CASA UHF Design Integrations + Innovations

Introduction:

The UHF title is inherited from an era when less was understood by the designers and users - that its centre-pin is compatible with the 4mm banana-plug is a clue to the naivety of the design? For better or worse, we are obliged to stick with the application traditions that surround its existence and its optimistic title.

Our modern-day technical impression is that the UHF style connector is mis-named by the over-optimistic naming-authorities before the 2nd WW. It may have been more suitably titled VHF but the UHF label has stuck. In spite of the various shortcomings the primitive shielded-banana-plug design is quite functional and still popular with the radio-ham and RF hobby market largely because it requires no special tools and has remained available at a relatively low cost for more than 50 years. Tradition has maintained its market and its on-going production and usage in all but professional RF equipments and associated test apparatus where it has been supplanted by its various modern successors.

With few exceptions Non-Impedance-Matched coaxial connectors are in declining use. Modern, match-impedance coaxial connectors in common use in professional applications and suitable for cables in the RG-58 through RG-213 size range - the most popular include: BNC series, TNC series, N series and SMA series.

Custom cabling to install (interconnect) RF equipment tends to be very sight specific. The skill, equipment and labour required to on-sight terminate (install) these modern designs is generally un-justified by the UHF connector traditionalist and likely to remain so for many years. However, this does not completely negate offering design-improvements that will help.

Depending upon the power-rating/limits of the coaxial-cable being deployed the UHF connector is considered capable of handling LF~VHF RF signals up to 150~250 Watts.

The "UHF" series has a nominal-maximum usable frequency limit of 200~300 MHz because the impedance of the connector is not optimised to the outer coupling. It is commonly used with flexible braided coaxial cables up to 11 mm (0.433") diameter. Both soldering and/or crimping techniques are used for terminating these depending upon the design implementations adopted to facilitate the basic PL259 connector functionality.

Applications for the UHF connectors are for low-frequency, HF, and some VHF communication equipment.

Sealing:

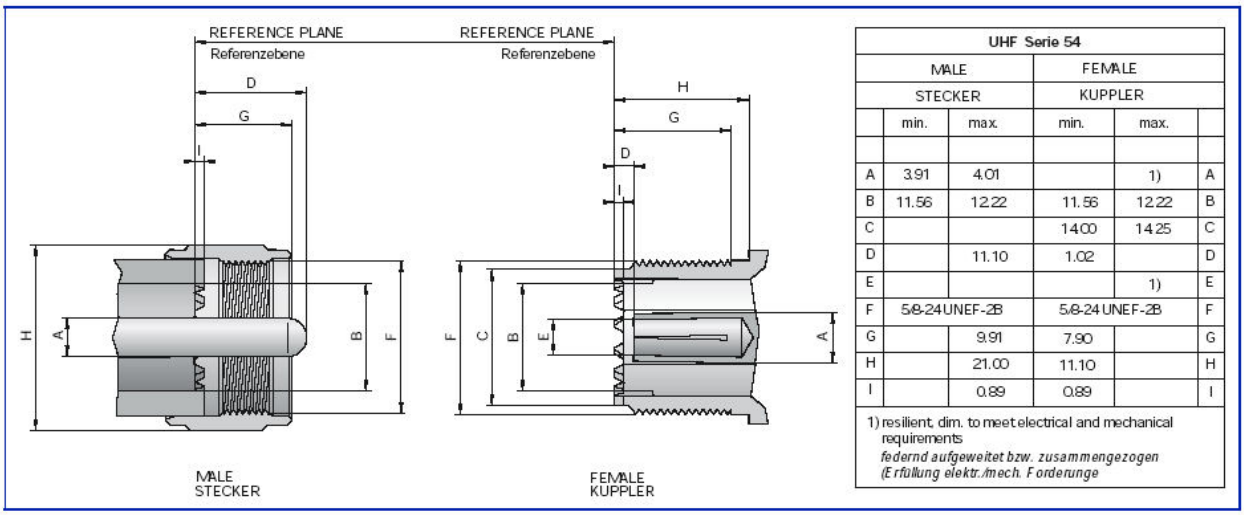
Apart from the non-matched impedance, perhaps the most significant shortcoming of the UHF series is the complete absence of any sealing gaskets or o-rings. This means that the ingress of moisture into the connector interface and the cable has to be eliminated by external-after-assembly treatments (coated heatshrink etc.)

Interface Specification:

The MIL specification-interface was adopted by the IEC for European usages as per "IEC 60169-12"
The basic details are contained in this jpg:

UHF **Interface Dimensions**

Interface Dimensions



UHF Serie 54					
	MALE STECKER		FEMALE KUPPLER		
	min.	max.	min.	max.	
A	3.91	4.01		1)	A
B	11.56	12.22	11.56	12.22	B
C			14.00	14.25	C
D		11.10	1.02		D
E				1)	E
F	5/8-24 UNEF-2B		5/8-24 UNEF-2B		F
G		9.91	7.90		G
H		21.00	11.10		H
I		0.89	0.89		I

1) resilient, dim. to meet electrical and mechanical requirements
federnd aufgeweitet bzw. zusammengezogen (Erfüllung elektr./mech. Forderunge

or direct from IEC by 400k file transfer (cost US$30):
http://webstore.iec.ch/preview/info_iec60169-12%7Bed1.0%7Db.img.pdf

Problems & Improvements:

We perceive that the identifiable and addressable problems with the traditional PL-259 include the following:

1) Difficult assembly/termination due to preparing, fitting and soldering the braid and the centre-conductor to the fixed pin without spoiling the cable and connector with excesses of heat, solder, fluxes etc.
2) Mica-filled-bakelite dielectric easily fails or contaminates and imposes higher losses and limits RF power-handling compared with better dielectric materials now readily available.
3) Adaption of the PL-259 to other cables with the UG-175/176 reducing adaptors adds costs, compromises cable retention and further complicates braid soldering without damage to the smaller cables.
4) Sealing requires the use of externally applied sealants which may be at least partly addressed with the use of some strategically included O-Rings. This is especially complicated when small cables are used and 2 sizes of coated-heatshrink may be required to achieve sealing transitions.

New UHF Objectives:

The NEW design must retain the basic interface standards *(IEC-60169-12)* and include design/feature enhancements that will help address the above shortcoming of the PL259 by improving the modularity and termination options to achieve better assembly, termination-efficiency and some aids to sealing.

1) Contact-Improvements*:* To improve the termination-method versatility, the centre-pin may have a crimpable end-reduction/transition to allow crimping of RG213/214 and similar cables and still provide a soldererable tip *(and/or cross-hole near the tip rather than the traditional solder-spill cut-away)*.

2) Primary Cable Types: It is our vision that the NEW PL259 (alias 11UHF-0-7-PL259) in its ***'native'*** mode will include use with the following cables & their near equivalents

RG-213, RG-8/U, RG-11/U, LMR-400

3) Small Cable Types: By the deployment of various reducing adaptors the PL259 capable of use with smaller cable sizes including RG-58 etc. A crimpable spigot extension integrated on to the UG-175/U reducing-adaptor will enable the PL259 body to become a SEMI-CRIMP (braid-crimp) connector compatible with industry standard crimp tools.

Perhaps the biggest distraction with the use of conventional reducing-adaptors is the difficulty of effectively soldering the braid through the 4 central holes in the PL-259 body. The new reducing adaptor is a better fit into the body cavity (less clearance) and yet will still allow solder to be applied through 1 or more of these holes to achieve the locking of the threaded reducing adaptor and/or an improvement in the RF electrical properties of the connector.

4) Optional Seals: If the PL-259 internal screw-on 7/16”-UNC thread for the cable-jacket is rebated by 3mm then, if readily available, an 8mm ID x 12mm O-Ring (or square-section sealing gasket) may be optionally applied to the reducing adaptor between the thread and the 11mm shoulder.

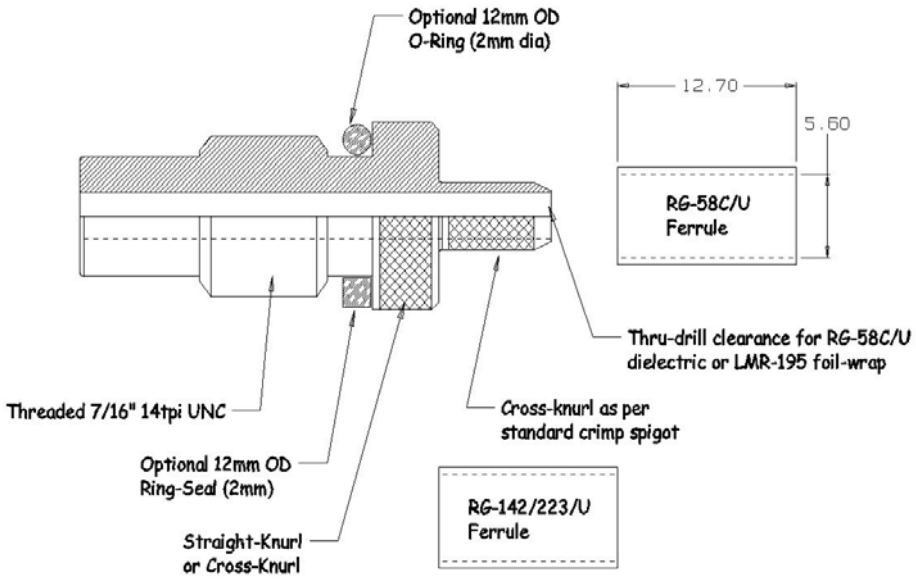
Such a seal will require the internal counterbore/rebate in the PL-259 and we recommend that CASA adopt this now even if the future is not deployed universally.

Note – some small amount of sealant will still be required to be applied to the RG-58 jacket to achieve a seal to abut the crimp shoulder (or the jacket clearance drilling in the basic non-crimp UG-175/176/U reducing adaptors if/when deployed.

Semi-Crimp Adaptor:

Given the ready availability of lower-cost (lower-precision/lower-quality/lower-life) crimp tools suitable for the casual installer for RG58~RG6 sizes of cables it seems very appropriate to provide for their usage without buying full-crimp connectors. An integrated reducing-adaptor and crimp-spigot has been designed for RG-58 or LMR-195 and near equivalents *(and/or double-screened RG-142 etc. with a ferrule change).*

Under certain conditions *(including effective de-soldering)* the Semi-Crimp adaptor may be used in pre-used PL-259 connectors to replace the traditional UG-175/176 reducing adaptors. In this regard the CASA **Semi-Crimp Adaptor** may be considered as a separate product



Note – In addition to the RG-58/142 crimp-adaptor we proposes Crimp-Spigot (reducing-adaptors) sizes be considered to include RG-59 and RG-6 and the 50 Ohm LMR equivalents:
For ***RG-59B/U*** use 4mm ID x 5mm spigot *(+ 6.4 x 7.6mm ferrule)* suits RG-59 (replaces UG-175/U) or LMR-240 (50 Ohm foam/foil/braid size equivalent of RG-59) etc.
For ***RG-6/U*** use 4.8mm ID x 6.5mm spigot *(+ 8.1 x 9.5mm ferrule)* suits RG-6 or LMR-300 (50 Ohm foam/foil/braid size equivalent of RG-6)

Part-Numbering:

For cataloging and ordering CASA will adopt the following semi-intelligent part-number conventions for the Integrated-Crimp-Adaptors – eg RA-PL259~RG58-CMP(SEAL):

RA = Reducing Adaptor
PL259 = Connector style with which it may be used
RG58 = primary cable type for which the adaptor is designed
CMP = Crimpable version
(SEAL) = Includes as sealing gasket or o-ring

Initial CASA stocks will include:

Type Number: ***RA-PL259~RG58-CMP***
Description: Reducing crimp-adaptor for RG-58C/U etc. in generic PL259 plugs
Type Number: ***RA-PL259~RG58-CMP(SEAL)***
Description: Reducing crimp-adaptor with seal for RG-58C/U etc. in CASA's PL259 plugs

Full-Crimp Future:

At the present time CASA will not pursue custom manufacture of Full-Crimp UHF connectors except for special high-volume orders when full-crimp versions may be manufactured to CASA's approved, customer-appropriate, designs and specifications.

Note - Telegartner ***and others*** have already achieved good full-crimp products and these are readily sourced in the general small quantities consumed in New Zealand.

Kings seem to have been the first to innovate the above Telegartner example of crimp-nose-pin to the ***fixed*** UHF pin-contact as illustrated in the RG-6 full crimp example:

http://www.casa.co.nz/Connectors/Coaxial/UHF/Gallery/images/11UHF-0-5-KU59-56-01.jpg

Other PL-259 Crimp Pin-Options:

By supplying/adding a special crimp-pin *(pin-n-pin style)* to this adaptor it will make a FULL-CRIMP assembly capable of being used with any suitable PL259 plugs having an appropriate bore in the pin-contact. Basically this may be achieved with a conventional crimp-pin-contact having a segmented/split bullet-shaped nose which is a compliant fit to the inner bore of the PL259 fixed-pin contact.

http://www.casa.co.nz/Connectors/Coaxial/UHF/pdf/Inst-3075.pdf

Huber+Suhner (who have dropped the UHF range from their catalogue because they became un-competitive in the market-place) adopted this style in early crimp UHF plugs for RG-58/59/223 until an integrual fixed crimp-pin became widely adopted by various manufacturers.

Rosenberger have also invented a semi-captive loose-solder/crimp-pin for RG-213/214 along the above described lines which are illustrated in their assembly-instruction sheet:
http://www.rosenberger.de/ok/html/ma/ma_54e1.pdf
and loosely represented in their data sheets:
http://www.rosenberger.de/ok/html/db/54S101-106A1.pdf
http://www.rosenberger.de/ok/html/db/54S101-115A1.pdf