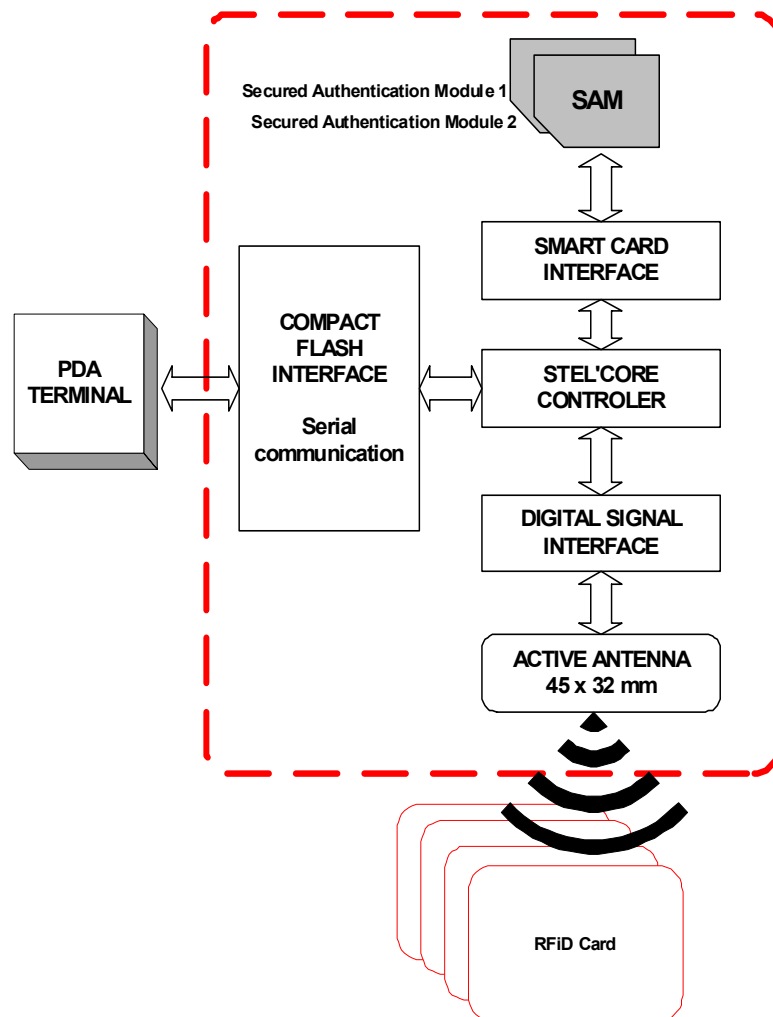


Figure 2 : Stella Compact Flash SCF 303 architecture

1. The **Stel'Core Controller** is a low cost, high-speed 8 bit microprocessor. It is in charge of the main logical communication between terminal, SAMs and RFID cards.

The software inside the Stel'Core controller handles a Stella secured protocol for communication with the terminal through a dedicated Stella Host API. Thus, it provides:

- An easy-to-use Application Programming Interface available for the terminal part.
- A secured transaction between the host and the coupler.
- A useful upload feature allowing upgradable firmware through the standard host interface.

Thanks to a modular C architecture, this Stella Host API is easily portable on PC platform or any embedded solution. See § 1.2 *For more information* for the API documentation.

2. The **Smarcard Interface** manages two electrical interfaces and communications compatible with ISO 7816 SIM format. It provides secret key management and cryptographic calculations that enable secured authentication and communication for your application.

The SAM interface has the following characteristics:

- 2 SAM slots
- Smart Card Power supply: 5 V
- Asynchronous ISO 7816-3 T= 0 and T = 1 protocols
- Innovatron proprietary High Speed Protocol (HSP)

3. The **Host Interface** is a 50 pin CompactFlash interface which manages the electrical interface and communication with the terminal. This interface emulates as a standard Rx,Tx serial port regarding the terminal.

4. The **digital signal interface** with its **active antenna** provides the RF transmitter with its encoding/decoding block. It drives the RF modulation at 10% or 100% with anti-collision mechanism.

It supports the following radio interface with high level scanning mode and power management capabilities:

- ISO 14443 A
- ISO 14443 B
- ISO 14443 B-Innovatron
- ISO 15693

3 DETAILED SPECIFICATIONS

3.1 Mechanical

The mechanic of the Stella Compact Flash SCF 303 coupler is a Compact Flash Type I externed card. It has the following characteristic (in mm):

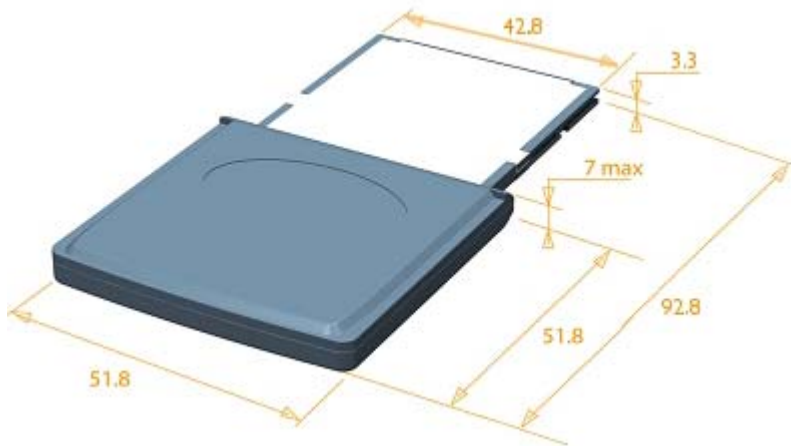


Figure 3 : Dimensions of the SCF 303

3.2 Compact Flash connector

The SCF 303 Compact Flash connector is compliant with the Compact Flash specification as defined in the §1.2 *For more information.*

3.3 SAM connector

There is two SAM connectors located inside the plastic extended box. These connectors are directly accessible when the cover of the Compact Flash coupler is removed.

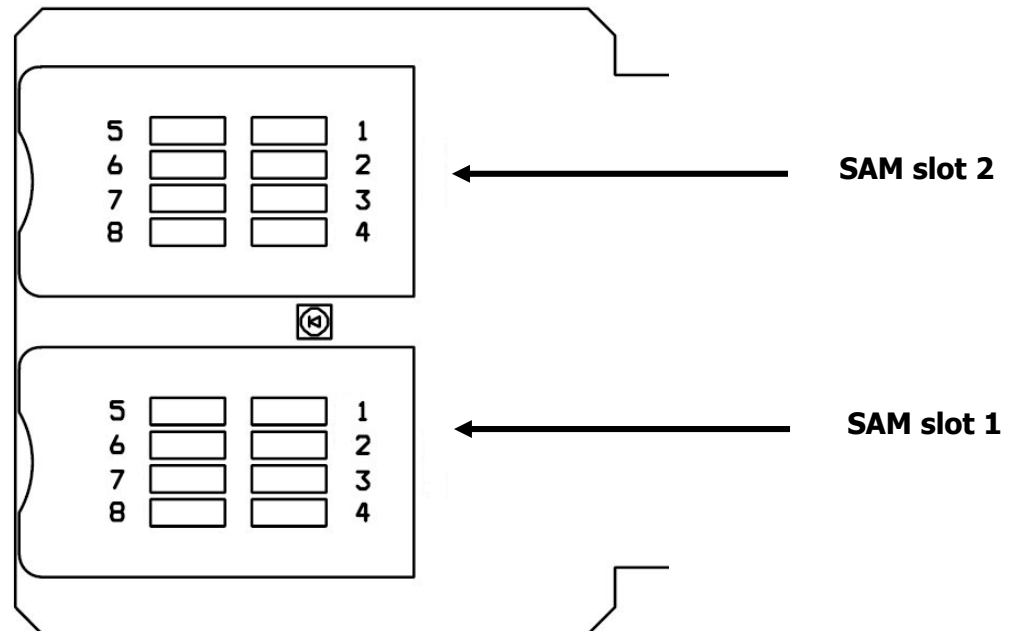


Figure 4 : SAM slot location

The SAM connector as shown below corresponds to a mirror's view of a SAM card's

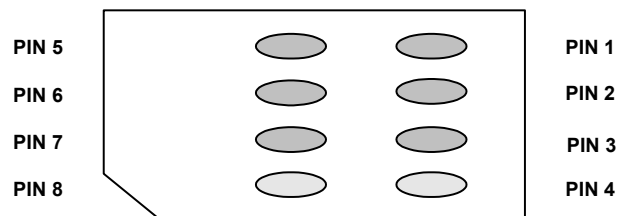


Figure 5 : Upper view of a each SAM connector

Pin #	Type	Description
1	Power	Vcc
2	In	Reset (RST)
3	In	Clock (CLK)
4	-	Rfu 1

Pin #	Type	Description
5	Ground	Ground (GND)
6	-	Rfu 3
7	I/O	Bidirectionnal line
8	-	Rfu 2

Table 1 : SAM connector

3.4 Electrical

The Stella SCF 303 reader has an advanced power management mode which allows 3 different power consumption levels:

- **Standby mode** which is the default state when the SCF 303 is inserted into the PDA.
- **Nominal (active) mode** corresponds to a standard RFID card exchange mode.
- **Scanning mode** is an embedded power management mode controlled by the reader which detects RFID card in its field. Depending duty cycle and delay between two RF card wake-up, the power consumption could be reduced from 50 to 80% compared to the active mode.

See detailed power consumption value in §3.4.2. (Icc, Iccs and Iccm values).

The equipment is powered by a SELV circuit, which is considered as a limited power source. The equipment is not provided with direct connection to main supply.

Die Ausstattung wird durch einen SELV - bestätigt der als begrenzte Energiequelle betrachtet wird. Man liefert die Ausrüstung ohne direktes Mittel von Verbindung mit einem Ernährung Sektor.

3.4.1 Operating Conditions

Symbol	Parameter	Min	Typical / Typische	Max	Unit / Einheit
T _A	Ambient temperature / Raumtemperatur	-20		+55	°C
T _s	Storage temperature / Lagertemperatur	-30		+60	°C
V _{CC}	Power supply/ Stromversorgung	3,2	3,3	3,6	V

Table 2 : Operating Conditions

Stresses above limit may cause permanent damage to the device.

Die obenstehenden Begrenzungen zu übersteigen kann zu dauerhaften Schäden an dem Gerät verursachen.

3.4.2 DC Characteristics

If not specified, default environment test conditions are $T=+25^{\circ}\text{C}$, $\text{RH} = 80\%$, without SAM consumption.

Wenn nicht angegeben, Standard-Umgebung Prüfbedingungen sind $T = +25^{\circ}\text{C}$, $\text{RH} = 80\%$, ohne SAM Verbrauch.

Symbol	Parameter	Min	Typical / Typische	Max	Unit / Einheit	Test Conditions / Test Bedingungen
I_{CC}	Standard active mode current with RF exchange / standard aktiv modus strom mit RF austausch		170		mA	
I_{CCS}	150 ms scanning mode current / 150 ms scan-modus strom		23		mA	
I_{SD}	Stand-by mode current / Stand-by mode strom		17		mA	
I_{CCM}	Maximum active current / Maximumale aktive strom		190		mA	Including 2 SAM consumption / Einschließung 2 SAM Verbrauch
I_{CC1}	active current at $+15^{\circ}\text{C}$ / aktiver strom bei $+15^{\circ}\text{C}$		170		mA	$+15^{\circ}\text{C}$, 70 % RH,
I_{SD1}	Stand-by mode current at 15°C / Stand-by modus strom bei 15°C		16		mA	$+15^{\circ}\text{C}$, 70 % RH,
I_{CC2}	active current at -12°C / aktiver strom bei -12°C		168		mA	-12°C
I_{SD2}	Stand-by mode current at -12°C / Stand-by modus strom bei -12°C		16		mA	-12°C
I_{CC3}	active current at $+35^{\circ}\text{C}$ aktiver strom bei $+35^{\circ}\text{C}$		174		mA	$+35^{\circ}\text{C}$, 90 % RH,
I_{SD3}	Stand-by mode current at $+35^{\circ}\text{C}$ / Stand-by modus strom bei $+35^{\circ}\text{C}$		17		mA	$+35^{\circ}\text{C}$, 90 % RH,

Table 3 : DC Characteristics

3.4.3 Smartcard characteristics

Symbol	Parameter	Min	Typical / Typische	Max	Unit / Einheit	Test Conditions / Test Bedingungen
V_{SAM}	SAM Vcc Output voltage / SAM Vcc produktionsstromspannung	4,7	5	5,2	V	5V SAM
I_{SAM}	SAM Output current for each SAM interface / SAM produktionsstrom für jede SAM Schnittstelle			50	mA	
F_{SCLK}	Card clock frequency / karte signal frequenz		3,6864		Mhz	
R_{SCLK}	Card clock duty cycle / karte signal duty cycle			55	%	
T_{RCLK}	Clock output rise time / signal Ausgangsanstieg-zeit		30		ns	
T_{FCLK}	Clock output fall time / signal Ausgangsfall-zeit		2		ns	
T_{RVSAM}	SAM Vcc output rise time / SAM Vcc Ausgangsanstieg-zeit		265		ns	
T_{FVSAM}	SAM Vcc output fall time / SAM Vcc Ausgangsfall-zeit		28		µs	

Table 4 : Smartcard dynamic characteristics

3.4.4 RF dynamic characteristics

Temperature test conditions is $T_a = 25^\circ\text{C}$ if not specified.

Temperatur test Bedingungen ist $T_a = 25^\circ\text{C}$, wenn nicht angegeben

Symbol	Parameter	Min	Typical	Max	Unit	Test Conditions
F_{CLK}	RF Card clock frequency	13.558	13.56	13.562	Mhz	
R_{CLK}	RF Card clock duty cycle		50	55	%	$T_a = 25^\circ\text{C}$
D_1	Distance above antenna for 1,5 A/m magnetic field		2.2		cm	$T_a = 25^\circ\text{C}$
MF_{MAX}	Maximum Magnetic Field value		6.75		A/m	$T_a = 25^\circ\text{C}$
ML	14443 Type B Modulation depth		12.5		%	$T_a = 25^\circ\text{C}$

Table 5 : RF dynamic characteristics

Communication signal interface Type B

ASK 10% amplitude modulation of the RF operating field.

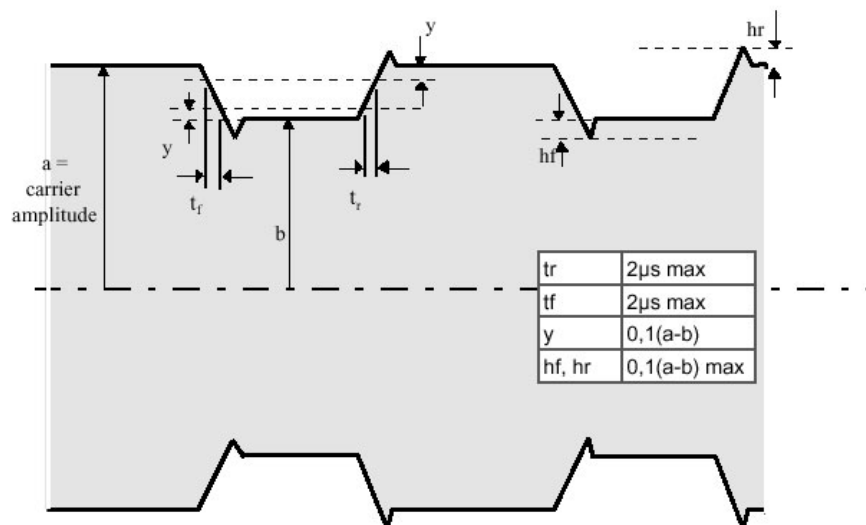


Figure 6 : Type B 10% ASK modulation waveform

Communication signal interface Type A

ASK 100% amplitude modulation of the RF operating field

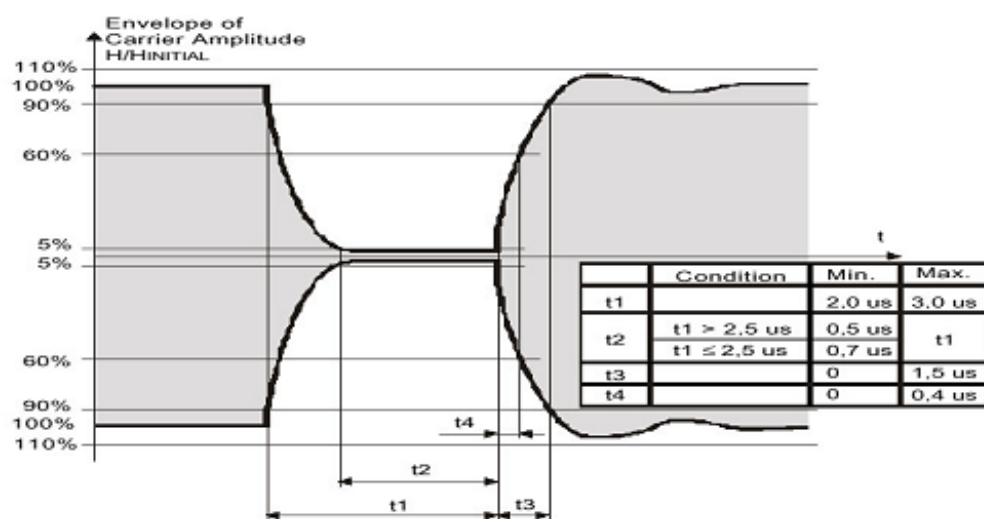


Figure 7 : Type A 100% ASK modulation waveform

4 PERFORMANCES

The Stella Compact Flash SCF 303 performances are given based on the following configuration:

PDA PSION Teklogix WorkAbout Pro + SCF 303 + 115200 baud + Stella software API v1.5.

4.1 Host-Coupler transaction timings

Ta = 25°C

Symbol	Description	Min	Typical	Max	Unit	Test Conditions
t1	Answer to Request ISO14443-A command (ATQA)		2,3		ms	Mifare 1K card
t2	Read 2 EF files (total 40 bytes)		86		ms	CD21 card
t3	Calypso session including following T=Cl commands: SAM Initialisation Select MF Read 3 records in EFs file Append 16 bytes in 1 record Card deselection		260		ms	CD21 card

Table 6 : RFID exchange timing

4.2 Radio frequency acquisition distance

Distance measurement is performed using an ISO 14443-3 REQA command and from the bottom cover.


Ta = 25°C

RF Card type	Distance	Unit
Mifare classic 1k (key A)	40	mm
Mifare classic 1k (key F)	35	mm
Mifare UltraLight	45	mm
Mifare DESFire	40	mm
CTS 512 B	40	mm
CD97	20	mm
GTML2	30	mm

Table 7 : RFID acquisition distance

5 COMPLIANCIES

5.1 CE Declaration of Conformity



i2e
TECHNOLOGIES

**"CE" DECLARATION
OF CONFORMITY
WITH THE EUROPEAN DIRECTIVES**

Reference : DQ06CER003

We hereby,

i2e
Avenue Guillebert de la Lauzière
ZAC de Pichaury II
13794 AIX EN PROVENCE Cedex 3

Declare under our own responsibility that the following equipment :

designation : **Stella CompactFlash RFID Coupler**.....

reference : **SCF 303**..... serial number : **All N°**.....

(referring to this declaration), is in compliance with the standards

ETSI 300 330 v1.5.1 (04/2006)

ETSI EN 304 89-1 v1.4.1 (08/2002).....

ETSI EN 301 489-3 v1.4.1 (08/2002).....

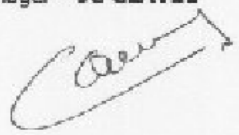
EN 55 024 (1999 + A1 + A2 de 2003).....

EN 50 357 (2001)

EN 60 950 (04/2002)

According to **European Directives 89/336/CEE, 92/31/CEE and 93/68/CEE** regarding the electromagnetic compatibility (CEM), **1999/5/CE** regarding the hertzian equipments and telecommunication devices (RTTE) and **73/23/CEE and 93/68/CEE** for electric safety.

Aix-en-Provence, **24th october 2006** ...

Quality Manager – **JC CLAVEL**
Signature : 

**VISA QUALITE
I.2.E**

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5.2 ROHS Declaration of Conformity



DECLARATION DE CONFORMITE RoHS

Référence : 060201CC__000200

Nous,

I2E

Avenue Guilibert de la Lauzière
ZAC de Pichaury II
13794 AIX EN PROVENCE Cedex 3

Déclarons sous notre seule responsabilité que le produit :

Désignation: SCF303

Référence: 48551 numéro de série : 00001 - 00160.....

Auquel se réfère cette déclaration, est composé des matériaux suivants :

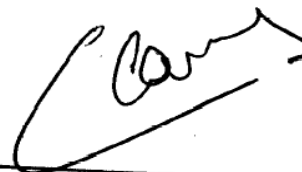
Matériaux	Présence Oui/Non	Taux	Observations
Plomb	Non		
Mercur	Non		
Cadmium	Non		
Chrome Hexavalent	Non		
PBB	Non		
PBDE	Non		

Conformément à la **DIRECTIVE EUROPEENNE 2002/95/CE** retranscrite en droit français par le décret 2005-829 du 20/07/2005.

Aix-en-Provence, 07 septembre 2006

Le Directeur Qualité – JC CLAVEL

Signature :


**VISA QUALITE
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086G1a

5.3 FCC Compliances

5.3.1 Labelling requirements (§ 15.19)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

5.3.2 Information to user (§ 15.21)




The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

5.3.3 Information to user (§ 15.105)

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

5.4 WEEE Declaration of conformity

	DECLARATION DE CONFORMITE AUX DIRECTIVES EUROPEENNES RELATIVE AUX EMBALLAGES ET DECHETS D'EMBALLAGES
Référence : 060201CC__000100	
Nous,	
I2E Avenue Guilibert de la Lauzière ZAC de Pichaury II 13794 AIX EN PROVENCE Cedex 3	
déclarons sous notre seule responsabilité que l'emballage du produit :	
désignation: SCF303	
référence: 48551numéro de série : 00001 - 00160.....	
auquel se réfère cette déclaration, est conforme aux DIRECTIVES EUROPEENNES 94/62/CE et 75/442/CEE concernant la recyclabilité et marquage des emballages et déchets d'emballages.	
Les emballages comportent les marquages suivant :	
Emballage primaire :	Emballage tertiaire :
 LDPE	
Aix-en-Provence, 07 Septembre 2006Le Directeur Qualité – JC CLAVEL	
Signature :	
