

# R&S® ESCU ENHANCED SIGNAL CONDITIONING UNIT

The evolution of preamplifiers



Product Brochure  
Version 03.00

**ROHDE & SCHWARZ**

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# AT A GLANCE

The R&S®ESCU enhanced signal conditioning unit significantly boosts system sensitivity to electromagnetic interference (EMI) and radiated spurious emission (RSE) and can also withstand unintended pulses and electrostatic discharges (ESD), particularly at its input.

The R&S®ESCU series of enhanced signal conditioning units covers the frequency range from 100 MHz to 18 GHz. The high performance preamplifiers improve overall system sensitivity and are ideal for measuring low signal levels. The preamplifiers are available in a rugged and compact case and can easily be adapted with brackets to the rack directly on the antenna mast.

A bias unit in the control room can supply power to the R&S®ESCU and significantly reduces the likelihood of potential noise emanating from a power supply into the test site.

Since preamplifiers are highly susceptible to damage from ESD, the R&S®ESCU input has been hardened to withstand high levels of static discharge. The R&S®ESCU has higher survivability rates, especially when antennas are connected to their input.



# BENEFITS AND KEY FEATURES

## Optimal low noise figure suitable for EMI and RSE testing

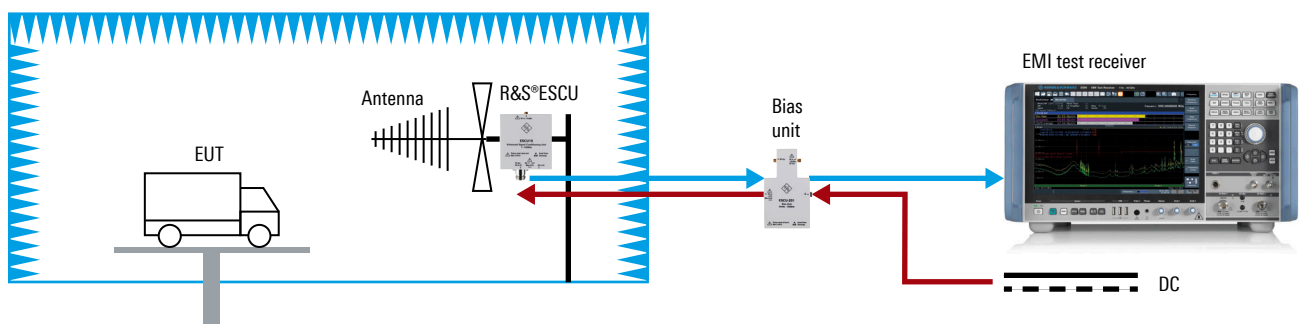
In EMI testing, it is important to have overall noise floor measurements that are substantially lower than the limit lines specified in EMI measurement standards.

Different methods help improve the noise floor, one is a very low loss cable. The second is an antenna with a good antenna factor. The third is adding an external preamplifier with a low noise figure. Finally, a combination of all three can also improve the noise floor. The first two typically improve noise floors by 2 dB to 4 dB, while the third method (external preamplifier) is more practical and effective since it can improve noise floors by > 10 dB with the right preamplifier. The R&S®ESCU series was specially developed and tested for such measurements.

## Key facts

- ▶ High gain with low noise figure  $\leq 4$  dB
- ▶ Bias unit in control room to supply power, eliminates need for power adapter at test site
- ▶ Hardened design to withstand unintended pulses and ESD at the R&S®ESCU input
- ▶ Compact and easy to mount on the R&S®UAS universal antenna stand

## Typical overview of an EMI test setup



### Removing potential noise emitters at test sites

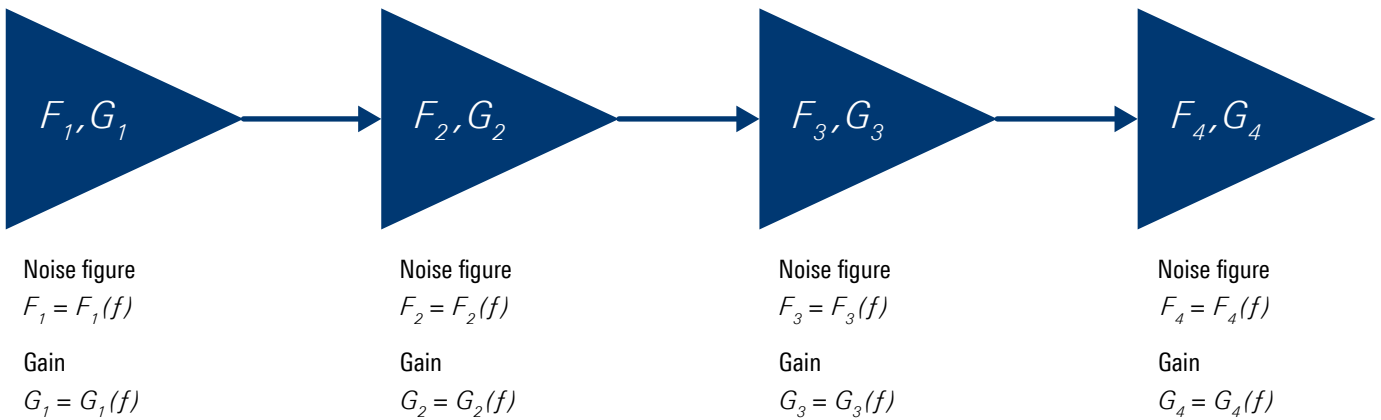
Typical power adapters are common noise sources that interfere with EMI testing at test sites or in anechoic chambers. The power adapters will need to be in an anechoic chamber during EMI testing since preamplifiers require power when in use. Linear power supplies may generate little noise but can be highly inefficient and require customization.

The R&S®ESCU comes with a bias unit that puts the power adapter outside the anechoic chamber. The bias unit carries DC power over an RF cable, which is connected directly to the preamplifier. A separate version with a traditional power supply is also available to replace existing setups.

### Applying Friis's formula

Applying Friis's formula to the cascaded receiver system shows that the overall system noise figure  $NF_{total}$  is mainly dominated by the device in the first stage.

### Friis's noise equation



$$F_{total} = F_1 + \frac{F_2 - 1}{G_1} + \frac{F_3 - 1}{G_1 G_2} + \frac{F_4 - 1}{G_1 G_2 G_3} + \dots$$

$$\text{System noise figure, } NF_{total} = 10 \log (F_{total} + 1)$$

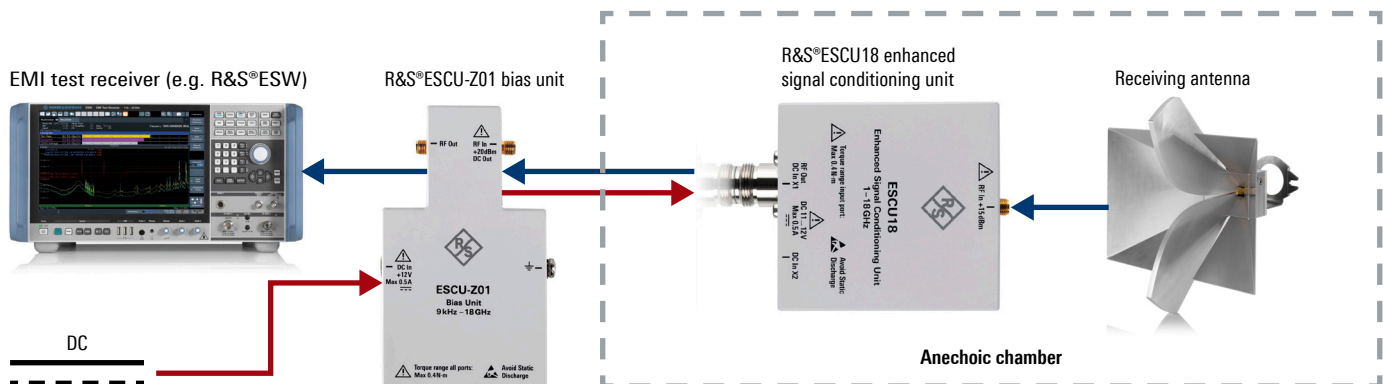
The first device with the best noise figure and highest gain generates the best total noise figure for the system.

### Increased resistance against unintended pulse signals and ESD

Low noise amplifiers or preamplifiers are typically deployed for weak signals of interest and allow the signal to be clearly seen. This makes preamplifiers extremely sensitive and susceptible to sudden high-power signals.

The R&S®ESCU series of enhanced signal conditioning units are designed to boost resistance towards the pulse signals occasionally found in equipment under test (EUT) during EMI testing. The R&S®ESCU input is also hardened to withstand an ESD of over 8 kV, which acts as a reinforcement against static build-up when handling the R&S®ESCU and connecting antennas.

### Connection of the R&S®ESCU to an EMI test receiver and antenna



# SPECIFICATIONS IN BRIEF

## Specifications in brief

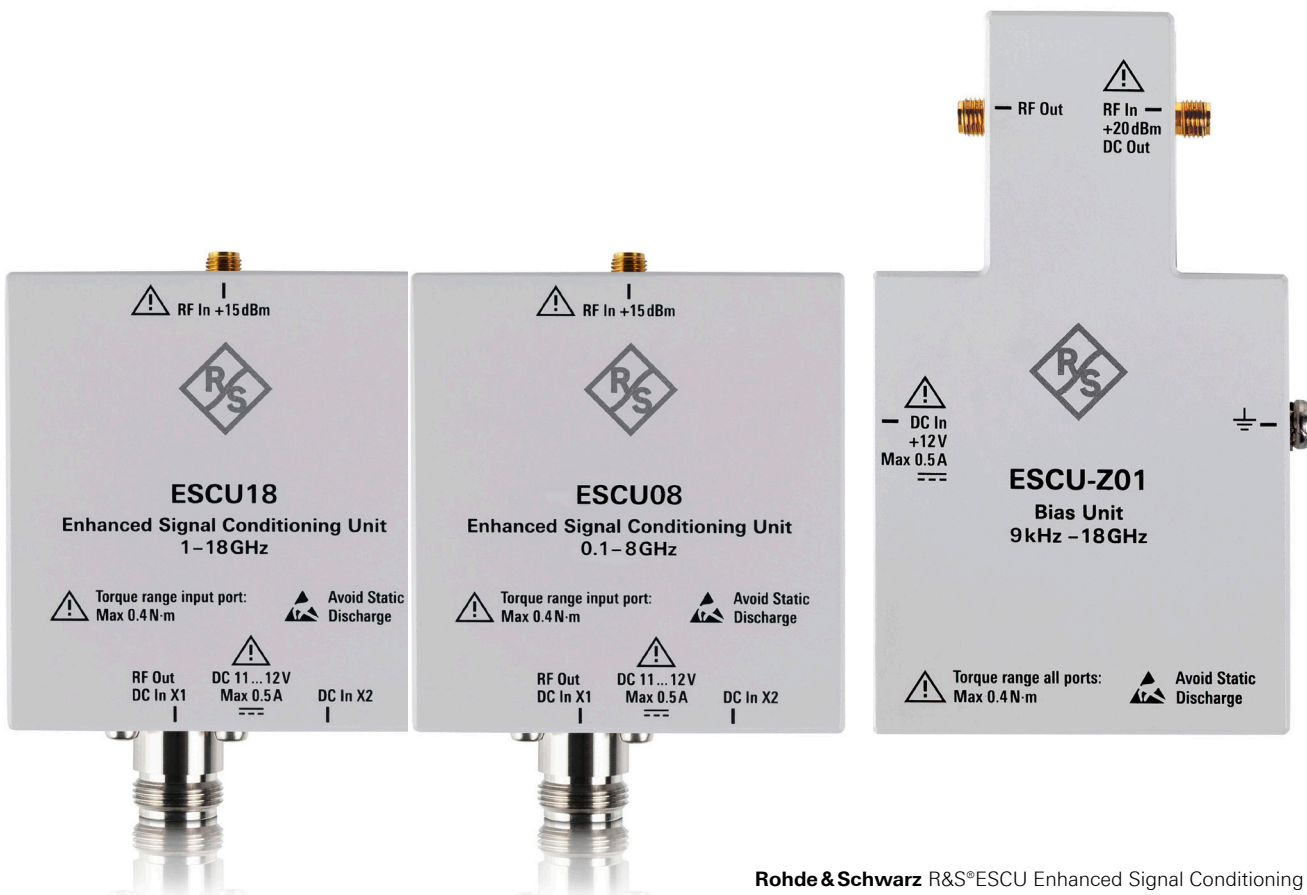
R&S®ESCU08	enhanced signal conditioning unit up to 8 GHz					
R&S®ESCU18	enhanced signal conditioning unit up to 18 GHz					
	with R&S®ESCU-Z01 bias unit			with AC adapter only		
	R&S®ESCU08 (model .21)	R&S®ESCU08 (model .31)	R&S®ESCU18 (model .41)	R&S®ESCU08 (model .20)	R&S®ESCU08 (model .30)	R&S®ESCU18 (model .40)
Frequency range	(30 MHz) <sup>1)</sup> 0.1 GHz to 8 GHz	(30 MHz) <sup>1)</sup> 0.1 GHz to 8 GHz	1 GHz to 18 GHz	(30 MHz) <sup>1)</sup> 0.1 GHz to 8 GHz	(30 MHz) <sup>1)</sup> 0.1 GHz to 8 GHz	1 GHz to 18 GHz
Minimum gain	≥ 31 dB	≥ 39 dB	≥ 39 dB	≥ 33 dB	≥ 41 dB	≥ 41 dB
Gain flatness	≤ ±3 dB			≤ ±2 dB		
Maximum input level (CW)	+15 dBm <sup>2)</sup>					
Noise figure <sup>3)</sup> at +23°C	≤ 3.5 dB <sup>4)</sup>	≤ 3.5 dB <sup>4)</sup>	≤ 4 dB	≤ 3.5 dB <sup>4)</sup>	≤ 3.5 dB <sup>4)</sup>	≤ 4 dB
Impedance	50 Ω					
Input VSWR	≤ 2.5:1					
Output VSWR	≤ 2.5:1					

<sup>1)</sup> Usable from 30 MHz.

<sup>2)</sup> Although R&S®ESCU is designed to allow input level of up to +24 dBm, warranty will be void if input level is > +15 dBm.

<sup>3)</sup> For the statement of conformity, the simple acceptance rule is selected (ref. ILAC-G8:09/2019 Clause 4.2.1).

<sup>4)</sup> From 300 MHz.





# ORDERING INFORMATION

Designation	Type	Order No.
<b>Bias unit versions</b>		
0.1 GHz to 8 GHz enhanced signal conditioning unit with R&S®ESCU-Z01 bias unit, 31 dB minimum gain, including AC adapter	R&S®ESCU08	5602.9825.21
0.1 GHz to 8 GHz enhanced signal conditioning unit with R&S®ESCU-Z01 bias unit, 39 dB minimum gain, including AC adapter	R&S®ESCU08	5602.9825.31
1 GHz to 18 GHz enhanced signal conditioning unit with R&S®ESCU-Z01 bias unit, 39 dB minimum gain, including AC adapter	R&S®ESCU18	5602.9825.41
<b>DC power supply versions</b>		
0.1 GHz to 8 GHz enhanced signal conditioning unit with DC jack, 33 dB minimum gain, including AC adapter	R&S®ESCU08	5602.9825.20
0.1 GHz to 8 GHz enhanced signal conditioning unit with DC jack, 41 dB minimum gain, including AC adapter	R&S®ESCU08	5602.9825.30
1 GHz to 18 GHz enhanced signal conditioning unit with DC jack, 41 dB minimum gain, including AC adapter	R&S®ESCU18	5602.9825.40
<b>Accessories</b>		
19" rackmount adapter 1 HU, for a single R&S®ESCU-Z01 bias unit	R&S®ESCU-ZZA	5602.9060.00
Mounting bracket to attach the R&S®ESCU to the R&S®UAS universal antenna stand with the R&S®HF907 horn antenna	R&S®ESCU- Z10	5602.9760.00
Contact your local Rohde&Schwarz sales office for R&S®ESCU mounting kits supporting the attachment of other antenna types to the R&S®UAS universal antenna stand.		

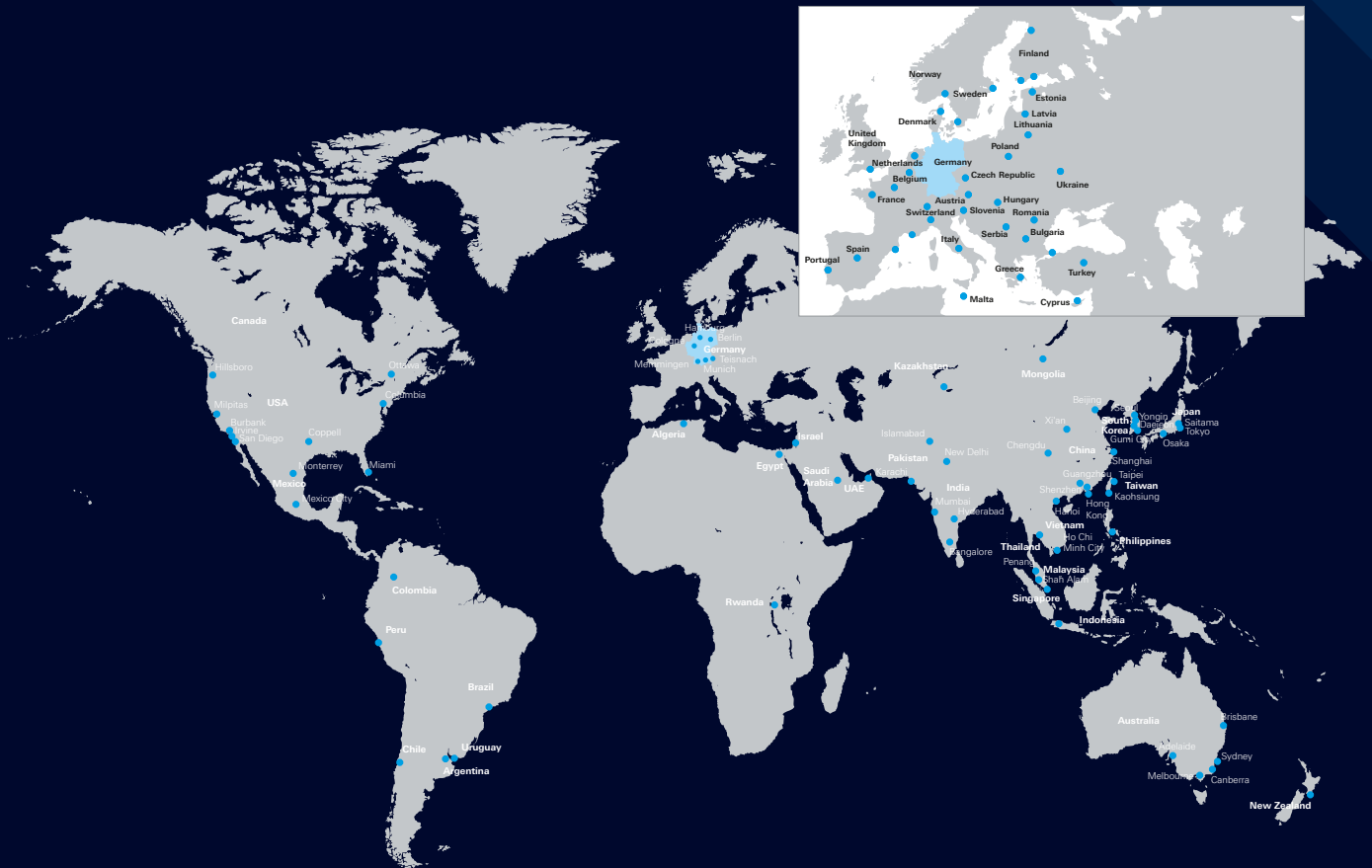
<b>Service options</b>		
Extended warranty, one year	R&S®WE1	Contact your local Rohde&Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty, three years	R&S®WE3	
Extended warranty, four years	R&S®WE4	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with calibration coverage, three years	R&S®CW3	
Extended warranty with calibration coverage, four years	R&S®CW4	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	
Extended warranty with accredited calibration coverage, three years	R&S®AW3	
Extended warranty with accredited calibration coverage, four years	R&S®AW4	

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- ▶ Training
- ▶ Operation/calibration/repair



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## Sustainable product design

- ▶ Environmental compatibility and eco-footprint
- ▶ Energy efficiency and low emissions
- ▶ Longevity and optimized total cost of ownership

Certified Quality Management

ISO 9001

Certified Environmental Management

ISO 14001

## Rohde & Schwarz training

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