

HIGH QUALITY SURFACE PLATING

Application guide
for **BBR**



ISO 9001 APPROVED



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Compared with today's kinds of plating, RADIALL's BBR is one of the highest quality surface finishes for RF connectors and microwave components for indoor or outdoor applications : BBR shows intermodulation characteristics comparable with that of silver

and largely better than that of Nickel or passivated stainless steel.

Less expensive than gold, it is more corrosion and scratch resistant, and offers at the same time better electrical performance than nickel without being allergen.

MAIN ADVANTAGES OF BBR

- Low Intermodulation
- Excellent corrosion resistance
- High abrasion resistance
- Good conductivity
- Low surface friction
- Solderability
- Environmentally friendly
- Bright finish

CURRENT PLATING

Most of the popular and available kinds of plating for RF connectors and microwave components meet only part of today's requirements.

For example :

Ag : high electrical performance but low corrosion resistance

Cr : high friction and corrosion resistance but low conductivity and heavy metal



Ni : high abrasion and corrosion resistance but magnetic and allergen



Au : the highest quality plating but expensive

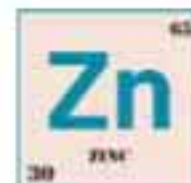
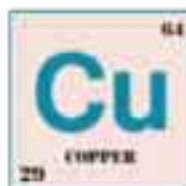


WHAT ABOUT BBR ?

BBR - Bright Bronze Radiall- is a COPPER-TIN-ZINC base alloy plating, obtained by electrolytic deposit, and applicable on all copper substrates.

Composition :

- **COPPER: 55%**
- **TIN: 30%**
- **ZINC: 15%.**



RADIALL 's **BBR** demonstrates **the best** compromise between electrical, mechanical and environmental characteristics.

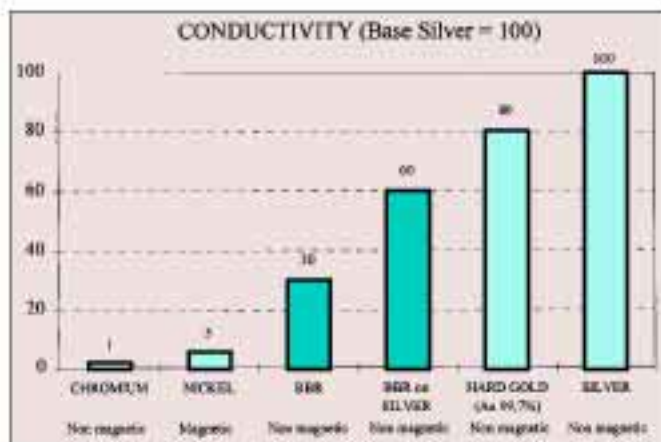
CONDUCTIVITY

RADIALL BBR combines good conductivity with relative permeability $\mu\Omega = 1$ (non-magnetic plating).

Composition of BBR is exempt from magnetic elements like ferrous materials or other nickel elements. Consequently :

- High power transmission allowed,
- RF insertion losses minimised in connectors or microwave components (even at high frequencies).

These properties can be significantly improved by a silver undercoating on strategic piece parts where an excellent electrical conductivity is required.



INTERMODULATION (IMP)

RADIALL is an active member of the IEC committee in charge of the definition of an Intermodulation test procedure and of the establishment of a new IEC specification (Working group IEC TC46-WG6 / Passive Intermodulation Measurement).

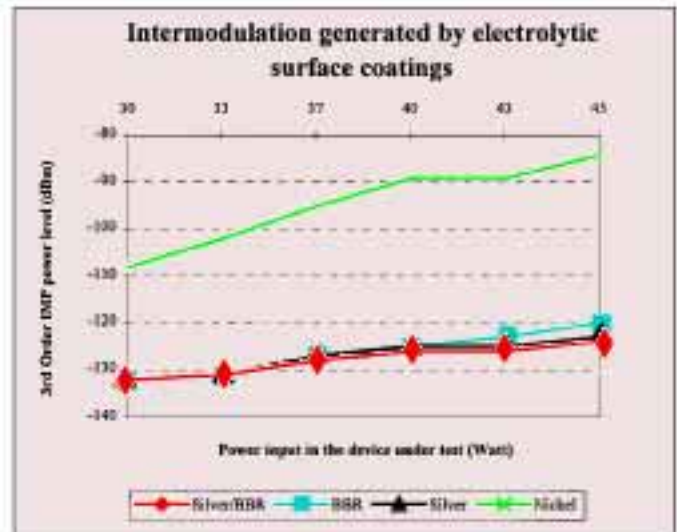
Therefore, RADIALL developed the BBR plating in order to meet the new requirements of applications such as base stations i.e :

LOWER INTERMODULATION PRODUCTS

As BBR is non-magnetic (non-ferrous alloy) and corrosion resistant, the intermodulation products caused by dissimilar metals, corrosion or discontinuities reduce.

So that :

- Intermodulation products generated by BBR are as low as that with Silver plating.
- Integrity of BBR finish is guaranteed by its corrosion resistance and its mechanical endurance.



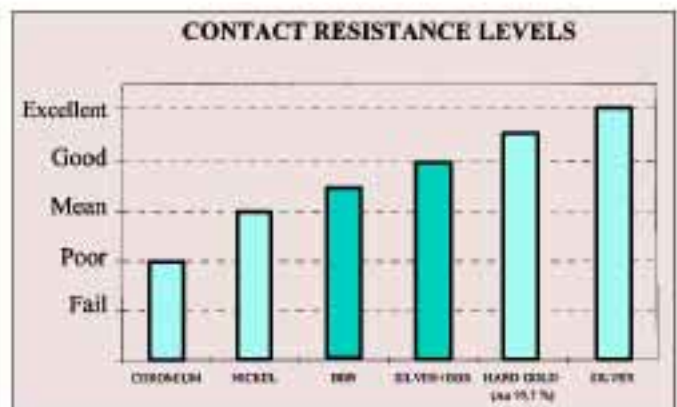
A Silver underlayer still improves the level of intermodulation (until +8 dBm/1800 GHz) and allows stability, better repeatability and measurement.

CONTACT RESISTANCE

The level of CONTACT RESISTANCE of BBR is situated between NICKEL plating and HARD GOLD plating (Au 99,7%).

Thus any RF connectors part, excepted center contact, can be BBR plated.

A silver underlayer improves also significantly the contact resistance on critical parts (spring outer contact for example), but without tarnishing or corroding them.



MECHANICAL CHARACTERISTICS

DUCTILITY

RADIALL BBR is characterised by a ductility comparable to electrolytic RADIALL Nickel plating.

This high level of ductility combined with a good adhesion on all copper base alloys used in connector and microwave component industry, allows to plate BBR on any parts, including crimping ones.

HARDNESS

The hardness of BBR is slightly higher than RADIALL Nickel finish and about five times the mean value of the silver one.

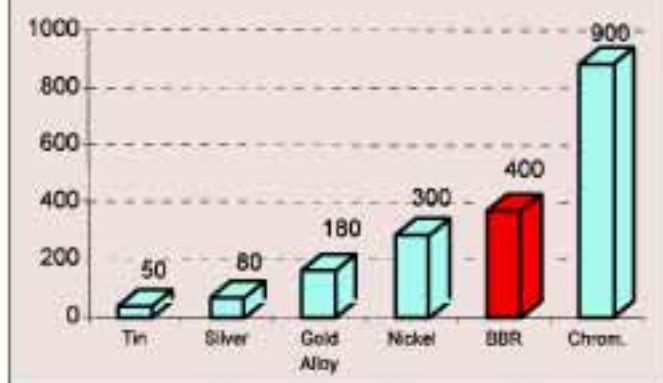
This property, combined with a low coefficient of friction, gives to RADIALL BBR an excellent wearing resistance largely better than Nickel plating.

BBR connectors meet the usual standard (MIL/CEI) in mechanical endurance with 500 matings/dismatings minimum.

COEFFICIENT OF FRICTION

The coefficient of friction of RADIALL BBR is 70% that of usual silver plating. That means less wearing particles when mating or dismating, and a longer connector life.

HARDNESS OF PLATING (Vickers)



SOLDERABILITY



Comparative quantitative tests performed by RADIALL on MCX PCB receptacles with a MENISCOGRAPH equipment (tin lead 60/40 - 235°C - RMA Flux - duration 10s), shows the level of solderability of 4 types of coatings.

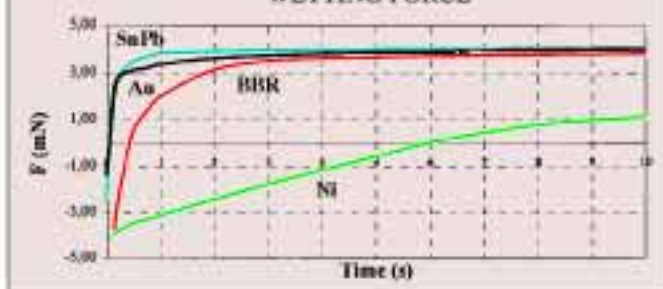
After 3 seconds, BBR shows a level of solderability equivalent to Tin-lead and Gold, when an appropriate flux is used.

Plating BBR on PCB connectors may improve considerably the solderability of the connectors, compared with Nickel plating.

BBR plating is solderable according to standard reference IEC-68-2-20, using standard tin-lead 60/40 material and low activated flux (rosin with less than 0,5% chlorure).

Solderability of BBR is maintained even after a long time of storage.

WETTING FORCE



ENVIRONMENTAL CHARACTERISTICS

1° - Corrosion and tarnishing resistance are among the most important environmental features of BBR.

The low relative electrolytic potential of BBR with common base material (copper, brass...) prevents from the corrosion generated by high galvanic potential difference that is met with other finishes.

Moreover, its tarnishing endurance is largely better than the silver one. BBR stays bright, does not discolor.

The direct consequence of these behaviours is the preservation of all electrical characteristics. While BBR finished connectors keep their contact resistance and their intermodulation level constant after usual corrosive tests, silver plated connectors have their characteristics degraded.

2° - BBR is fully sealed with a plating thickness of 2µm (non porous plating). This is possible by the low level of porosity of BBR, better with that of Nickel.

ELECTROCHEMICAL CORROSION POTENTIALS
(SALT MIST ATMOSPHERE)

Couple in mV	METAL / ALLOYS
0	Au - Au alloys - Pt - Rh
- 150	Ag - Ag alloys (high % of Ag)
- 300	Ni - Monel - Ni alloyed Cu (high % of Ni)
- 350	Cu - Brass and Bronze (high % of Cu) - Austenetic stainless steel Ni alloyed Cu (high % of Cu) - Ni alloyed Cr - Ag brazing
- 400	Commercial Brass and Bronze
- 450	BBR
- 450	Brass and Bronze with a low % of Cu - Marine Brass
- 500	Stainless steel (18/8)
- 600	Cr plated - Tin plated - Stainless steel (12 % of Cr)
- 650	Tin - Tin-lead welding
- 750	Al - Duralumin type alloys
- 900	Al alloyed Si
- 950	Cd
- 1120	Zn - Zn alloys - Die cast zinc

3° - Excellent properties of covering (even in internal holes), and regularity of deposit in term of depth make the BBR be one of the best electrolytic plating in electronic industries, far better than Nickel.

ENVIRONMENTAL TESTS

CORROSION

Salt Mist

BBR passes the test of exposure to salt mist (96 hours / 35°C / 5% NaCl) to check resistance to sea coast atmosphere and to evaluate its compatibility with the various base metals and undercoating.

No change of contact resistance were observed thanks to BBR low galvanic potential with base metals like copper, brass, etc...

Industrial atmosphere gas test

Exposure of BBR plated mated parts in initial condition and after matings.

After 10 days to SO₂ Gas exposure (10 ppm - 74% RH) or 4 days to H₂S-SO₂ Gas exposure (H₂S=1 ppm / SO₂ =10 ppm), electrical characteristics kept unchanged.

After 100 hours to K₂S Gas exposure (K₂S 10% - 100% RH - MIL-C-39029D), contact resistance still met the standard requirements.



Notes :

- The addition of a silver underlayer does not affect these test results. When an ultra low level of intermodulation products is required, a silver undercoating may be used without risking corrosion.
- Nickel and Silver don't pass all these Industrial Atmosphere Tests.

Silver plated receptacle after salt mist exposure ▼



▲ BBR plated receptacle after salt mist exposure

MOISTURE TESTS



Exposure of BBR plated parts to high humidity environment over a 10 day period (cyclic humidity 10 cycles MIL-STD 202 Meth 106) or 21 days (damp heat steady state 40°C / 95% RH), do not cause any significant impact on appearance and on the connector outer contact resistance.



HIGH TEMPERATURE ENDURANCE

Neither appearance nor contact resistance of BBR were affected when exposed to an environmental condition of 155°C/1000 hours. No problem of plating adhesion occurred.

THERMAL SHOCKS

This test was performed to determine the resistance of the parts to exposures at high and low temperatures and to the shock of transfer. Effects of thermal shocks include cracking and delamination of finishes.

Exposure of BBR plated parts to 5 cycles at -55°C/+155°C with a transfer time $t < 20s$ demonstrated fully satisfactory results. Results showed no problem of adhesion, or cracking of the plating.

MORE DETAILS

APPEARANCE

RADIALL BBR looks like a pleasant bright white silver.

"GREEN" PLATING

RADIALL BBR shows the advantage of not containing heavy metals like Cadmium or Chromium.

As a Nickel-free plating, BBR meets the European directive DG-XI-76/769 restricting Nickel utilisation. BBR is not allergen.



AVAILABILITY

BBR is available for all RADIALL coaxial connectors : SMA, BMA, N, 7/16...etc

SPECIFICATIONS

BBR meets all usual standard requirements for RF connectors like the well-known MIL 39012, IEC 1169, CECC 22000 specifications.

BBR has been qualified on representative parts by RADIALL in an CECC/CEI approved Test Laboratory.

BBR process and products are periodically audited within a continuous improvement program aimed at Total Quality.

RADIALL ELECTROPLATING FACILITIES

RADIALL plating facilities stand as one of the most advanced in electronic industry.

Implementation of Statistical Process Control (SPC) in manufacturing processes and particularly of follows-up of thickness and deposit alloy composition, leads to a continuous high finish quality.

Moreover, RADIALL plating facilities stick to the legislation relative to waste treatment. The quality of the used water is checked through daily, weekly and quarterly samplings.

