



**HYBRID CIRCUIT TECHNOLOGY  
FOR WIRELESS APPLICATIONS**  
**BY - LORENZO SIGNANI-AREA MANAGER-AUREL S.P.A. &  
TOM TERLIZZI-V.P.-GM SYSTEMS LLC**

**Microelectronic Operations**

**April 2018**



***iMAPS New England Chapter***

**International Microelectronics Assembly and Packaging Society**



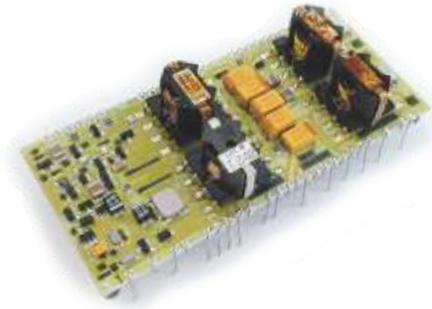


COMPANY PROFILE





**WIRELESS**



**MICROELECTRONICS**



**AUTOMATION**

**1970** Year of foundation

**20** Engineers

**96** Employees

**16Mln€** Revenues (2017)

## WIRELESS

### STANDARD CATALOGUE

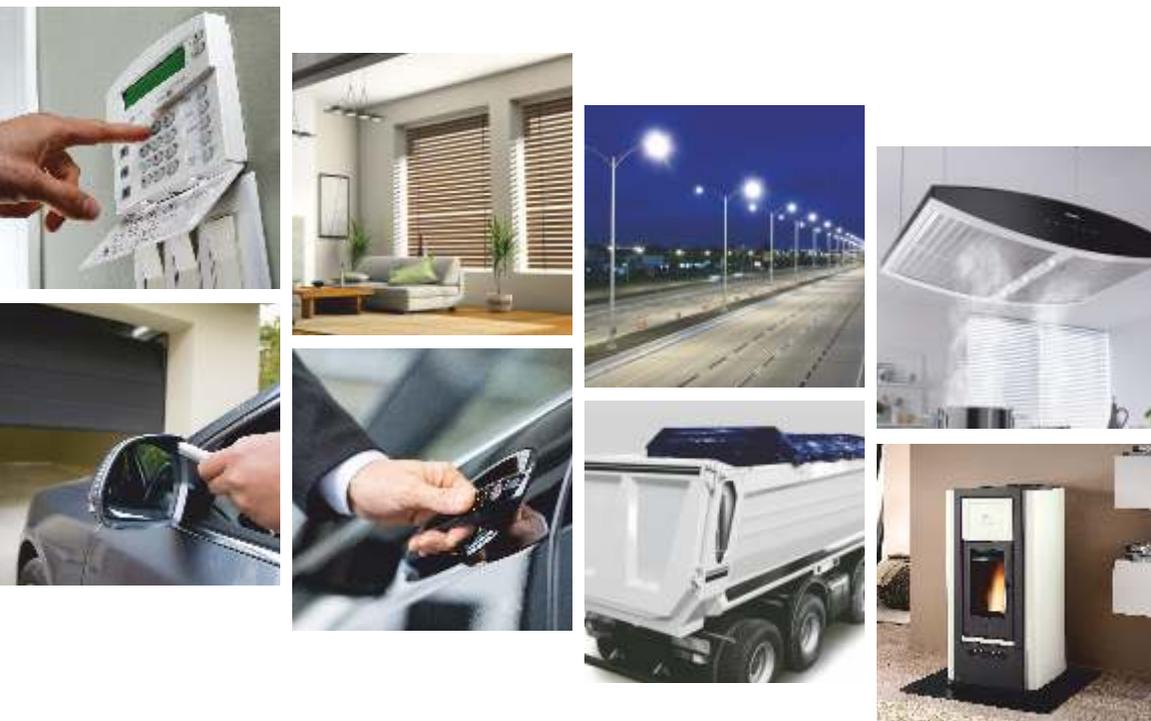


### CUSTOM LINE



## WIRELESS STANDARD CATALOGUE

SRD wireless radio solutions (Short Range Devices) on IMS free-license bands of 433 MHz, 868 MHz and 2,4 GHz according on the European normative.



### PRODUCTS

- AM & FM receivers
- AM & FM transmitters
- Keyfobs
- Transceivers
- Decodings
- Antennas
- LoRa™ modules

### NORMATIVE

- 2014/53/EU
- EN 301 489-3 V1.4.1 (2002-08)
- EN 300 220-2 V2.3.1 (2010-02)
- EN 60950 : 2006

### APPLICATIONS

- Home automation
- Remote controls (gates, roller shutter, lights)
- Street lighting
- Home alarm systems
- Heating system control
- Access controls



## WIRELESS CUSTOM LINE

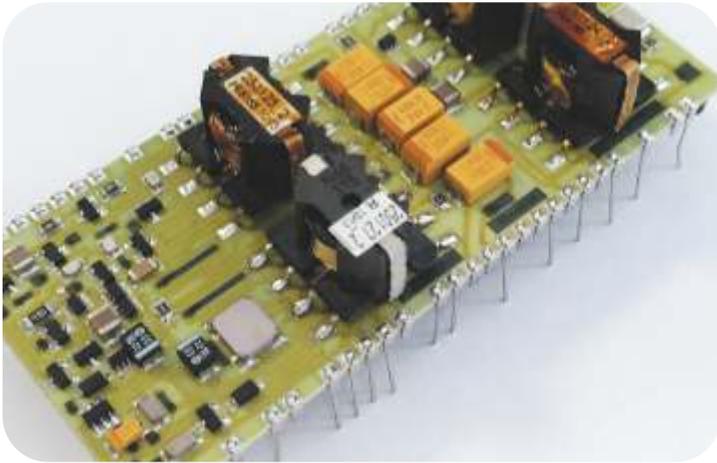


AUREL has a fully specialized laboratory with engineers skilled in the development of finished RF solutions .

AUREL offers its customers more than twenty years of experience in the development, prototyping and production of electrical circuits and RF modules on customer demand.

The appropriate equipments (spectrum analyzers, nets analyzers) allow to apply pre-compliance test directly in our plant.

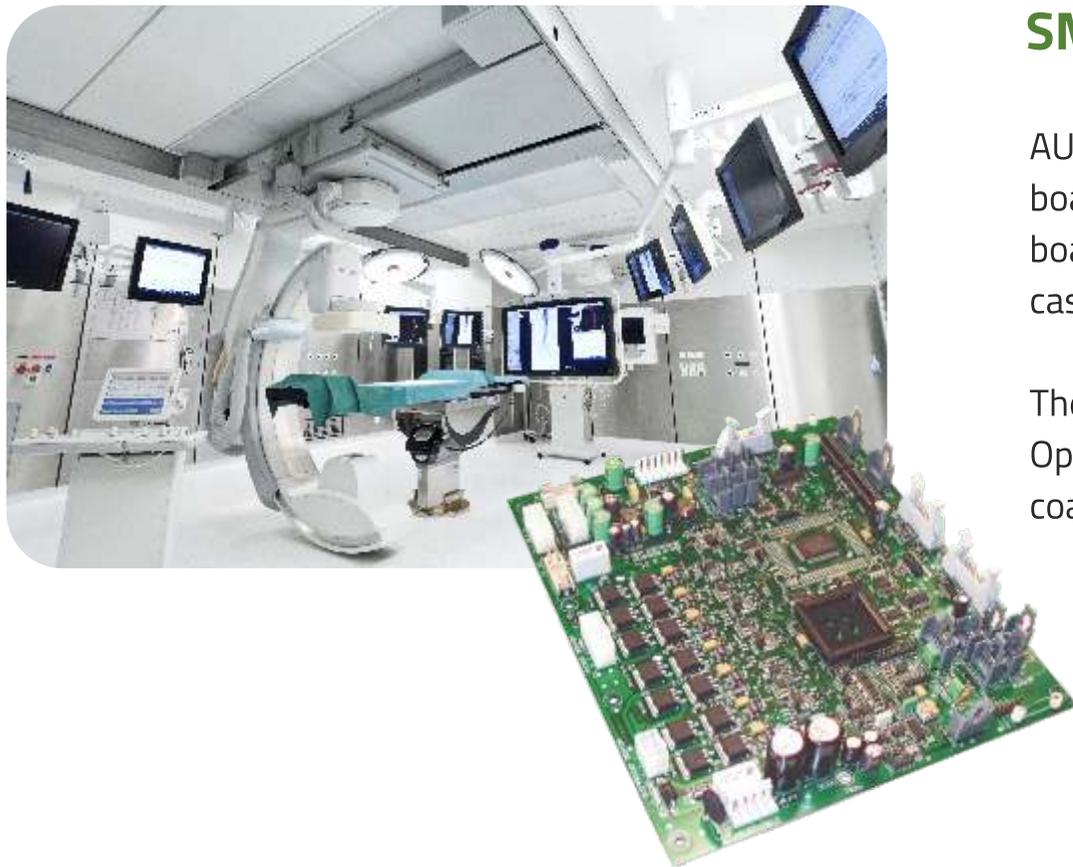
## MICROELECTRONICS



- Thick film hybrid circuits on Alumina
- Thick film hybrid circuits on Aluminum Nitride
- Thick film on Aluminum (THIFAL)
- SMD manufacturing service
- Insulated metal substrate circuits (IMS)
- Chip & Wire circuits
- Power resistors
- Braking resistors



## MICROELECTRONICS

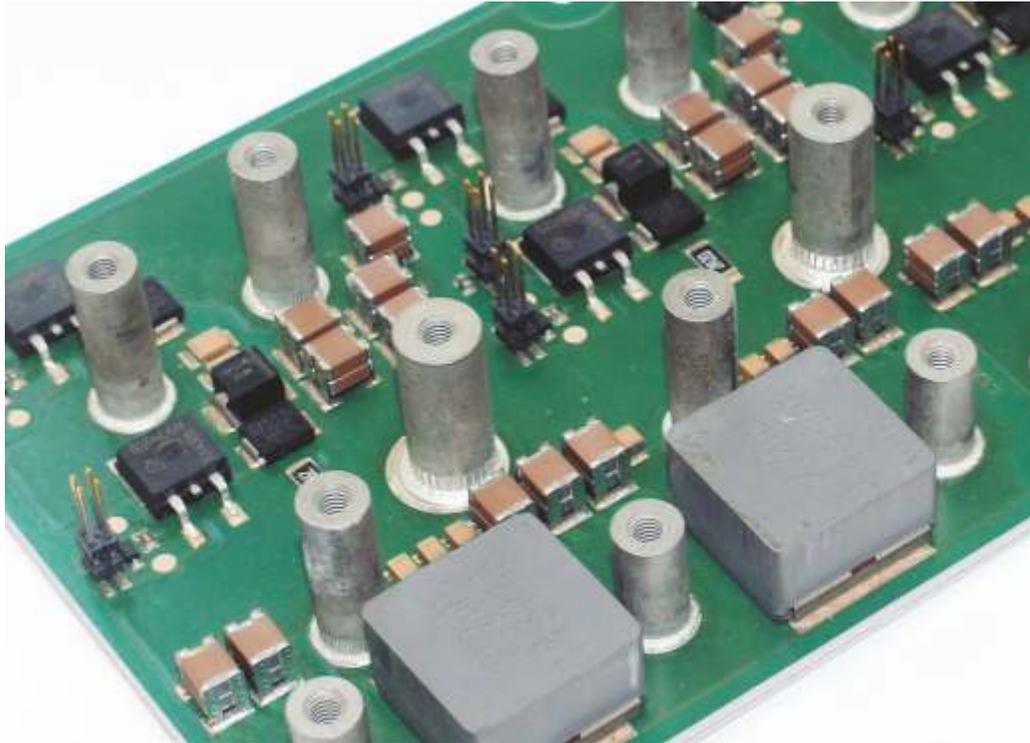


### SMT MANUFACTURING SERVICE

AUREL production lines are suitable for SMD technology boards or mixed technology on multilayer printed circuit boards, rigid or flexible, metal-core, handling components with case as 0201, BGA and micro BGA, also placed on both sides.

The quality of the product is ensured by AOI (Automatic Optical Inspection), X-Ray inspection, functional testing, coating.

## MICROELECTRONICS



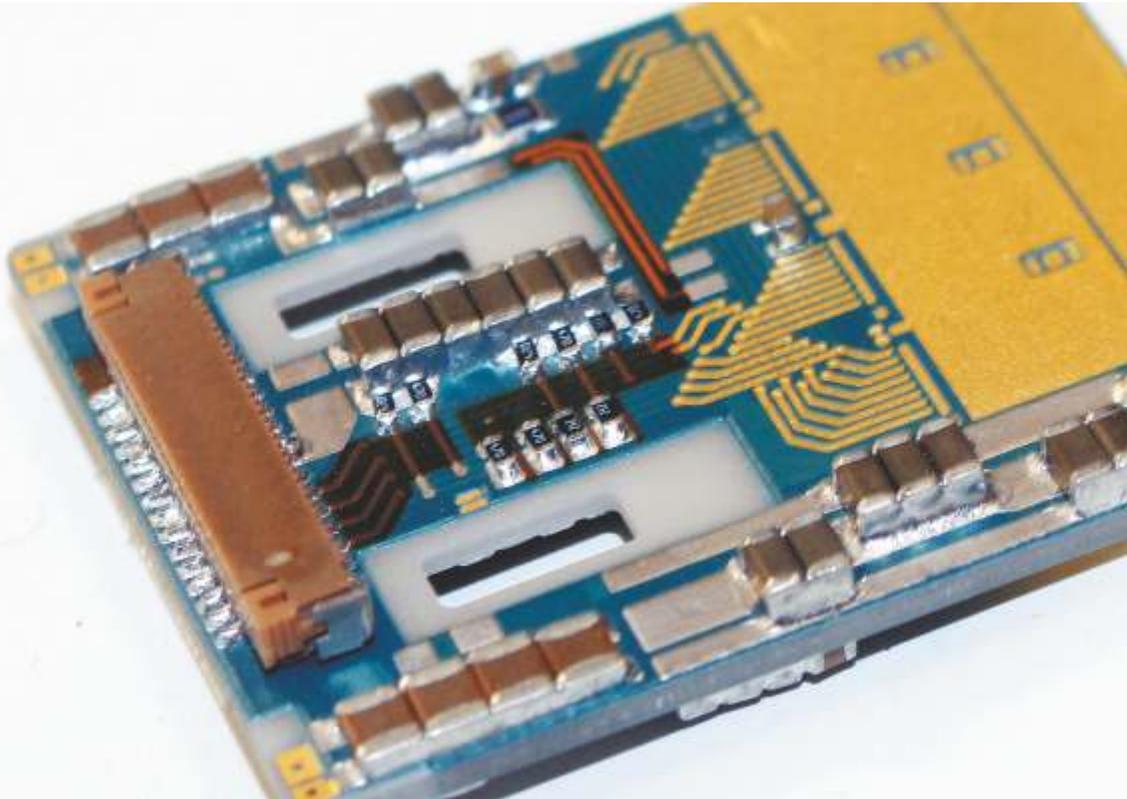
### INSULATED METAL SUBSTRATE

IMS Technology is suited for applications where it is requested to increase thermal dissipation in high wattage surface mount design.

This technology limits the need to use multiple parts while achieving maximum insulation (> 2 kV) for modules 100% tested and ready for production.

- **INDUSTRIAL**  
power suppliers, inverters, soldering machines
- **AUTOMOTIVE**  
ignition, electronic control units, lamp gears, fan controls
- **LIGHTING**  
light sources, street lights, power leds, power lighting
- **SOLAR ENERGY**  
inverters, concentration units

## MICROELECTRONICS



### THICK FILM ON ALUMINA & ALUMINUM NITRIDE

AUREL has wide expertise in design and production of different hybrid circuits types on alumina or aluminum nitride substrates, with complex lay-out and through hole metallization.

The technology allows a high degree of integration, multilayer structures and laser trim.

- BIOMEDICAL
- AUTOMOTIVE
- SENSORS
- AVIONIC

## MICROELECTRONICS



### POWER RESISTORS ON STAINLESS STEEL & CERAMICS SUBSTRATES

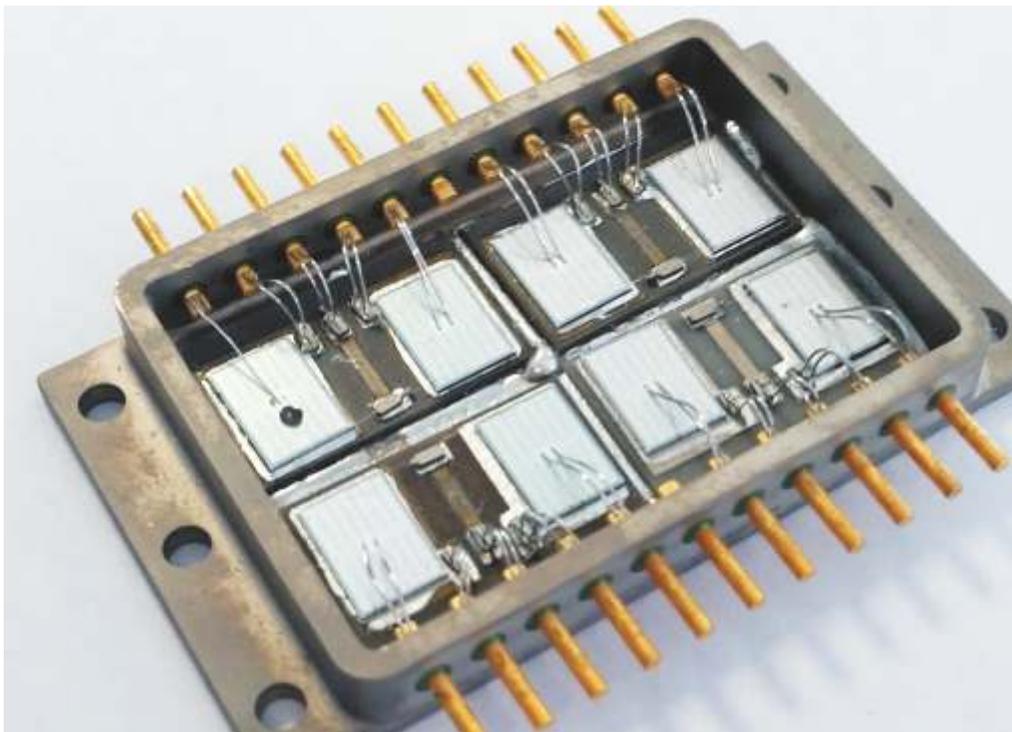
Heating elements and power resistors are realized by printing on top of Stainless Ferritic or Austenitic steel/ceramics substrates, an electrically insulating, but thermally conductive, ceramic dielectric layer.

On top of it are subsequently printed conductive and resistive layers to obtain the desired power value.

A major advantage of this technology is the maximum speed in terms of heat transfer.

- TEA KETTLES
- DOMESTIC FOOD PROCESSORS
- MILK FROTHERS
- HUMIDIFIERS
- PROFESSIONAL BRAISING PANS
- COFFEE MACHINES
- FOOD STEAMERS

# MICROELECTRONICS



## CHIP & WIRE (CLEAN ROOM ISO 7)

Chip on Board (C.O.B) technology consists of die directly attached to its substrate.

C.O.B. assemblies allow to achieve high density and better performances due to shorter interconnection paths.

Wire bonds in Au (25  $\mu\text{m}$  thick) are used.

AUREL boasts a clean room (class ISO 7) with automatic die attach and wire bonding machines.

# MICROELECTRONICS

## APPLICATION TECHNOLOGIES

### SUBSTRATES

- Aluminium Oxide
- Aluminium Nitride
- Silica Glass
- PET
- PC
- Polyimides

### FILMS THICKNESS RANGE

- Screen Printing: 5 – 100  $\mu\text{m}$
- Ink-jet Printing: 2 – 20  $\mu\text{m}$
- Spray Coating: 1 – 15  $\mu\text{m}$

### DEPOSITION TECHNIQUE

- Screen Printing
- Spray Coating
- Ink-jet Printing

### MATERIAL VISCOSITY RANGE

- Screen Printing Paste: 3000 - 50000 mPas-s
- Ink-jet Printing Ink: 1 – 2.5 mPas-s
- Spray Coating Lacquer: 2 – 150 mPas-s

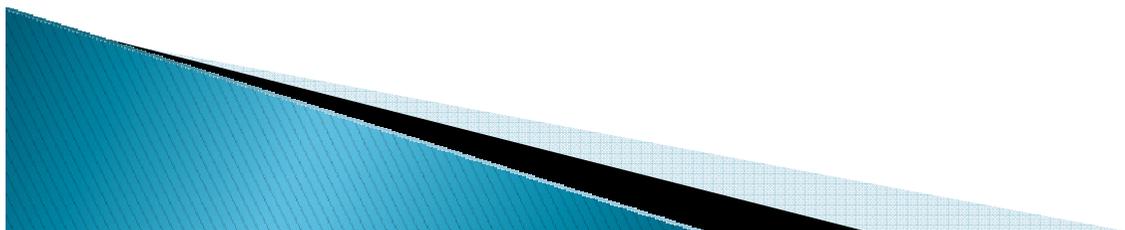
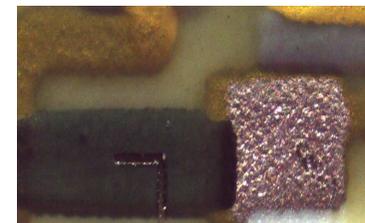
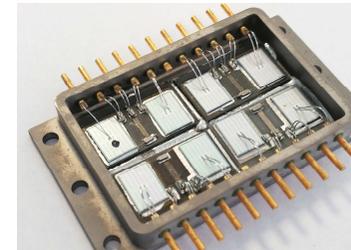
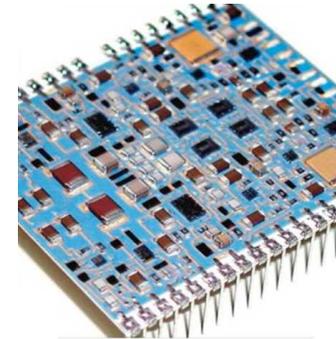
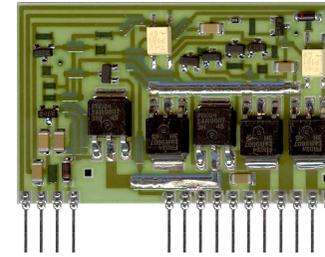
### MATERIAL CURING TECHNIQUE

- Thermal
- Near IR
- UV



## Type of Thick Film Hybrid Circuit

- SIL (single in line thick film hybrid circuit)
- DIL ( dual in line )
- Double-Sided
- Double-Sided with laser made metal coated pass-thru holes
- Hybrids suitable for sub-gigahertz and microwaves bandwidths
- High Power applications hybrids
- Gold pads silicon dies hybrids
- Multilayer hybrids
- Screen printed resistors trimmed by laser
- Overglazed hybrids

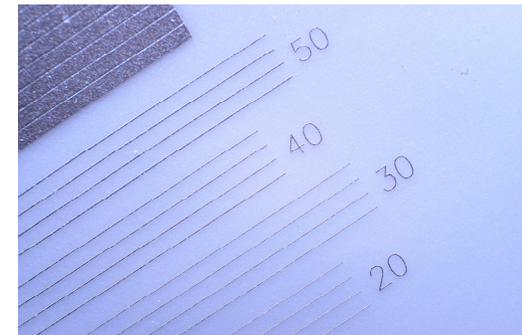
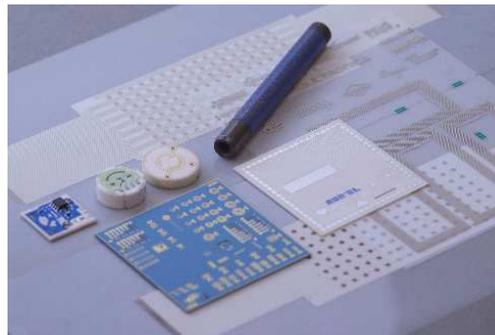




## Main differences between Thick film, Fine line & Thin film

Characteristics	Thick film	Fine line	Thin Film
Conductor lines definition ( $\mu\text{m}$ )	$\geq 150$	30	10-20
Quality of Definition	Sufficient	Good	Very Good
Resistor precision ( % on the R value )	0,5 %	0,5 %	0,1 %
Resistor TCR ( ppm)	50÷100	50÷100	Few (5-10)
Cost compared to Thick Film	1	1,2	8-10

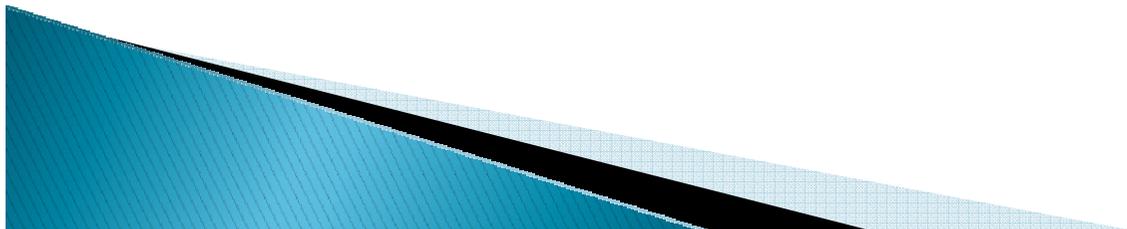
Other than a greater thickness, the thick film tracks are rougher and more uneven.





## Main differences between Thick Film substrates and PCBs

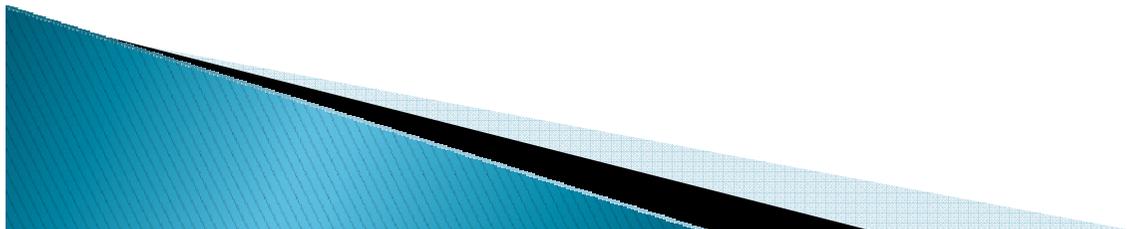
Characteristics	Thick Film Hybrid Circuits	PCB FR4
Substrate Size L x W	≤ 101.6 x 152.4 mm	≥ 200 x 200 mm
Substrate Thickness	0,254 ÷ 1,27 mm	1 ÷ 1,6 mm
Substrate Type	Alumina, AL <sub>2</sub> O <sub>3</sub> 96%/99,5%/99,6% Aluminium Nitride AlN	FR4: Fibre-Glass + Epoxy Resin
Conductive Tracks	Ag, Pd/Ag, Pt/Ag, Au, Ag ( Thick Silver ), Pt/Au	Cu
Conductive Track Thickness (µm)	Ag, Pd/Ag, Pt/Ag 12 ÷ 15 ; Au 08 ÷ 10 ; Ag ( Thick Silver ) 30 ÷ 250	17, 35, 70 + galvanic deposition 20-50
Number of Conductive layers	≤ 5	≤ 12
Passive Components	Integrated on the substrate	Must be mounted with SMT process
Conductor Protection	Overglaze, Polimeric Overgraze	Solder Mask by Epoxy Resin





## Main differences between Thick Film substrates and PCBs

Characteristics	Thick Film Hybrid Circuits	PCB FR4
Humidity Absorbing	0	< 0.16 %
Maximum Operating Temperature	150 °C	120 °C
Coefficient of Thermal Expansion (ppm/°C)	6	12-15 X,Y direction / 70 Z direction
Coefficient of elasticity	320	25
Process	Screen Printing Drying ( 150 °C ) Firing ( 850 °C ) For Each layer Drilling Scribing	Drilling Hole Plating ( PTH & Vias ) Photoresist Deposition Photoresist Exposition Photoresist Stripping Galvanic process, Cu Sn/Pb Etching Photoresist Tin/Lead Stripping Solder Mask Finishing

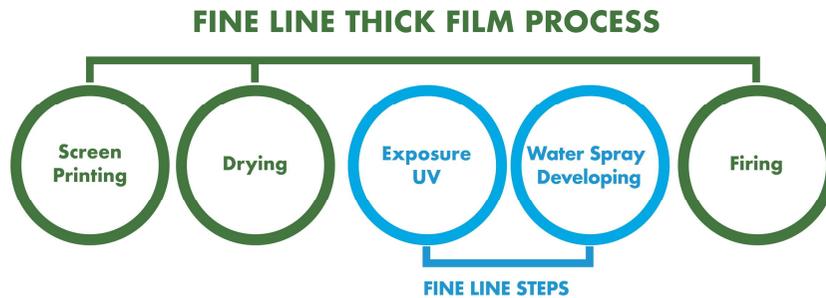




## Other technologies, Fine Line

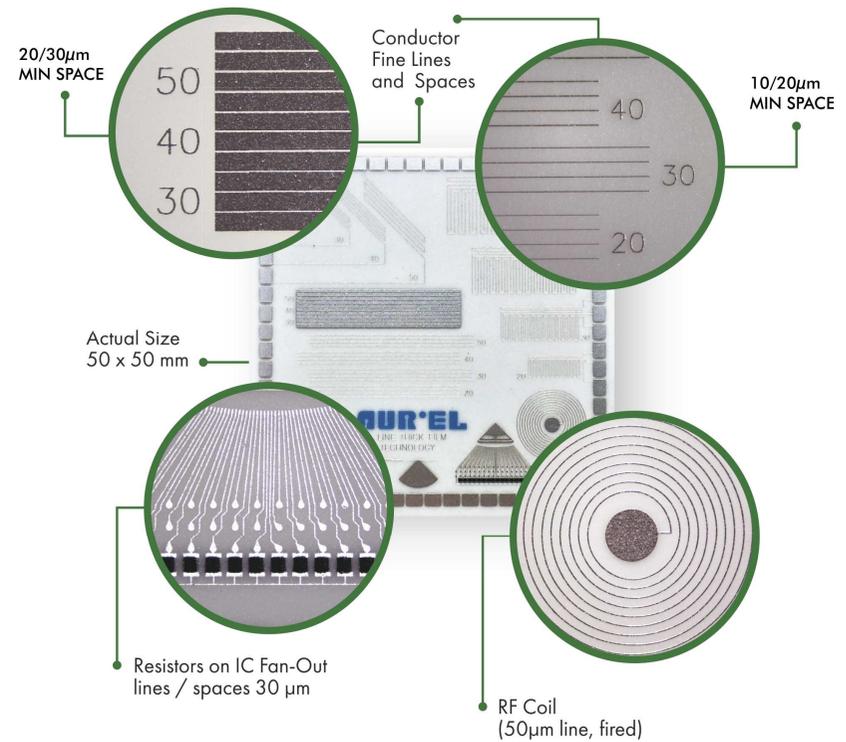
### Fine Line on Fired Ceramics

### Fine Line on Green Tape



Fine Line Thick Film is an alternative technology to Thin Film.

### FINE LINE ON FIRED CERAMIC



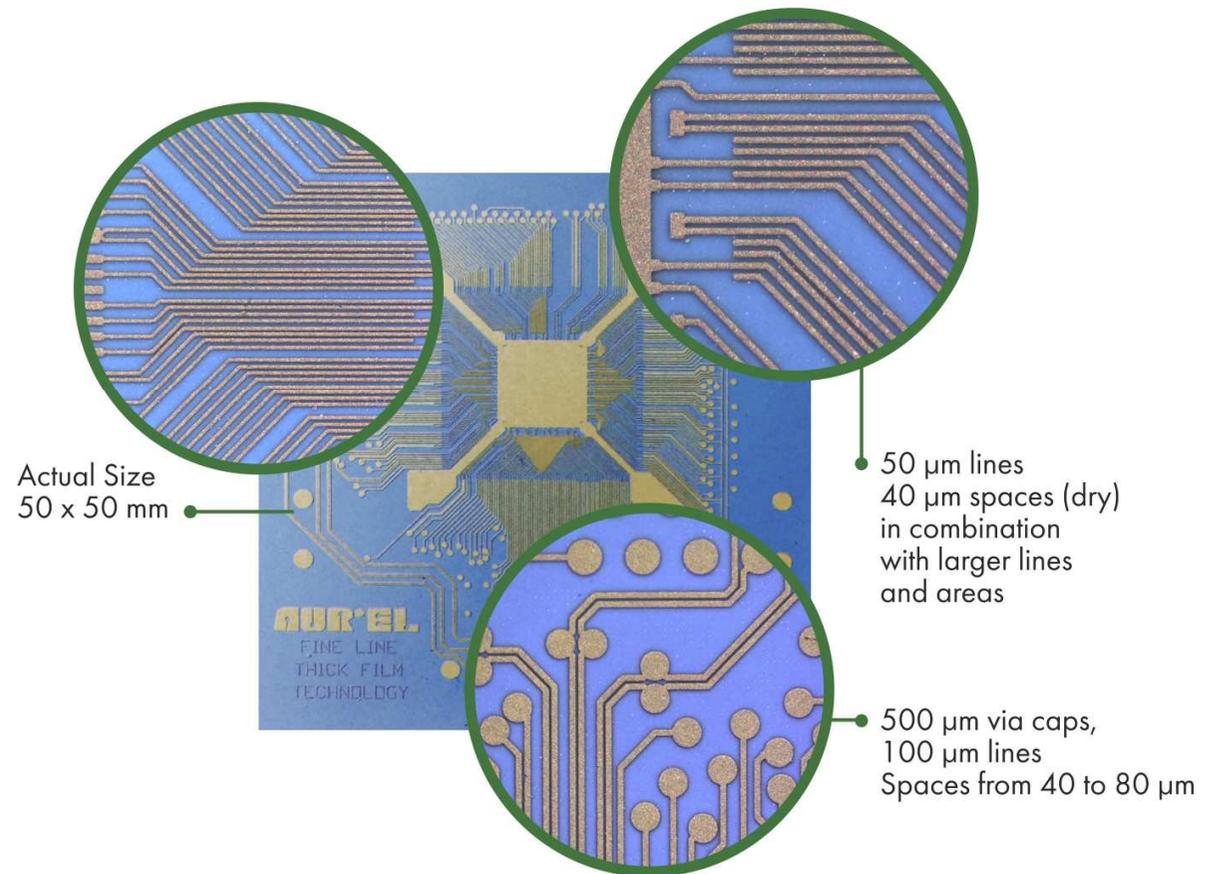


## Other technologies, Fine Line

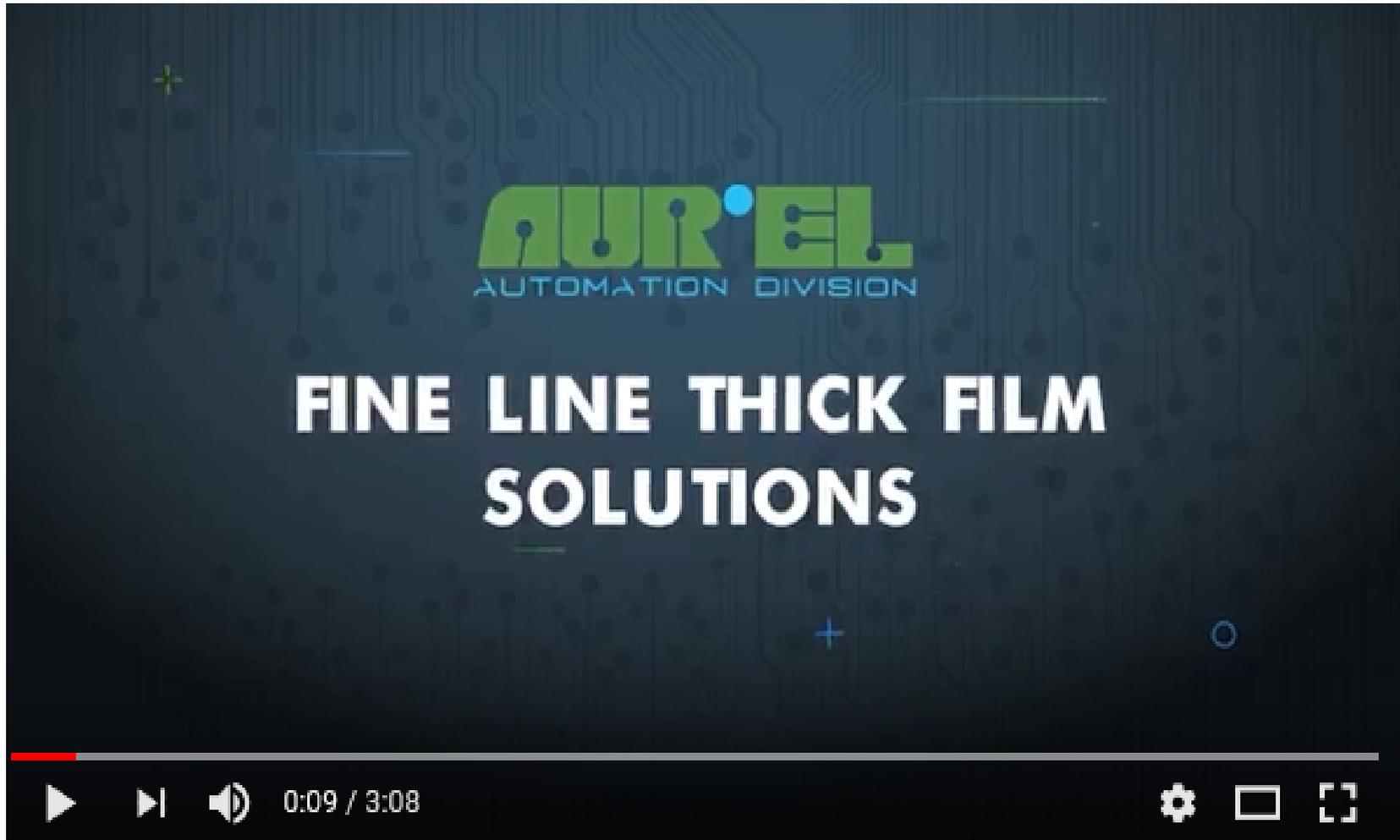
Fine Line on Fired Ceramics

Fine Line on Green Tape

### FINE LINE ON GREEN TAPE



Fine Line Thick Film is an alternative technology to Thin Film.



**YOUTUBE LINK <https://www.youtube.com/watch?v=nB9mmK9oSok>**

**CLICK HERE FOR AUREL VIDEO ON FINE LINE THICK FILM SOLUTIONS**

**SEE NEXT PRESENTATION PAGES FOR MORE INFORMATION  
ON AUREL WIRELESS PRODUCTS AND CONTACT INFORMATION**

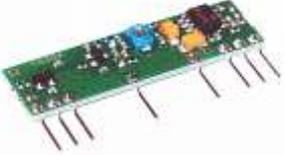
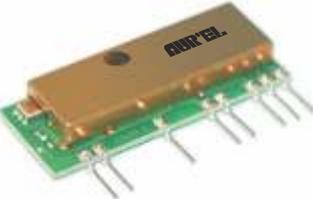


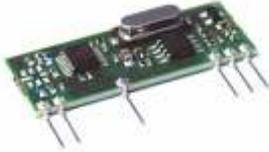
## WIRELESS MODULES

SECURITY ALARM SYSTEM  
TUBULAR MOTOR CONTROL  
COOKING HOODS  
HEATING SYSTEM CONTROL  
GATE/GARAGE OPENER  
AUTOMATIC DRIVER RECOGNITION SYSTEM  
STREET LIGHTING  
TARPAULIN SYSTEMS

2017/18

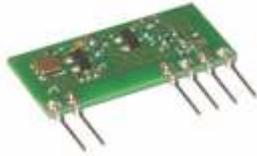
# RECEIVERS

	AC-RX2/CS	APPROVED CAT. 2	RX-4M30RR01SF	RX-4MM5/F	RX-4MM5++/F
				 <b>Available RX-4MM3/F (650201139G)</b>	 <b>Available RX-4MM3++/F (650201138G)</b>
<b>Part Number</b>	650201133G		650200590G	650201110G	650201140G
<b>Modulation</b>	ASK (AM)		ASK (AM)	ASK (AM)	ASK (AM)
<b>Supply</b>	5V		3V	5V	5V
<b>Frequency</b>	433.92 MHz		433.92 MHz	433.92 MHz	433.92 MHz
<b>Sensitivity</b>	-106 dBm		-100 dBm	-113 dBm	-114 dBm
<b>Consumption</b>	2.5 mA		0.07 mA	7.5 mA	7.5 mA
<b>Dimension</b>	38.1 x 12.3 x 3 mm		40.1 x 17.5 x 5.5 mm	36.5 x 14.5 x 4 mm	36.5 x 14.5 x 4 mm

	RX-MID 3V	RX-FM4SF	RX-8ML5/F	RX-4MA5LC-SMD	NEW
			 <b>Available RX-8ML5++/F (650201208G)</b>	 <b>Available in Tape &amp; Reel</b>	
<b>Part Number</b>	650201034G	650201096G	650201220G	650201443G	
<b>Modulation</b>	ASK (AM)	FSK (FM)	ASK (AM)	ASK (AM)	
<b>Supply</b>	3V	5V	5V	5V	
<b>Frequency</b>	433.92 MHz	433.92 MHz	868.30 MHz	433.92 MHz	
<b>Sensitivity</b>	-113 dBm	-105 dBm	-112 dBm	-113 dBm	
<b>Consumption</b>	6 mA	5.6 mA	10 mA	7.5 mA	
<b>Dimension</b>	25.4 x 12.4 x 4 mm	37.4 x 17.5 x 4 mm	36.5 x 16 x 4 mm	22.8 x 12.7 x 3 mm	

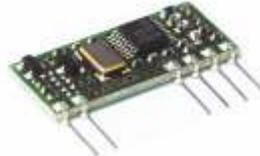
# TRANSMITTERS

## TX-SAW MID 3V/CS

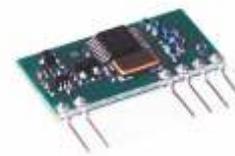


Available TX-SAW MID 5V/CS (650201132G)

## TX-FM-MID

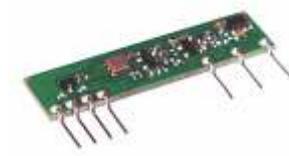


## TX-AM-868-MID



Available TX-FM-868-MID (650201130G)

## TX-SAW-434-L



Available TX-SAW-434-L-3V (650201410G)

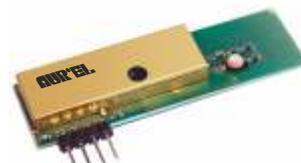
**NEW**

<b>Part Number</b>	650201131G	650200926G	650201182G	650201409G
<b>Modulation</b>	ASK (AM)	FSK (FM) PLL	ASK (AM) PLL	ASK (AM)
<b>Supply</b>	3V	3V	3V	3=12V
<b>Frequency</b>	433.92 MHz	433.92 MHz	868.30 MHz	433.92 MHz
<b>Consumption</b>	6 mA	14 mA	16 mA	7.5 mA
<b>Out RF Power</b>	10 mW	10 mW	10 mW	10 mW
<b>Dimension</b>	25.4 x 12.5 x 2.5 mm	25.4 x 12.4 x 2.5 mm	25.4 x 13.5 x 2.5 mm	38.1 x 11 x 3 mm

## TX-4M10HA



## TX-8L25IA



## TX-SMD-AI



Available in Tape & Reel

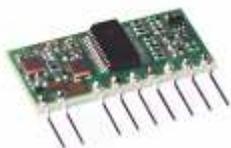
**NEW**

<b>Part Number</b>	650200819G	650200846G	650201426G
<b>Modulation</b>	ASK (AM)	ASK (AM)	ASK (AM)
<b>Supply</b>	3V	3V	3V
<b>Frequency</b>	433.92 MHz	868.30 MHz	433.92 MHz
<b>Consumption</b>	25 mA	25 mA	11 mA
<b>ERP Power</b>	10 mW	25 mW	2 mW
<b>Dimension</b>	56 x 18.5 x 8 mm	56 x 18.5 x 5 mm	22.9 x 12.7 x 2.5 mm

# TRANSCEIVERS

## RTX-4M3V-ASK

**NEW**



Available RTX-4M3V-FSK (650201427G)

## RTX-8L3V-ASK

**NEW**



Available RTX-8L3V-FSK (650201425G)

## RTX-868 FSK



## RTX-915 FSK FCC-IC

**NEW**



<b>Part Number</b>	650201420G	650201424G	650201343G	650201418G
<b>Modulation</b>	ASK (AM)	ASK (AM)	2FSK	2FSK
<b>Supply</b>	3V	3V	3V	3V
<b>Frequency</b>	433.92 MHz	868.30 MHz	868.30 MHz - 869.85 MHz	915 MHz - 916.5 MHz
<b>Sensitivity</b>	-113 dBm	-107 dBm	-108 dBm	-105 dBm
<b>Consumption</b>	12 mA (TX) - 9.2 mA (RX) - < 1 µA (standby)	12 mA (TX) - 11.2 mA (RX) - < 1 µA (standby)	31 mA (TX) - 6 mA (RX) - 1 µA (standby)	23 mA (TX) - 6 mA (RX) - 1 µA (standby)
<b>Out power</b>	7 mW	5 mW	4 mW ERP	0.3 mW ERP
<b>Channels</b>	1	1	2	2
<b>Dimension</b>	25.4 x 12.4 x 3 mm	25.4 x 12.4 x 3 mm	25.4 x 22 x 2.5 mm	25.4 x 22 x 3.7 mm

## XTR VF 2.4 LP



## XTR VF 2.4 HP/V



## RF4CE SMD



## RTX LONG RANGE 869



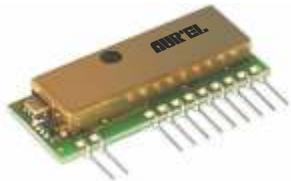
<b>Part Number</b>	650201025G	650201340G	650201314G	650201347G
<b>Modulation</b>	GFSK	GFSK	FSK	GFSK
<b>Supply</b>	3V	3V	3V	3V
<b>Frequency</b>	2.4 GHz	2.4 GHz	2.4 GHz	869.4-869.65 MHz
<b>Sensitivity</b>	-97 dBm	-104 dBm	-97 dBm	-118 dBm
<b>Consumption</b>	34 mA (TX) - 21 mA (RX) - < 1 µA (standby)	185 mA (TX) - 31 mA (RX) - 2 µA (standby)	39 mA (TX) - 25 mA (RX) - 1 µA (standby)	550 mA (TX) - 32 mA (RX) - 8 µA (standby)
<b>Out power</b>	2 mW ERP	100 mW ERP	2 mW ERP	500 mW
<b>Channels</b>	82	78	3	7
<b>Dimension</b>	35 x 25 x 5 mm	35 x 25 x 5 mm	20 x 15 x 2 mm	33 x 23 x 8 mm

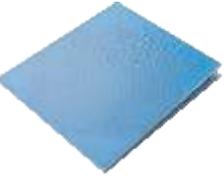
# KEYFOBS

	HCS-TX-3	TX-6M-HCS	TX4-RP-HCS 433 N	NEW	TX-12CH-EVO
					
	Available 1/2/3 channels Available 868 MHz version	Available 2/4/6 channels Available 868 MHz version	Available 1/2/4 channels		
<b>Part Number</b>	650200684G	650200828G	650201421G		650201226G
<b>Modulation</b>	ASK (AM)	ASK (AM)	ASK (AM)		ASK (AM)
<b>Battery supply</b>	3V (CR2032 Lithium)	12V (23A Alkaline)	3V (CR2032 Lithium)		3V (CR2032 Lithium)
<b>Frequency</b>	433.92 MHz	433.92 MHz	433.92 MHz		433.92 MHz
<b>Consumption</b>	10 mA	15 mA	10 mA		10 mA
<b>ERP Power</b>	0.5 mW	1 mW	1 mW		1 mW
<b>Dimension</b>	55 x 44 x 15 mm	73 x 40 x 16 mm	72 x 39 x 11 mm		85 x 54 x 10 mm
	TX-KEY-15	TX-12E-2TK	TX4-RP-CP 433 N	NEW	TX 4M µP-LP
					
		Available 1/2 channels	Cloner of fixed code keyfobs		Compatible only with RX-4M µP/LP (650201168G)
<b>Part Number</b>	650201297G	650201001G	650201422G		650201166G
<b>Modulation</b>	ASK (AM)	ASK (AM)	ASK (AM)		ASK (AM)
<b>Battery supply</b>	3V (2x1.5V AA Alkaline)	12V (23A Alkaline)	3V (CR2032 Lithium)		3V (CR2032 Lithium)
<b>Frequency</b>	433.92 MHz	433.92 MHz	433.92 MHz		433.92 MHz
<b>Consumption</b>	40 mA	10 mA	12 mA		10 mA (TX)
<b>ERP Power</b>	10 mW	1 mW	0.5 mW		0.5 mW
<b>Dimension</b>	170 x 75 x 32 mm	65 x 37 x 15 mm	72 x 39 x 11 mm		73 x 40 x 16 mm

NOTE: above Part Number refer to keyfobs programmed with AUREL manufacturer code.

# DECODER & SENSOR

	RX-4MHCS	RX-4M $\mu$ P/LP	HCS DEC 4F
			
	Compatible only with AUREL HCS remote control	Compatible only with TX-4M $\mu$ P/LP (650201166G)	Available 1/2/4 relays Compatible only with AUREL HCS remote control
<b>Part Number</b>	650200997G	650201168G	650201042G
<b>Modulation</b>	ASK (AM)	ASK (AM)	ASK (AM)
<b>Supply</b>	5V	3V	12 VDC - 24 VAC
<b>Frequency</b>	433.92 MHz	433.92 MHz	433.92 MHz
<b>Sensitivity</b>	-106 dBm	-114 dBm	-100 dBm
<b>Consumption</b>	3 mA	0.07 mA	8 mA (DC) - 20 mA (AC)
<b>Dimension</b>	41 x 18 x 6 mm	41 x 20 x 3.1 mm	65 x 45 x 18 mm

	MAG HCS/Z	SIR 2008 HCS/HT12E	CAPACITIVE RAIN SENSOR <b>NEW</b>
			
<b>Part Number</b>	650201257G	650201090G	650201442G
<b>Modulation</b>	ASK (AM)	ASK (AM)	-
<b>Supply</b>	3V (CR2 Lithium)	3V (2 x AAA Alkaline)	12V
<b>Frequency</b>	433.92 MHz	433.92 MHz	-
<b>Power ERP</b>	3 mW	1 mW (Power ERP)	-
<b>Consumption</b>	32 mA (TX) - 5 $\mu$ A (standby)	9 mA (TX) - 13 $\mu$ A (standby)	0.25 mA
<b>Dimension</b>	98 x 38 x 24 mm	120 x 60 x 45 mm	30.5 x 35.5 x 2 mm

# LoRa™ MODULES



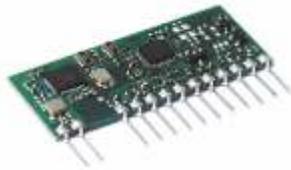
	XTR-8LR100	XTR-8LR10	XTR-8LR-USB	NEW	XTR-8LR-4ZN	NEW
					 Compatible only with 650201431G	
<b>Part Number</b>	650201364G	650201415G	650201428G		650201429G	
<b>Modulation</b>	LoRa™	LoRa™	LoRa™		LoRa™	
<b>Supply</b>	3V	3V	5V by USB		3V (CR2032 Lithium)	
<b>Frequency</b>	869.4 ÷ 869.6 MHz	868 ÷ 870 MHz	869.4 ÷ 869.6 MHz		868.30 MHz	
<b>Sensitivity</b>	-118 to -145 dBm	-115 to -137 dBm	-118 to -145 dBm		-122 dBm	
<b>RF output power</b>	100 mW (max)	25 mW	100 mW ERP		10 mW ERP	
<b>Consumption</b>	17 mA (RX) - 110 mA (TX)	17 mA (RX) - 30 mA (TX)	20 mA (RX) - 135 mA (TX)		35 mA	
<b>Dimension</b>	37 x 18 x 2.4 mm	33.5 x 15.4 x 2.4 mm	69 x 25 x 13 mm		72 x 39 x 11 mm	

	XTR-8LR-ENC	NEW	XTR-8LR-DEC	NEW	XTR-8LR100-DEMO	XTR-8LR10-DEMO
	 Compatible only with 650201431G		 Compatible only with 650201429G & 650201430G			
<b>Part Number</b>	650201430G		650201431G		650201374G (8LR100)	650201392G (8LR10)
<b>Modulation</b>	LoRa™		LoRa™		LoRa™	LoRa™
<b>Supply</b>	3V		3V		6V (4 x 1.5V) AA Alkaline or Ext. DC supply	6V (4 x 1.5V) AA Alkaline or Ext. DC supply
<b>Frequency</b>	868.30 MHz		868.30 MHz		868 ÷ 870 MHz	868 ÷ 870 MHz
<b>Sensitivity</b>	-122 dBm		-126 dBm		-118 to -145 dBm	-115 to -137 dBm
<b>RF output power</b>	20 mW ERP		20 mW		100 mW ERP (XTR-8LR100)	25 mW ERP (XTR-8LR10)
<b>Consumption</b>	35 mA (TX) - < 1µA (PWRN)		< 1 mA (RX IDLE) - 16 mA (RX) - 35 mA (TX)		24 mA (RX) - 125 mA (TX)	24 mA (RX) - 30 mA (TX)
<b>Dimension</b>	35.5 x 18 x 2.3 mm		38.5 x 16 x 3.8 mm		90 x 70 x 33 mm	90 x 70 x 33 mm

# RFTIDE™ MESH NETWORK MODULES



## RFT-868-3V/V2



Available RFT 868 5V/V2 (650201382G)

## RFT-868-SML



## RFT-868-USB-V/V2



## RFT 868 4CH



<b>Part Number</b>	650201380G	650201375G	650201378G	650201377G
<b>Modulation</b>	FSK	FSK	FSK	FSK
<b>Supply</b>	3.3V	3.3V	5V by USB connector	3V (1 x CR2032 Lithium)
<b>Frequency</b>	868.30 MHz	868.30 MHz	868.30 MHz	868.30 MHz
<b>Sensitivity</b>	-100 dBm	-100 dBm	-100 dBm	-100 dBm
<b>Out RF Power</b>	5 mW	5 mW	5 mW ERP	2 mW ERP
<b>Consumption</b>	10 mA (RX) - 33 mA (TX)	10 mA (RX) - 33 mA (TX)	20 mA (RX) - 43 mA (TX)	33 mA (< 1 µA standby)
<b>Dimension</b>	38.6 x 18.2 x 2 mm	28 x 15 x 2 mm	72 x 10 x 24 mm	72 x 39 x 11 mm

## RFT-868-EVKIT/V2



### RFTide Evaluation Kit - P.N. 650201371G

- n. 1 - RFT 868 USB-V/V2
- n. 4 - RFT-868-DEMO
- n. 5 - RFT 868 3V/V2
- n. 8 - AA 1.5 V BATTERIES

\* PC Software downloadable from [www.rftide.com](http://www.rftide.com)



# ANTENNAS

	ANT AS 433	ANT AS 868	ANT GP 433	ANT GP 868
				
	<b>Connector + Cable (BNC + 2.5 mt RG58)</b>	<b>Connector + Cable (BNC + 2.5 mt RG58)</b>	<b>Connector Cable (BNC Plug + 2.5 mt RG58)</b>	<b>Connector Cable (BNC + 2.5 mt RG58)</b>
<b>Part Number</b>	650200596G	650200597G	650200313G	650200599G
<b>Type</b>	Stylus	Stylus	Ground plane	Ground plane
<b>Frequency</b>	433.92 MHz	868 ÷ 880 MHz	433.92 MHz	868 ÷ 880 MHz
<b>Impedence</b>	50 Ohm	50 Ohm	50 Ohm	50 Ohm
<b>Gain</b>	2.1 dBi	2.1 dBi	2.1 dBi	2.1 dBi
<b>Dimension</b>	34 x 170 mm	34 x 90 mm	190 x 460 mm	110 x 255 mm
	ANT T/TA	ANT T8/T8A	ANT 868 SMA	ANT RP SMA 2.4
				
	<b>Cable (10 cm RG174)</b>	<b>Cable (10 cm RG174)</b>	<b>Connector (SMA Plug)</b>	<b>Connector (RP-SMA)</b>
<b>Part Number</b>	650200442G (T) - 650200448 (T-A)	650200607G (T8) - 650200608 (T8A)	650201433G	650201098G
<b>Type</b>	Stylus	Stylus	Stylus	Stylus
<b>Frequency</b>	433.92 MHz	868 ÷ 880 MHz	820 ÷ 960 MHz, 1700 ÷ 2100 MHz	2400 ÷ 2500 MHz
<b>Impedence</b>	50 Ohm	50 Ohm	50 Ohm	50 Ohm
<b>Gain</b>	2.1 dBi	2.1 dBi	1 dBi	2 dBi
<b>Dimension</b>	90 x 6 mm	90 x 6 mm	41 x 9.5 mm	108 x 10 mm

# LoRa™ XTR-8LR100 TEST REPORT



Radio communications between devices located in adjacent cities



XTR-8LR-DEMO

D1 = 18 Km	BW 125 KHz	BW 65,2 KHz	BW 20,8 KHz
SF = 7	100%	/	100%
SF = 8	100%	100%	100%
SF = 10	100%	100%	100%
SF = 12	100%	100%	100%

D2 = 29 Km	BW 125 KHz	BW 65,2 KHz	BW 20,8 KHz
SF = 7	/	89%	94%
SF = 8	52%	91%	94%
SF = 10	82%	94%	96%
SF = 12	85%	97%	99%

Test has been conducted with two demoboard: one is a base station and the other is mobile connected to laptop.

For every combination of parameters (bandwith BW and spreading factor SF) percentage of correct packets is reported.

Data packet length is 8 bytes.

# CASE STUDY: RFTIDE MESH NETWORK FOR ENERGY SAVING



Concentration unit (PC or embedded board) gets wireless real time data about light, temperature and presence and switches/dims lamps in the warehouse.

This allows to cut down costs of energy.



PIR SENSOR



SWITCH



DIMMER



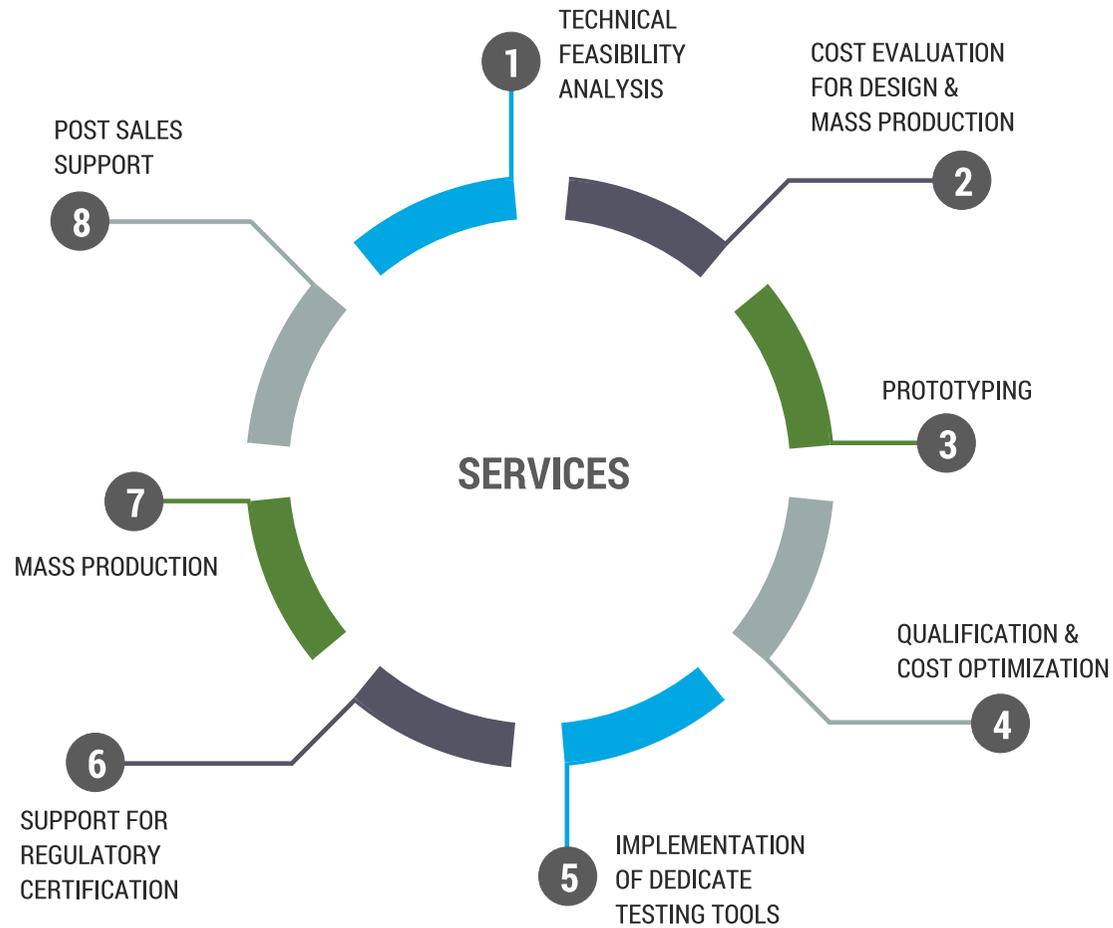
LIGHT / TEMPERATURE SENSOR



# CUSTOM PROJECTS



AUREL is delighted to evaluate customer proposal for tailored made products requiring our skill in RF design. Keeping in mind the importance of providing reliable and cost effective products, we can offer following services:



# APPLICATIONS



**SECURITY ALARM SYSTEM**



**TUBULAR MOTOR CONTROL**



**COOKING HOODS**



**HEATING SYSTEM CONTROL**



**GATE/GARAGE OPENER**



**AUTOMATIC DRIVER  
RECOGNITION SYSTEM**



**STREET LIGHTING**



**TARPAULIN SYSTEMS**

# CONTACT TOM TERLIZZI GM SYSTEMS LLC FOR INFORMATION ON AUREL MICROELECTRONICS AND WIRELESS PRODUCTS IN USA

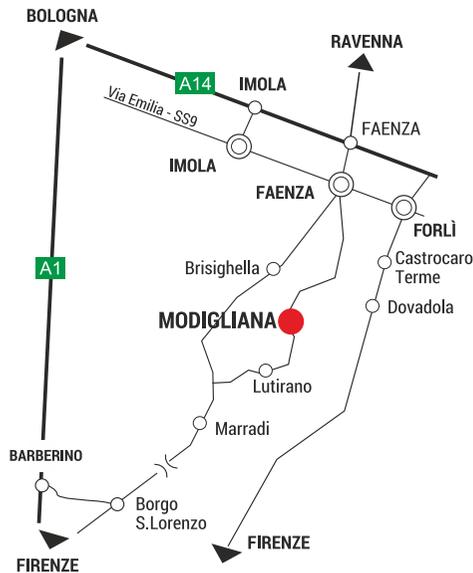
516-807-9488 CELL OR 631-269-3820 OFFICE LAND LINE

EMAIL: [Terlizzi@gmsystems.com](mailto:Terlizzi@gmsystems.com) Web site <http://www.gmsystems.com/index.html>

CONTACT

## ABOUT US

Established	1970
Employees	71
Engineers	15
Turnover (2016)	11.3 Million of euro
Dimensions	4.600 mq (3.500 covered)
Certification	ISO 9001



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