R&S®ESCU
ENHANCED SIGNAL CONDITIONING UNIT

The evolution of preamplifiers

Product Brochure
Version 04.00

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

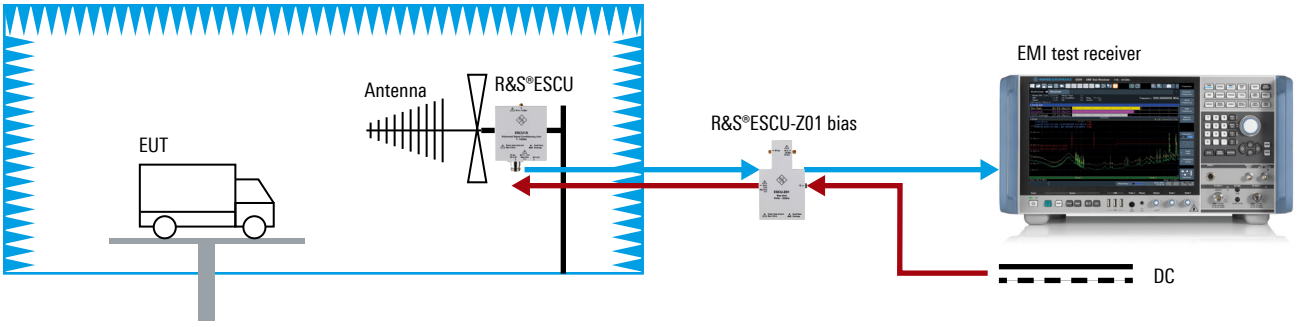
Optimal low noise figure suitable for EMI and RSE testing
In EMI testing, it is important to have overall noise floor measurements that are substantially lower than the limit lines specified in EMI measurement standards.

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 floor 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 ≤ 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

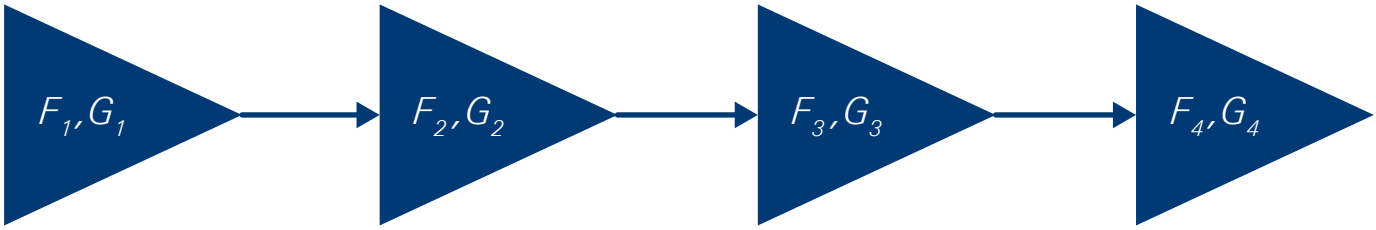
Applying Friis's formula to the cascaded receiver system shows that the overall system noise figure NF_{total} is mainly dominated by the device in the first stage. The first device with the best noise figure and highest gain generates the best total noise figure for the system.

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.

Friis's noise equation



Noise figure

$F_1 = F_1(f)$ $F_2 = F_2(f)$ $F_3 = F_3(f)$ $F_4 = F_4(f)$

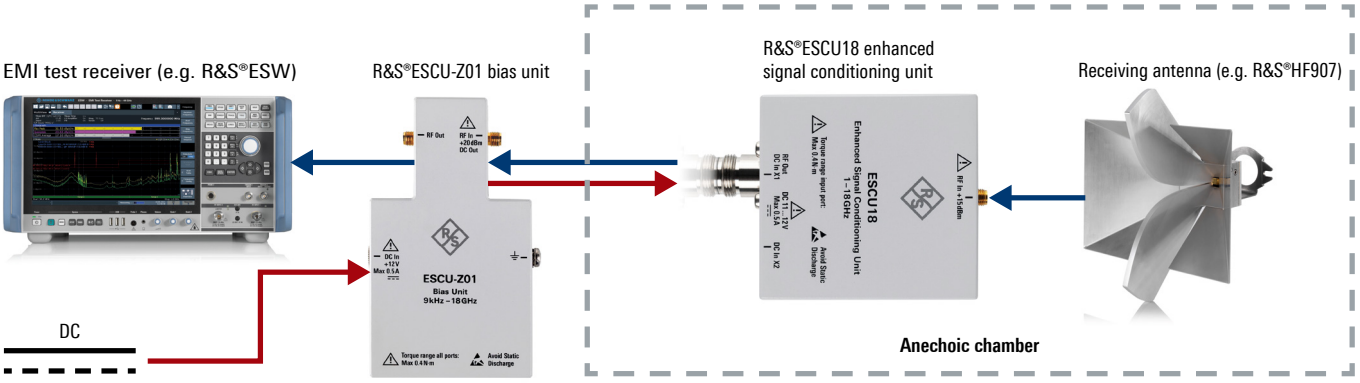
Gain

$G_1 = G_1(f)$ $G_2 = G_2(f)$ $G_3 = G_3(f)$ $G_4 = G_4(f)$

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

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

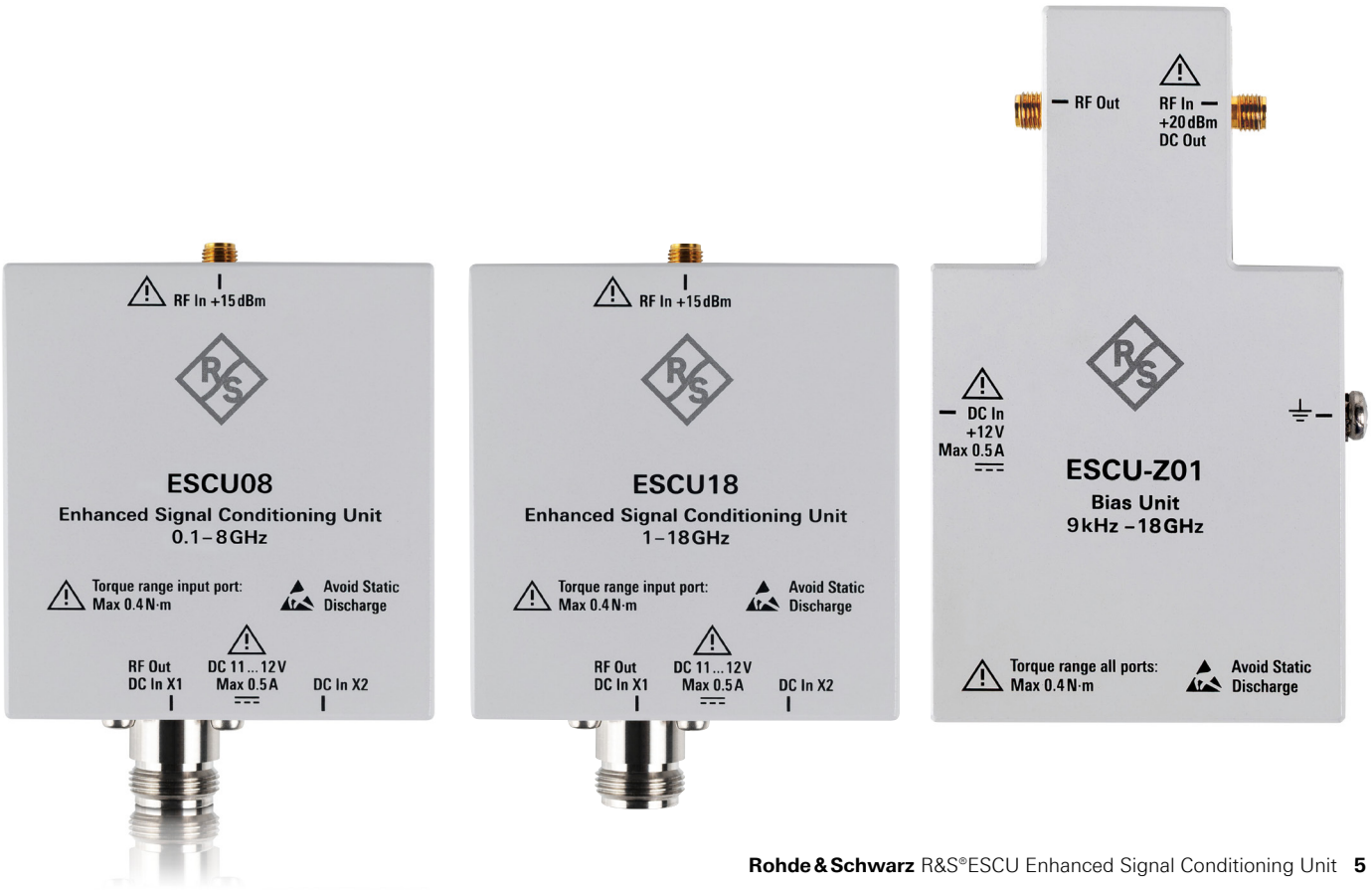
Connection of the R&S®ESCU to an EMI test receiver and antenna



SPECIFICATIONS IN BRIEF

Specifications in brief		
Frequency range	R&S®ESCU08 (models .20/.30/.21/.31)	(30 MHz) [1] 0.1 GHz to 8 GHz
	R&S®ESCU18 (models .40/.41)	1 GHz to 18 GHz
Minimum gain	R&S®ESCU08 (model .21)	≥ 31 dB
	R&S®ESCU08 (model .31)	≥ 39 dB
	R&S®ESCU18 (model .41)	≥ 39 dB
	R&S®ESCU08 (model .20)	≥ 33 dB
	R&S®ESCU08 (model .30)	≥ 41 dB
	R&S®ESCU18 (model .40)	≥ 41 dB
Gain flatness	R&S®ESCU08 (models .21/.31), R&S®ESCU18 (model .41)	≤ ±3 dB
	R&S®ESCU08 (models .20/.30), R&S®ESCU18 (model .40)	≤ ±2 dB
Maximum input level (CW) [2]	R&S®ESCU08 (models .20/.30/.21/.31), R&S®ESCU18 (models .40/.41)	+15 dBm
Noise figure [3] at +23 °C	R&S®ESCU08 (models .20/.30/.21/.31)	≤ 3.5 dB (typ.) (from 0.5 GHz)
	R&S®ESCU18 (models .40/.41)	≤ 4.5 dB (typ.)
Impedance	R&S®ESCU08 (models .20/.30/.21/.31), R&S®ESCU18 (models .40/.41)	50 Ω
Input VSWR	R&S®ESCU08 (models .20/.30/.21/.31), R&S®ESCU18 (models .40/.41)	≤ 2.5:1
Output VSWR	R&S®ESCU08 (models .20/.30/.21/.31), R&S®ESCU18 (models .40/.41)	≤ 2.5:1

[1] Usable from 30 MHz.
[2] 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.
[3] For the statement of conformity, the simple acceptance rule is selected (ref. ILAC-G8:09/2019 Clause 4.2.1).



ORDERING INFORMATION

Designation	Type	Order No.
Bias unit versions		
Enhanced signal conditioning unit, 0.1 GHz to 8 GHz, with R&S®ESCU-Z01 bias unit, 31 dB minimum gain, including AC adapter	R&S®ESCU08	5602.9825.21
Enhanced signal conditioning unit, 0.1 GHz to 8 GHz, with R&S®ESCU-Z01 bias unit, 39 dB minimum gain, including AC adapter	R&S®ESCU08	5602.9825.31
Enhanced signal conditioning unit, 1 GHz to 18 GHz, with R&S®ESCU-Z01 bias unit, 39 dB minimum gain, including AC adapter	R&S®ESCU18	5602.9825.41
DC power supply versions		
Enhanced signal conditioning unit, 0.1 GHz to 8 GHz, with DC jack, 33 dB minimum gain, including AC adapter	R&S®ESCU08	5602.9825.20
Enhanced signal conditioning unit, 0.1 GHz to 8 GHz, with DC jack, 41 dB minimum gain, including AC adapter	R&S®ESCU08	5602.9825.30
Enhanced signal conditioning unit, 1 GHz to 18 GHz, with DC jack, 41 dB minimum gain, including AC adapter	R&S®ESCU18	5602.9825.40
Accessories		
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 double-ridged 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.		

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R&S®ESCU Enhanced Signal Conditioning Unit
Data without tolerance limits is not binding | Subject to change