WFC725A - FR3 frequency extension for VST

6900MHz-25800MHz

1200MHz iBW

wupatec

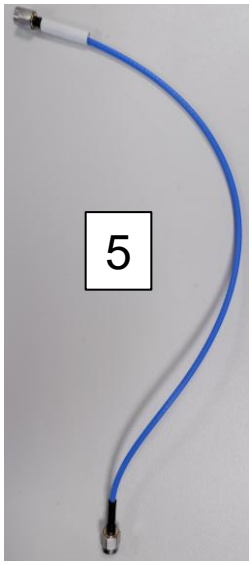
Main features

- **VST frequency extension with Up and Down-conversion for measurements from 6.9GHz to 25.8GHz**
- **Control embedded in Wupatec RFSoC based VST firmware using AMD ZCU670 kit**
  - **Dedicated firmware to run the VST like a benchtop instrument grade solution**
  - **Combined frequency range from 10MHz to 25.8GHz**
  - **Measurement of RF Power Amplifier in base station-like conditions**
    - **LTE/5G PA Tests with signal generation and analysis bandwidth up to 1200 MHz**
    - **1-tone measurements: CW and pulsed CW characterization with configurable rise/fall time**
    - **2-tone measurements for video bandwidth analysis**
    - **IQ signal generation and analysis with Digital Predistortion capabilities - Acquisition averaging in IQ modulation mode for high dynamic range characterization**

Contents

2

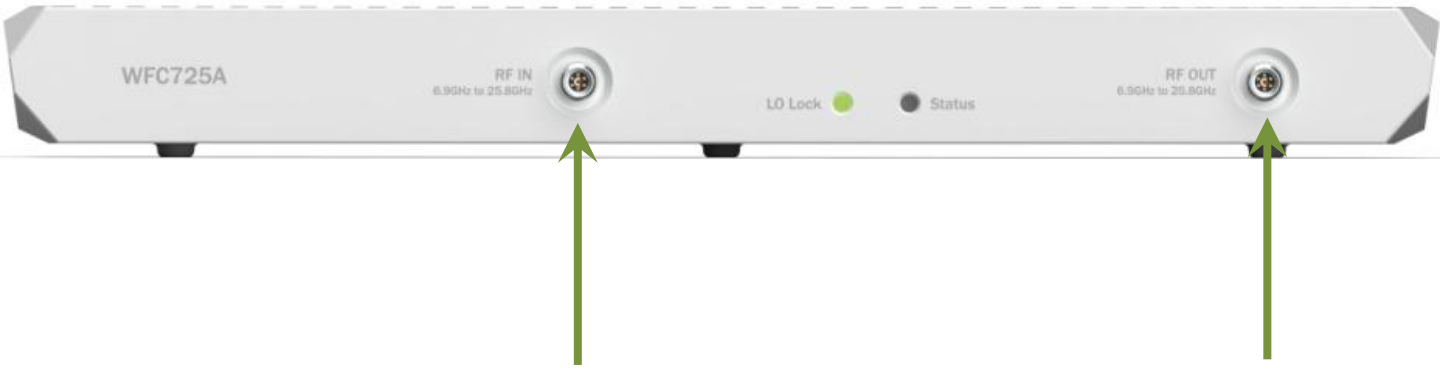
4



1. **WFC725A Frequency Extender**
2. **Digital IO adapter for ZCU670**
3. **Digital IO cable**
4. **SMA 50Ω load**
5. **SMA cable x2**

Description

Front view



RF Input port **RF Output port**

RF Output port

Main output channel of the frequency extender. The wideband transmitter (1200MHz) can be tuned to any frequency with fine granularity covering the complete 5G FR3 band.

On-board output power adjustment is used to optimize SNR over a wide dynamic range.

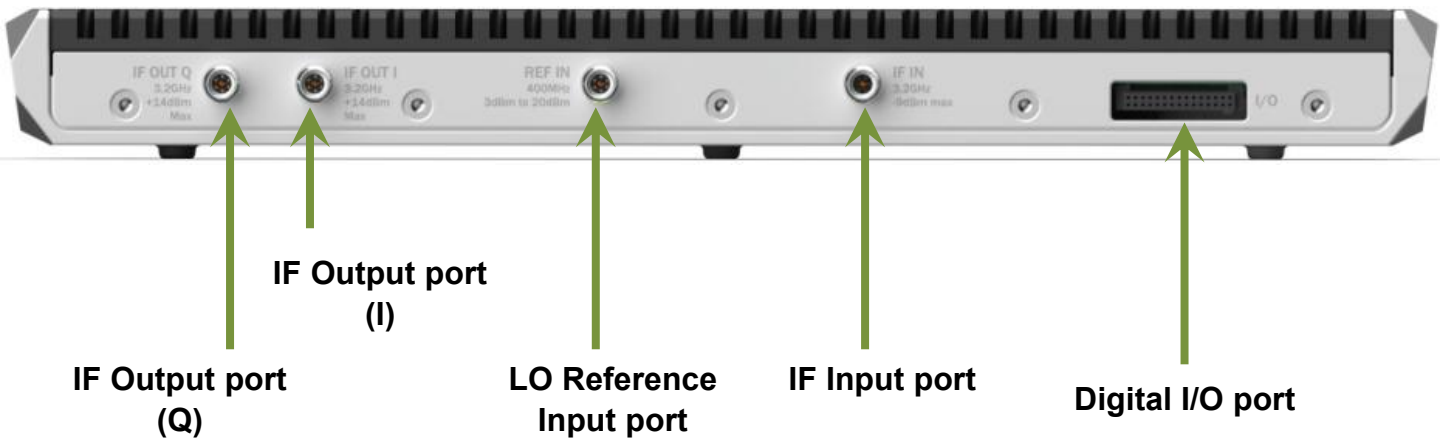
The maximum transmitter output power depends on the center frequency, refer to section “Typical performances” in the datasheet for more information.

RF Input Port

Wide bandwidth receiver (1200 MHz) of the frequency extender. Refer to “Specifications” in the datasheet for maximum input power and optimum input power for best dynamic range.

Description

Rear view



IF Input port

Input signal from the VST for the frequency extender transmit channel. The signal is centered on the Intermediate Frequency.

See “Specifications” in the datasheet for maximum input power and optimum input power for best dynamic range

IF Output port I & Q

Output signal from the frequency extender receive channel to the VST complex IQ receiver

LO Reference Input port

Input frequency reference signal for the frequency extender LO generator

Digital I/O Port

Power supply and digital I/O connection for the control of the frequency extender by the VST.

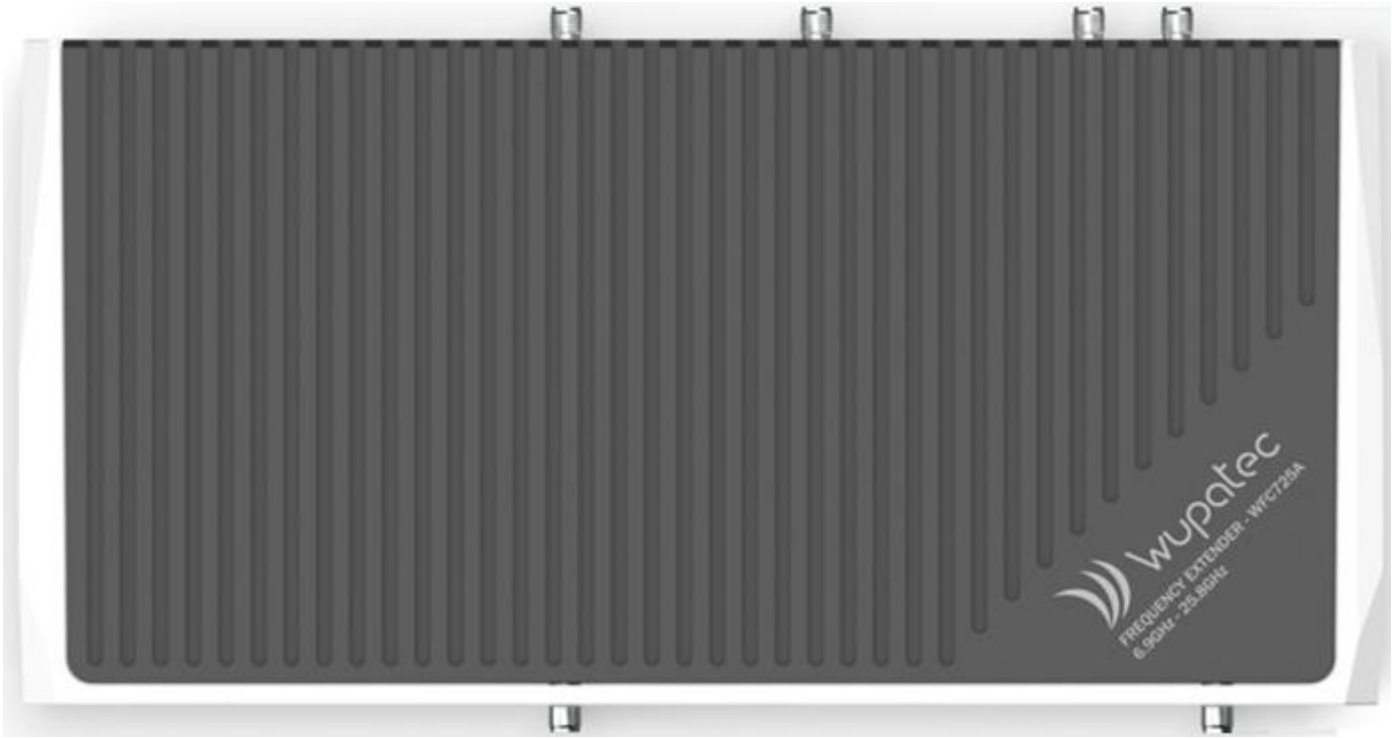
Mechanical Dimensions

Dimensions: 26 mm (H) x 250 mm (L) x 133 mm (W)

Front view

Rear view

Top view



Specifications

General Specifications.		
Center frequency range		6.9GHz to 25.8GHz
Instantaneous bandwidth		1.2GHz
Frequency accuracy with Wupatec RFSoC VST		± (Output frequency x 270ppb)
RF OUTPUT PORT		
Connector		3.5mm female, 50 Ω nominal
Max. reverse input power level		+8dBm
Max. DC voltage input level		±16V
Max. power		see Typical performances
Output Third-Order Intercept (OIP3)		see Typical performances
Output level range setting		
	On-board	23.5dB relative to max power
	With Wupatec RFSoC VST	100dB relative to max power
Max. spurs level		
	≤ 21GHz	< -25dBc
	21GHz – 25.8GHz	< -15dBc
Output level accuracy with Wupatec RFSoC VST		< ± 3dB
Output level setting resolution with Wupatec RFSoC VST		0.01 dB
RF INPUT PORT		
Connector		3.5mm female, 50 Ω nominal
Max. DC voltage input level		±16V
Optimum input power level		-2.5dBm (peak)
Max. safe input power level		0 dBm (peak)
Damage input power level		
	WFC725A only	+30 dBm (peak)
	With Wupatec RFSoC VST	+2 dBm (peak)
IF OUTPUT PORT (I and Q)		
Frequency range		2.5GHz to 4GHz
Center frequency with Wupatec RFSoC VST		3.2GHz ±12.5MHz
Connector		3.5mm female, 50 Ω nominal
Max. reverse input power level		+10dBm
Max. DC voltage input level		0V
Max. power		+4.5dBm @ RF input = -10dBm
Max. spurs level		≤ -35dBc
IF INPUT PORT		
Frequency range		2.5GHz to 4GHz
Center frequency with Wupatec RFSoC VST		3.2GHz ±12.5MHz
Connector		3.5mm female, 50 Ω nominal
Max. DC voltage input level		0V
Optimum input power level		-9dBm (peak)
Max. safe input power level		1 dBm (peak)
Damage input power level		3 dBm (peak)

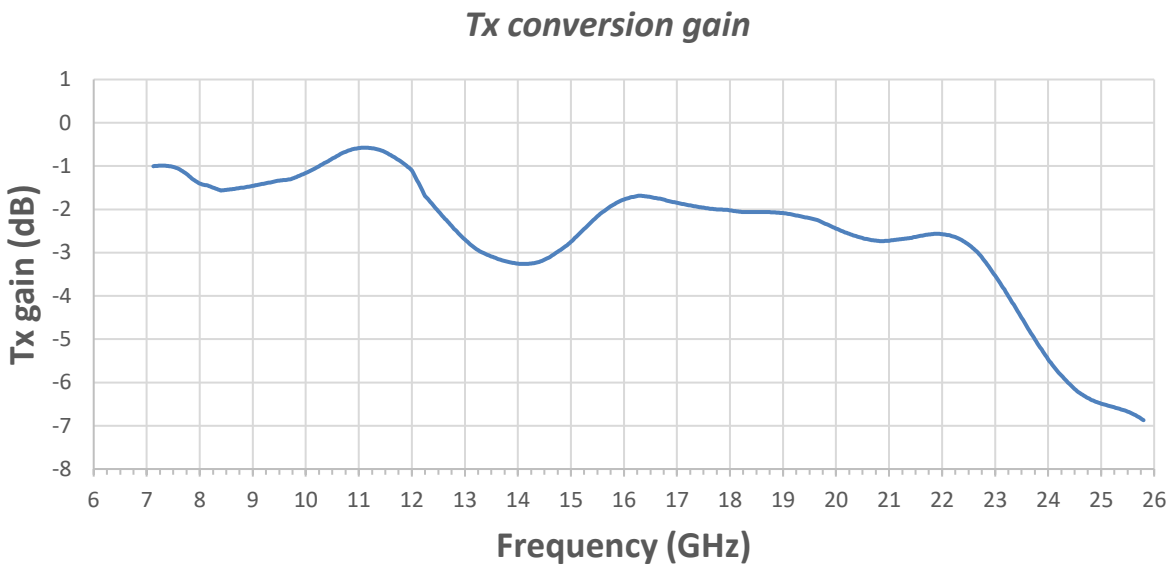
Specifications

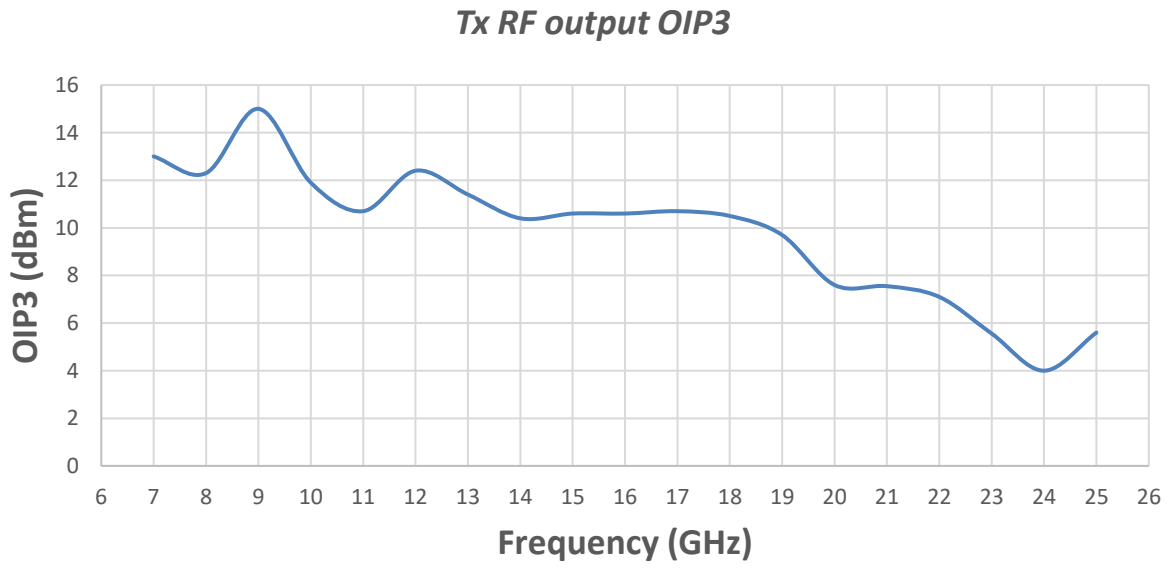
General Specifications (continued).	
LO REFERENCE INPUT PORT	
Frequency	400MHz
Input power level (square wave)	+3dBm to +20dBm
Slew rate	> 800 V/µs
LO Phase noise	see Typical performances
DIMENSIONS AND WEIGHT	
Dimensions	26 mm (H) x 250 mm (L) x 133 mm (W)
Weight	1.32kg
Environmental conditions	
Altitude up to 2000m, Temperatures : 5 to 40°C , Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.	

Dependencies	
Baseboard	AMD ZCU670 kit with Wupatec VST firmware v0.98 and above
Software	IVCAD Suite 2026.2 and above

General Specifications – Coupled with ZCU670 running Wupatec VST firmware	
Vector Signal Generator and Vector Signal Analyzer - IQ waveform mode	
Sampling rate	245.76MSa/s, 491.52MSa/s, 983.04MSa/s, 1474.56MSa/s
Capture depth	2GSa, 546ms @ 983.04MSa/s
Maximum signal generation and analysis bandwidth	1180MHz
INPUTS AND OUTPUTS	
REF OUT (ZCU670 J147 – SI5381 OUT8)	SMA female, AC coupled, 50 Ω nominal Output level: +8dBm ± 1dB (square waveform) Frequency: 10MHz ± 270 ppb
REF IN (ZCU670 J143 – 1588 CLK3 IN P)	SMA female, AC coupled, >1 kΩ nominal Input level range: -8 to +13dBm (sine or square waveform) Frequency: 10MHz Lock range: ± 9.2 ppm
TRIG OUT (ZCU670 J145)	SMA female, DC coupled Output level: 1.8V

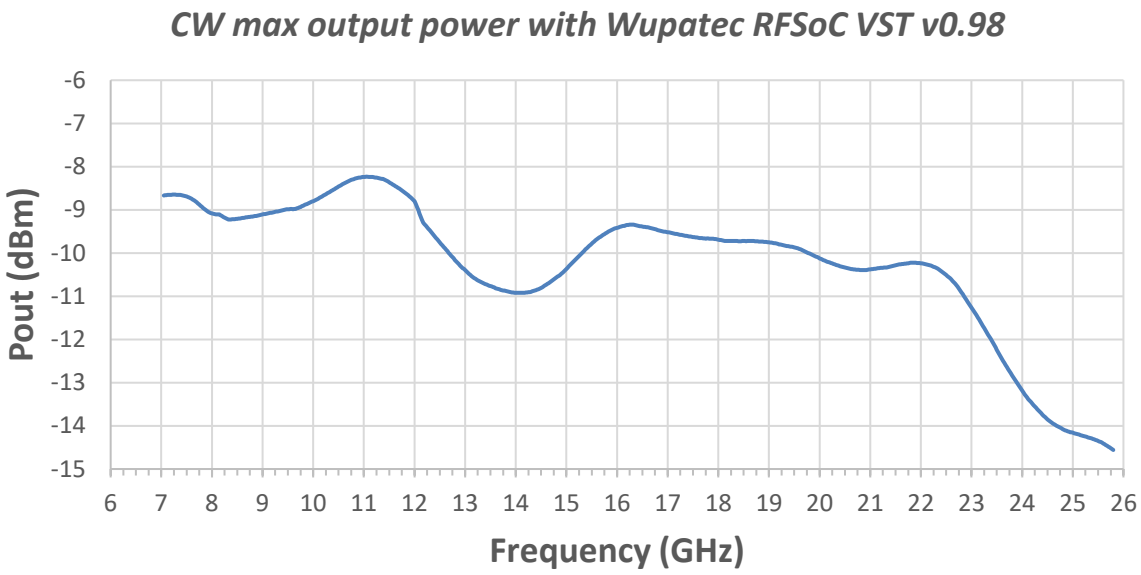
Typical Performances

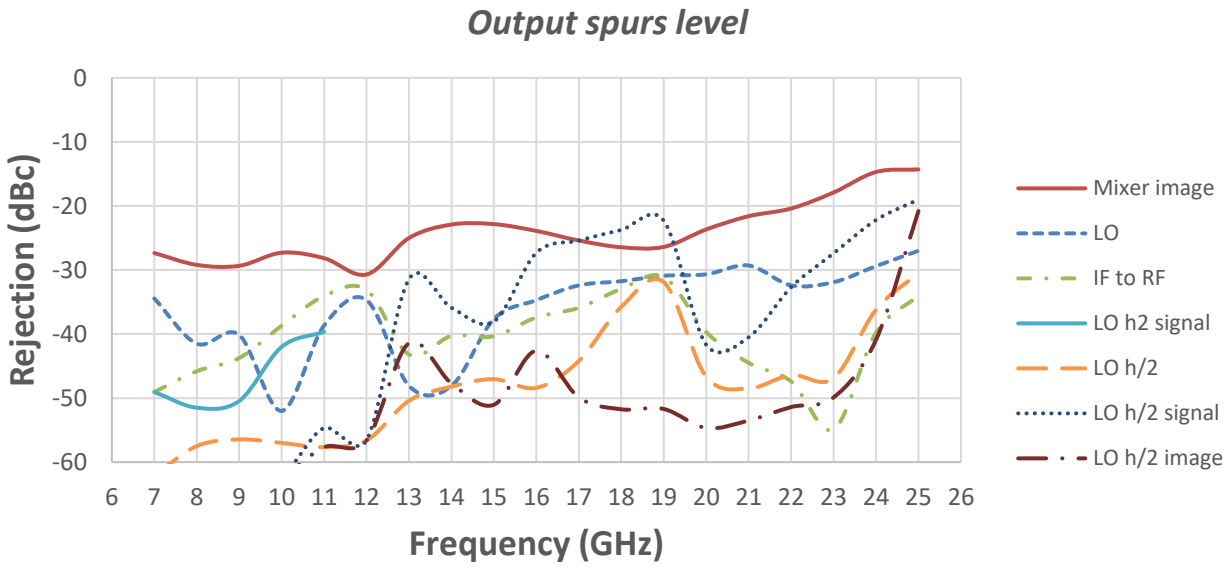




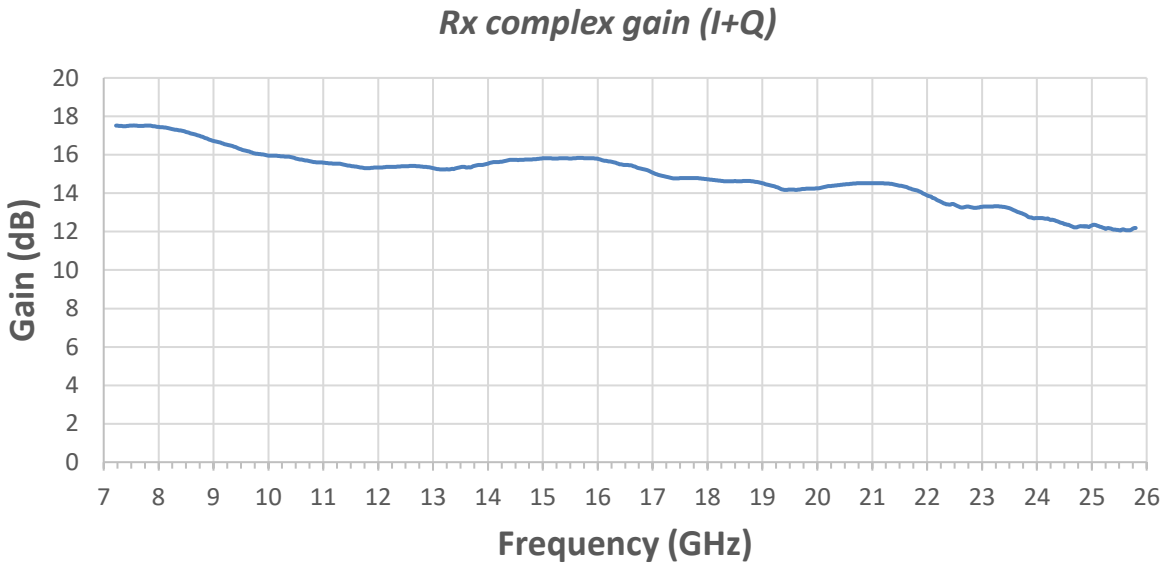
Note: IF Amplitude = −15 dBm per Tone, F1 = 3180MHz, F2 = 3220MHz

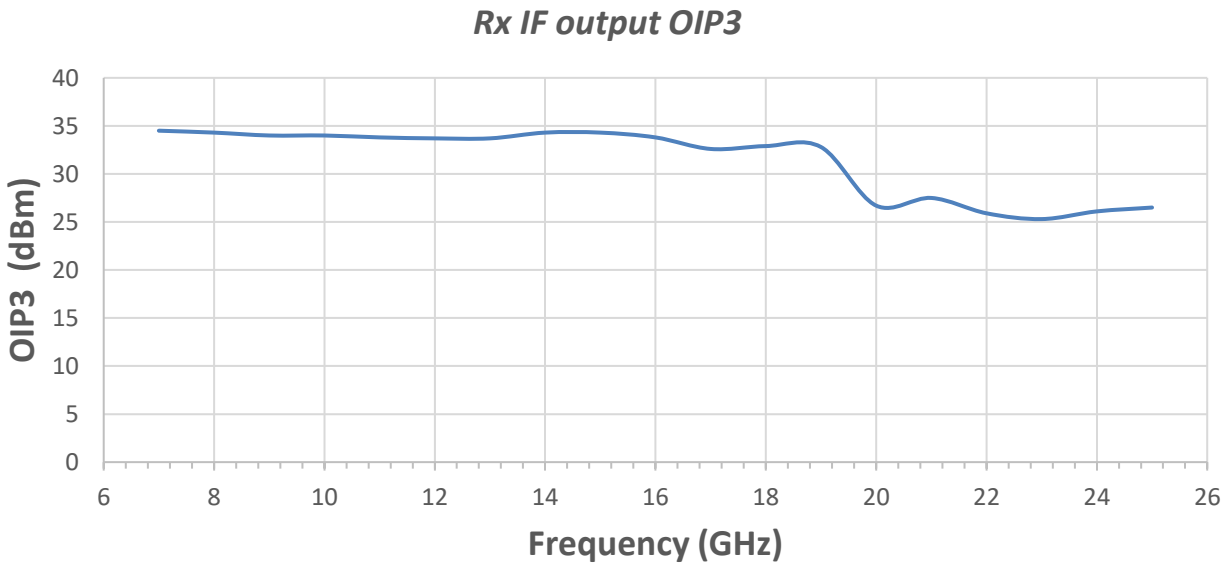
Typical Performances





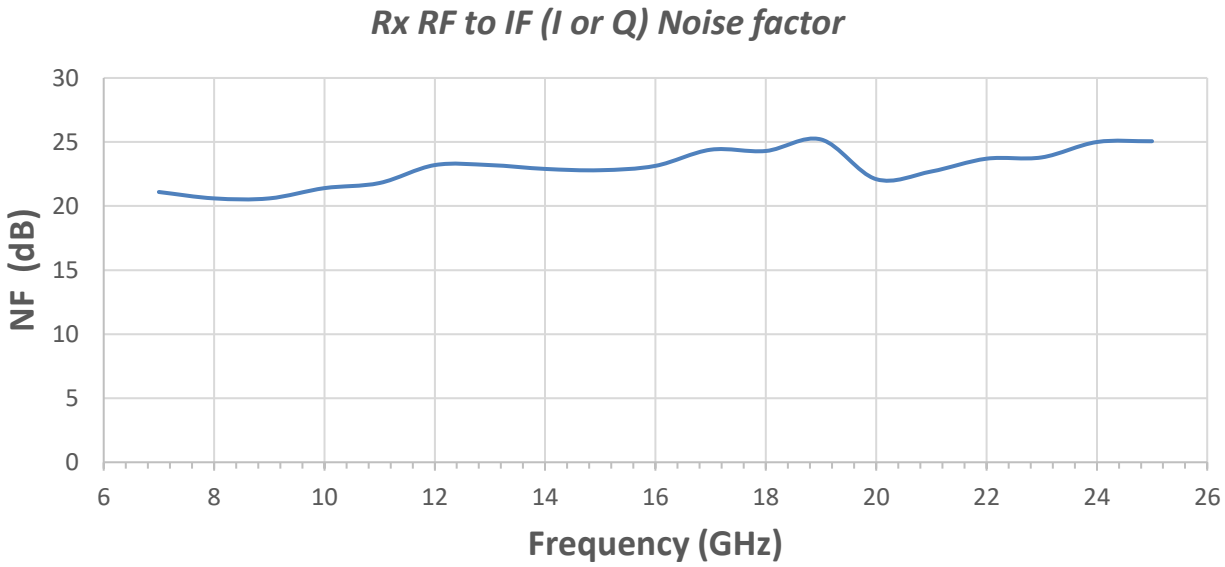
Typical Performances

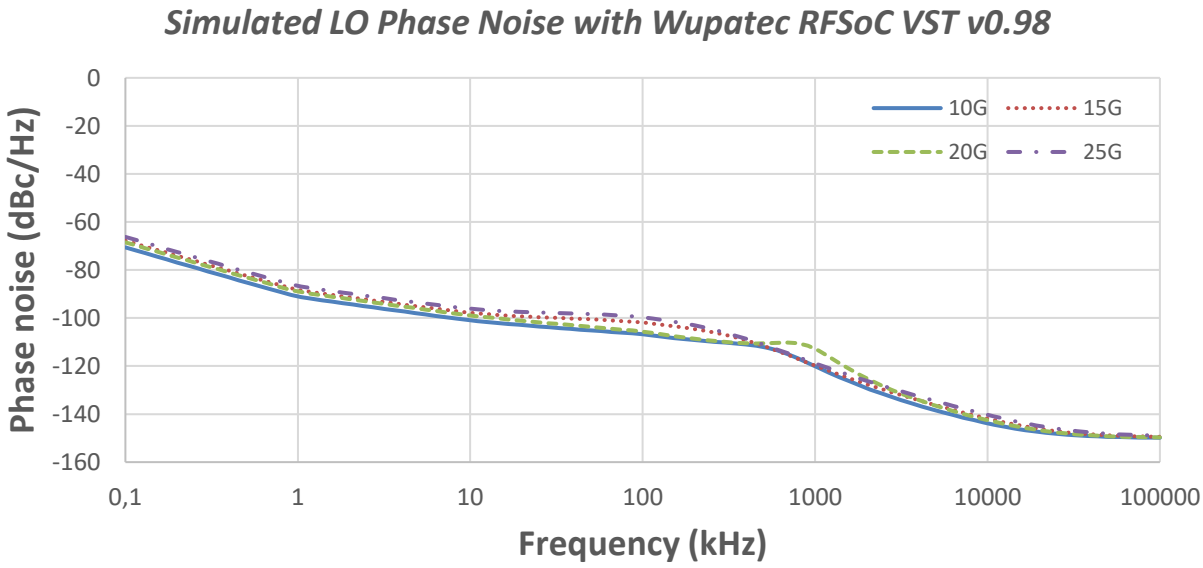




Note: RF Amplitude = −9 dBm per Tone, ΔF = 40MHz, measurement on Rx IF Q output

Typical Performances



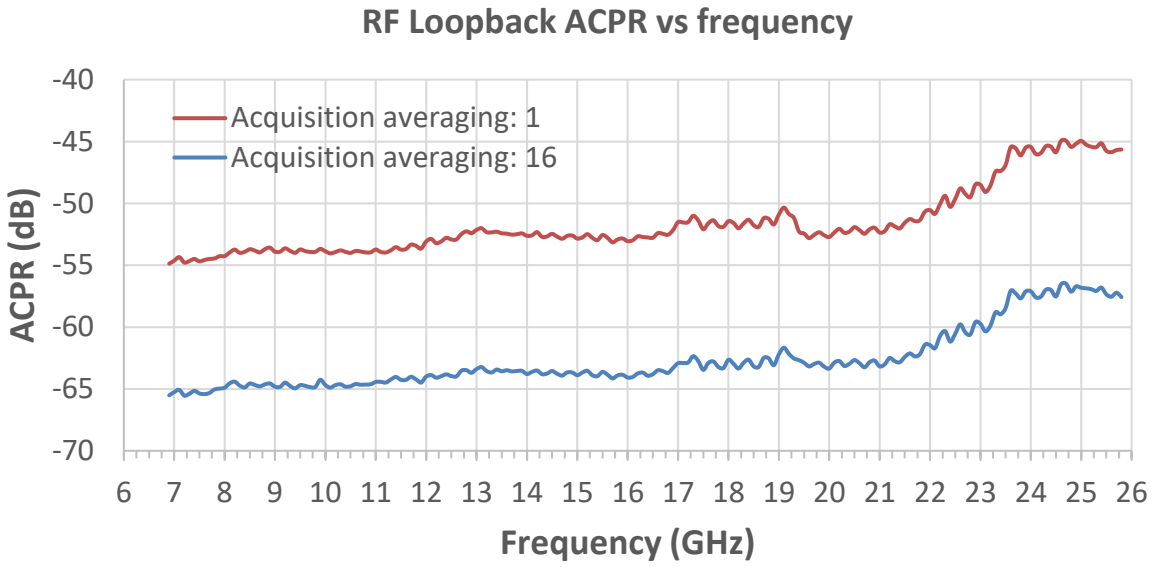


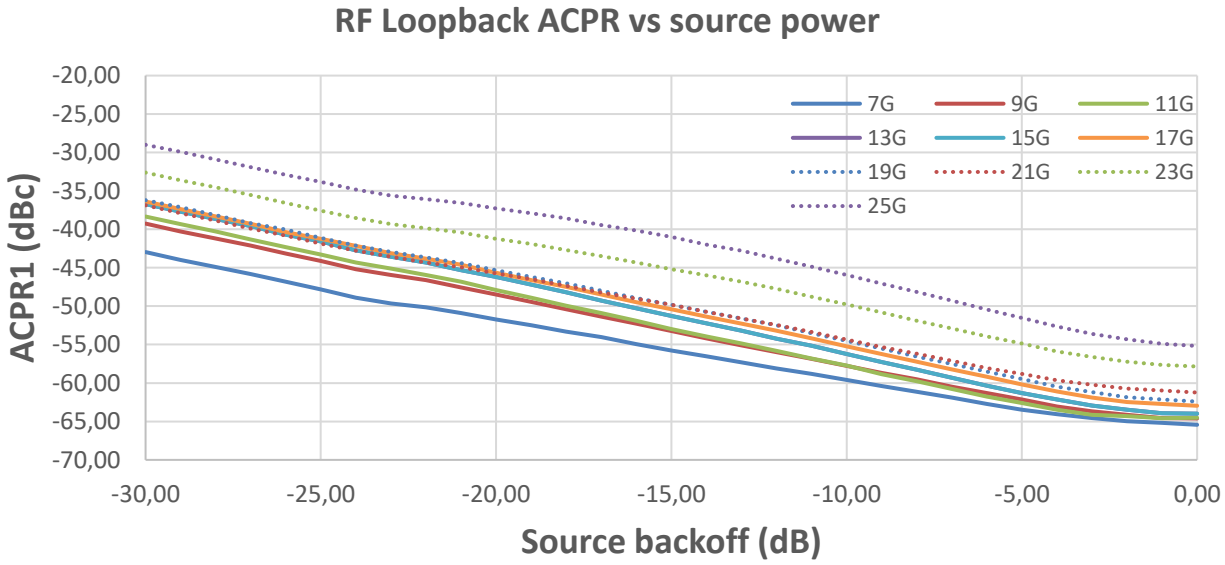
Note: Phase noise performance is dependent on the reference clock phase noise. Better performance can be achieved by providing a better reference clock than the ZCU670 8A34001 clock generator

5G Typical Performances with Wupatec RFSoC VST v0.98

5G performances with 100MHz bandwidth 8dB PAPR

RF output loopback to RF input, source power set to maximum, sampling rate = 1474.56MSa/s
ACPR measurement performance is limited by the source power below Rx optimum input power





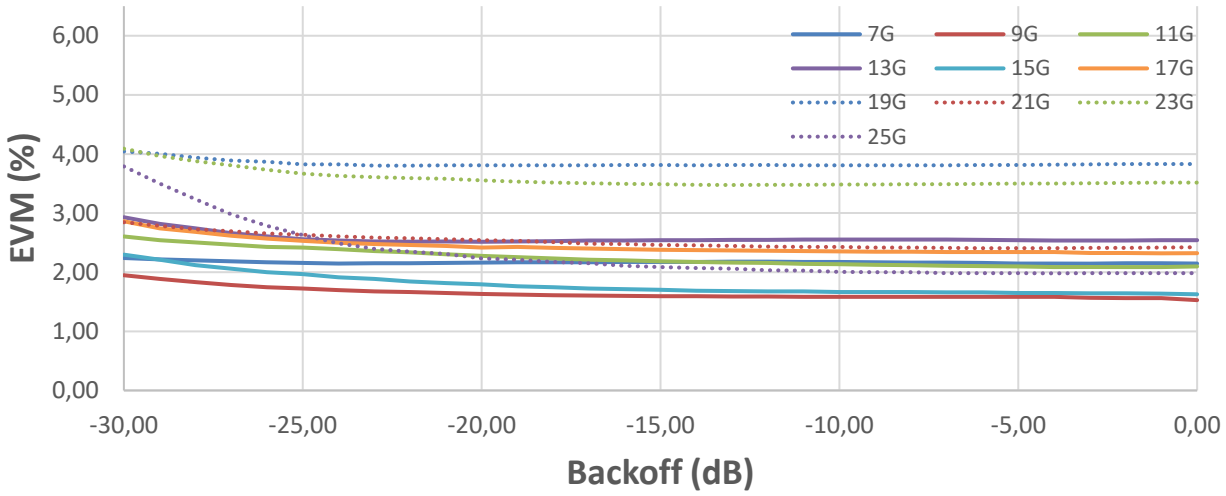
Note: Acquisition averaging set to 16. Backoff applied by onboard gain setting up to -23.5dB, reduced IF input power below this level

5G Typical Performances with Wupatec RFSoC VST v0.98

5G performances with 100MHz bandwidth 8dB PAPR

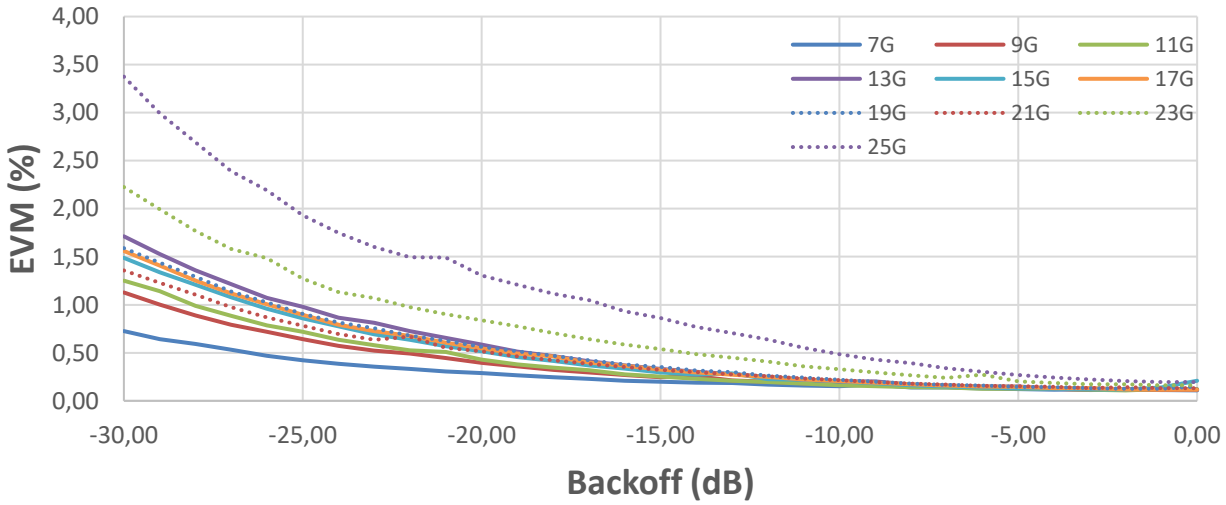
RF output loopback to RF input, source power set to maximum, sampling rate = 1474.56MSa/s
ACPR measurement performance is limited by the source power below Rx optimum input power

RF Loopback raw EVM vs source power



Note: Acquisition averaging set to 16. Backoff applied by onboard gain setting up to -23.5dB, reduced IF input power below this level

RF Loopback equalized EVM vs source power

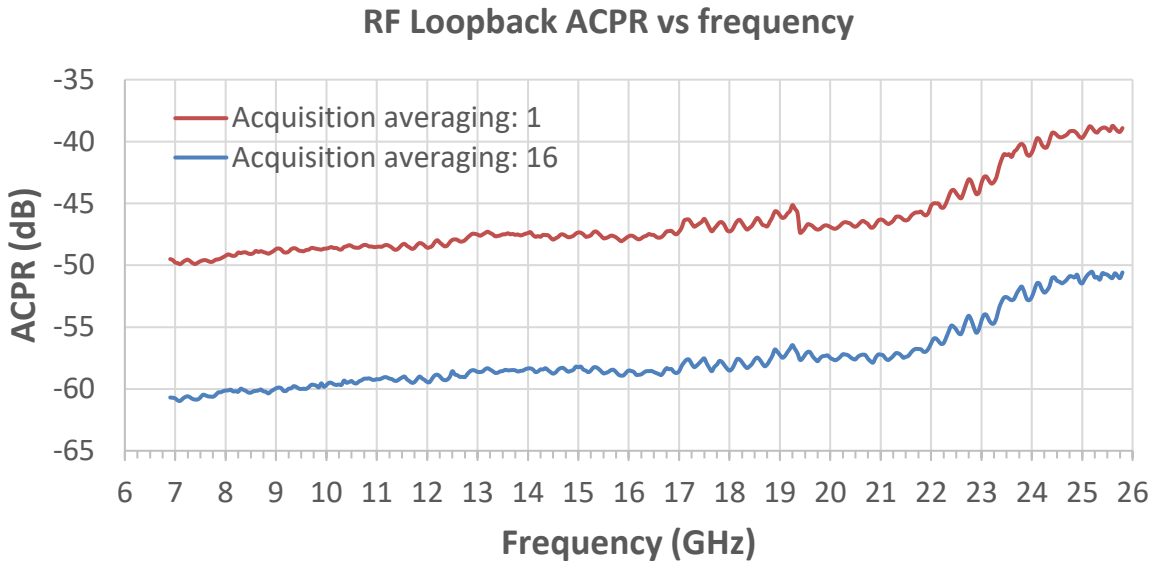


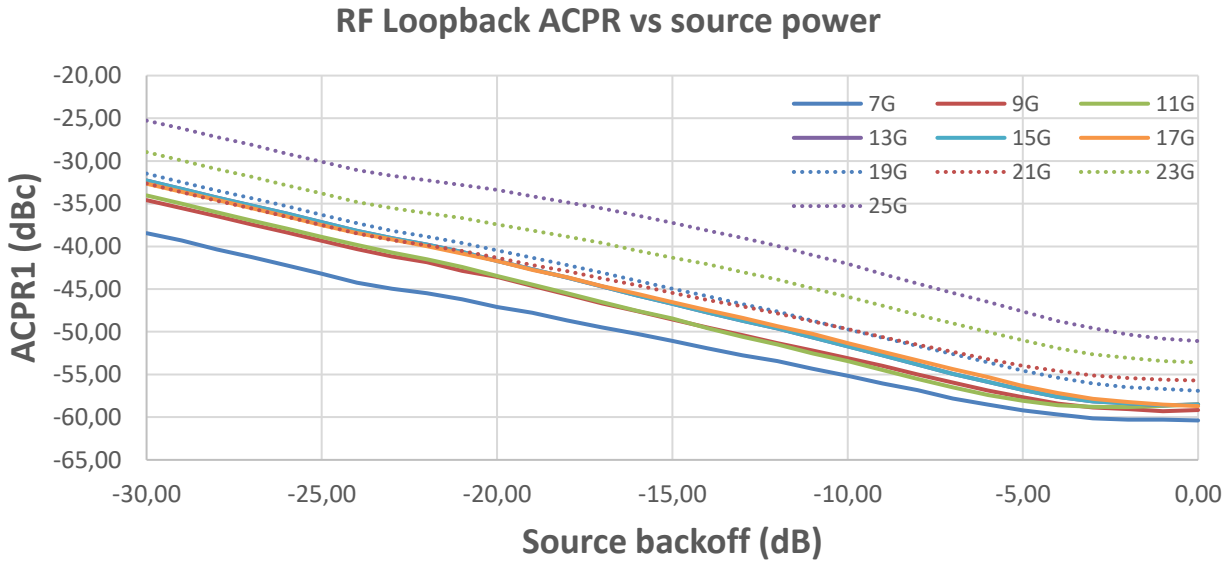
Note: Acquisition averaging set to 16. Backoff applied by onboard gain setting up to -23.5dB, reduced IF input power below this level

5G Typical Performances with Wupatec RFSoC VST v0.98

5G performances with 4x100MHz bandwidth 8dB PAPR

RF output loopback to RF input, source power set to maximum, sampling rate = 1474.56MSa/s
ACPR measurement performance is limited by the source power below Rx optimum input power





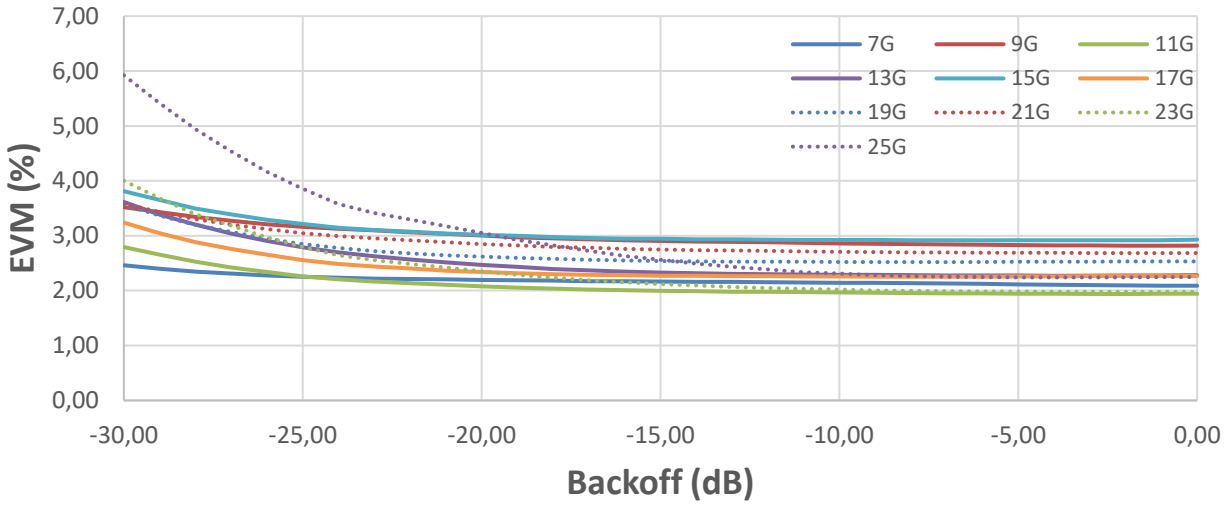
Note: Acquisition averaging set to 16. Backoff applied by onboard gain setting up to -23.5dB, reduced IF input power below this level

5G Typical Performances with Wupatec RFSoC VST v0.98

5G performances with 4x100MHz bandwidth 8dB PAPR

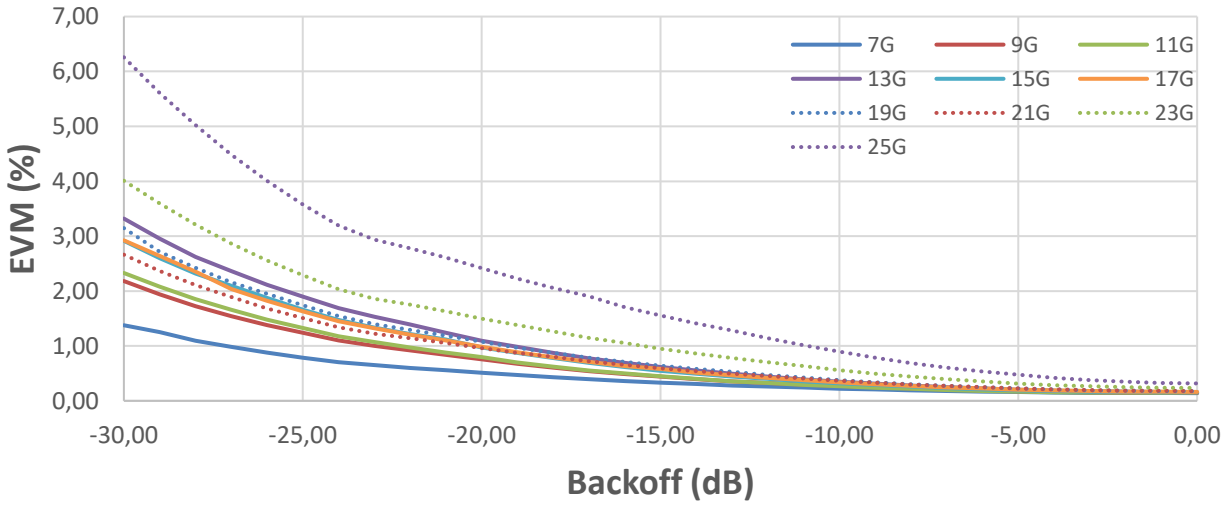
RF output loopback to RF input, source power set to maximum, sampling rate = 1474.56MSa/s
ACPR measurement performance is limited by the source power below Rx optimum input power

RF Loopback raw EVM vs source power



Note: Acquisition averaging set to 16. Backoff applied by onboard gain setting up to -23.5dB, reduced IF input power below this level

RF Loopback equalized EVM vs source power

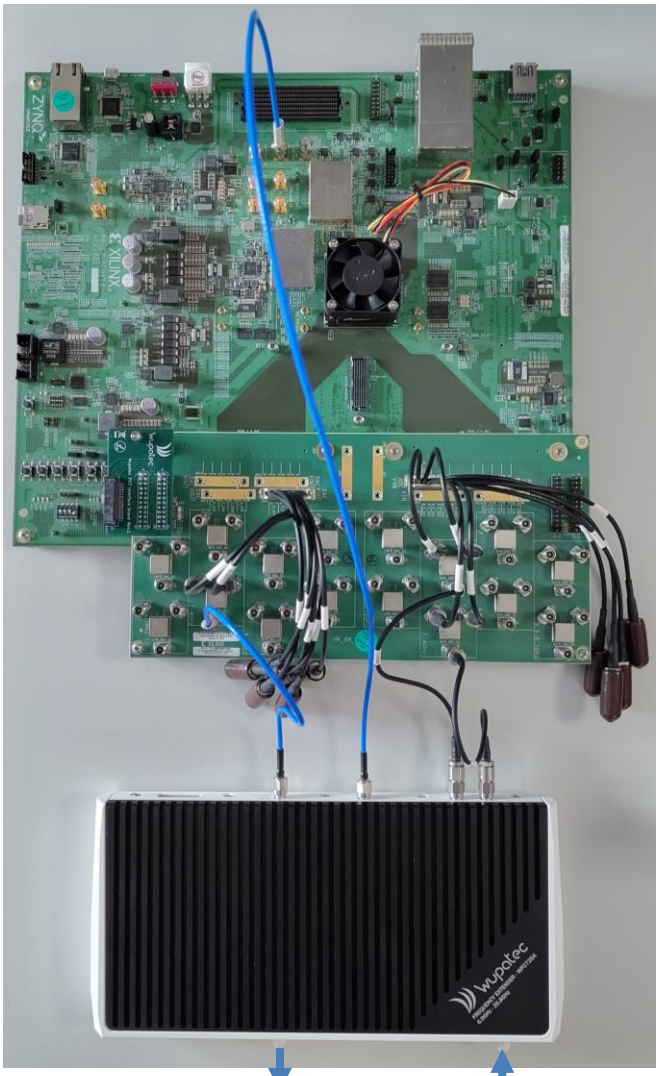


Note: Acquisition averaging set to 16. Backoff applied by onboard gain setting up to -23.5dB, reduced IF input power below this level

Quick start guide – Connection to ZCU670

The Frequency extender is connected to the AMD ZCU670 board using the following connections:

Connector correspondence	
WFC725A	**XM755**
IF OUT Q	**J3**
IF OUT I	**J7**
REF IN	**J6 (ZCU670)**
IF IN	**J25**



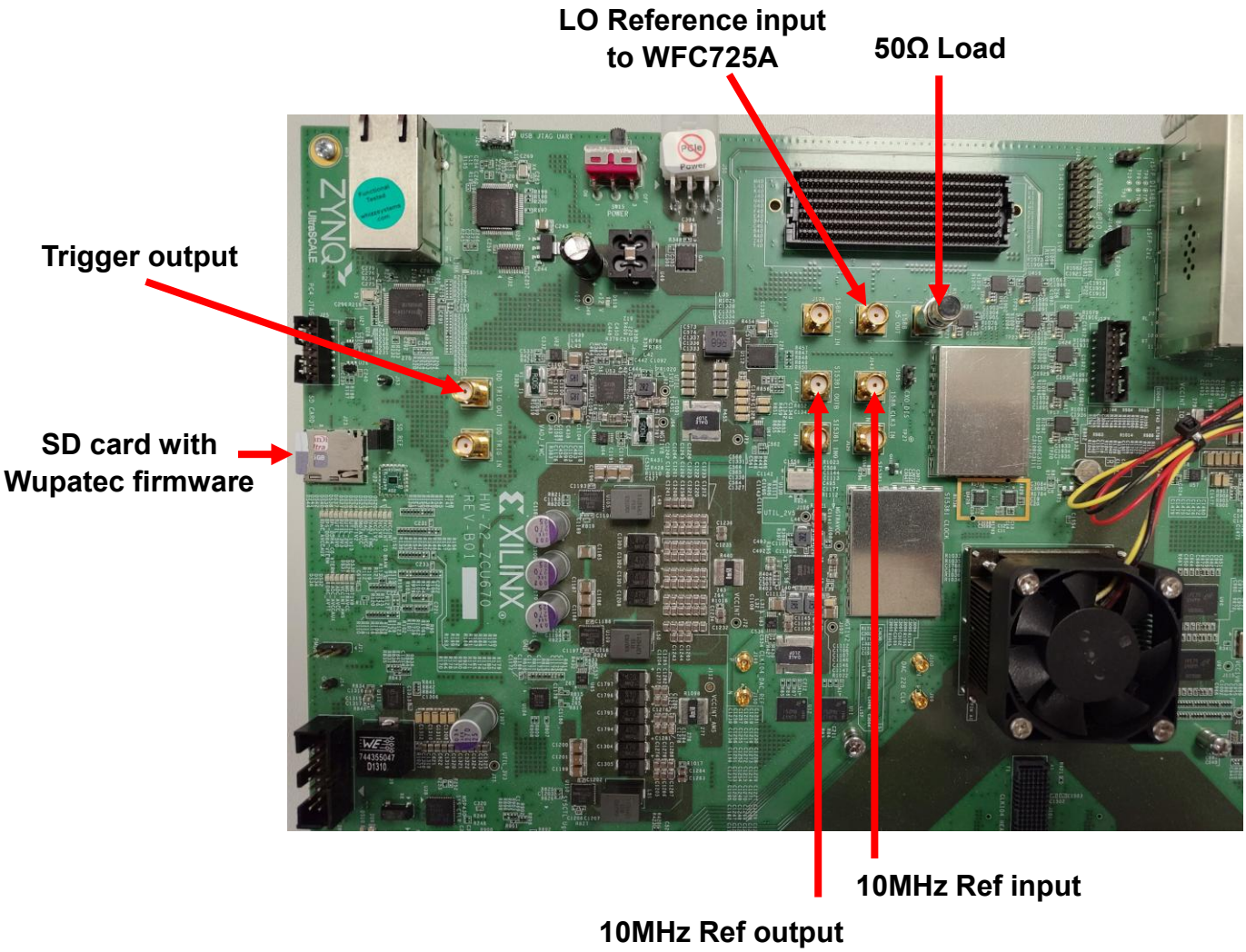
Quick start guide – Connection to ZCU670

The Frequency extender is connected to the AMD ZCU670 board using the following connections:

Quick start guide – Connection to ZCU670

The Wupatec VST firmware running on the AMD ZCU670 configures the on-board clock generators for use with the WFC725A frequency Extender.
Use the provided long SMA cable to connect the LO Reference to the WFC725A.

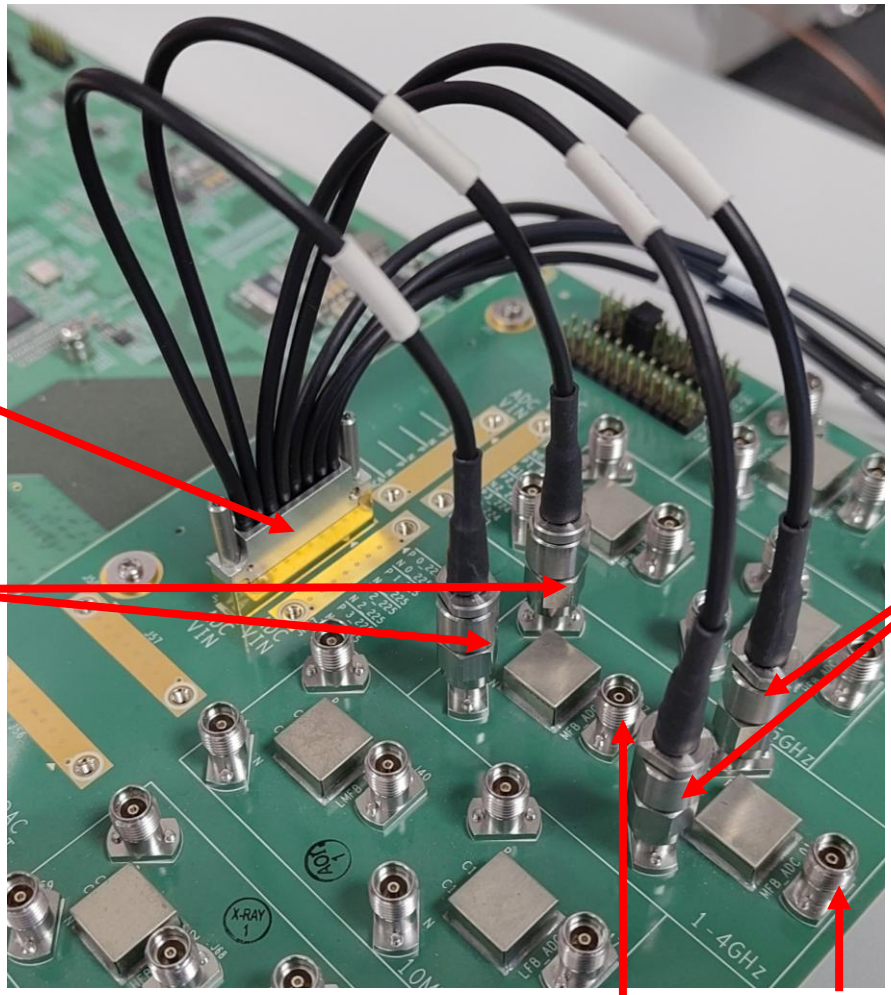
Additional Reference signals are available for synchronization with external laboratory equipment:



Quick start guide – Connection to ZCU670

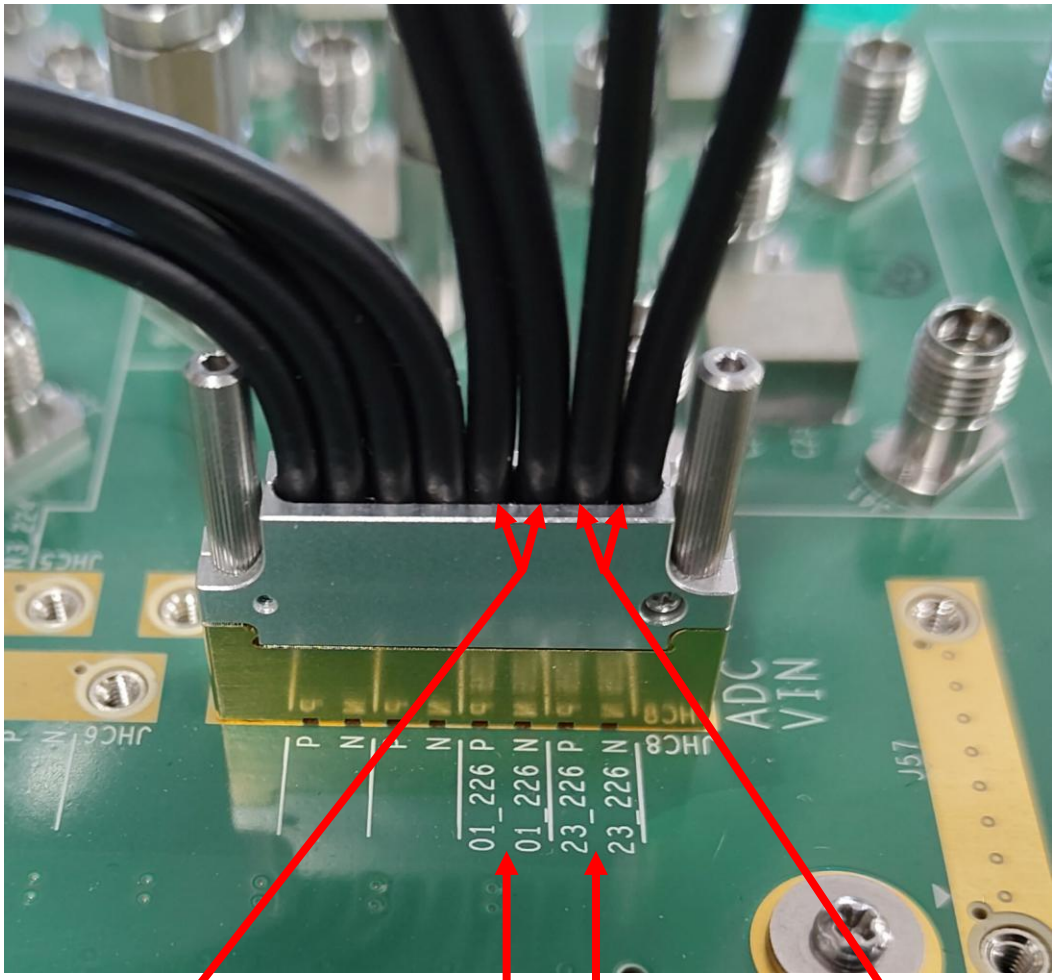
The Wupatec VST firmware running on the AMD ZCU670 configures the RFSoC DAC and ADC for use with the WFC725A frequency Extender.

The ZCU670 DAC and ADC use differential inputs/outputs and must be connected through the balun provided by the XM755 board from the AMD ZCU670 kit
Wupatec VST firmware uses Dual ADC 226 connected through the 1-4GHz baluns on the XM755 balun board :



Quick start guide – Connection to ZCU670

ZCU670 JHC8 connector to RFSoC ADC details



SMA cables for WFC725A I output

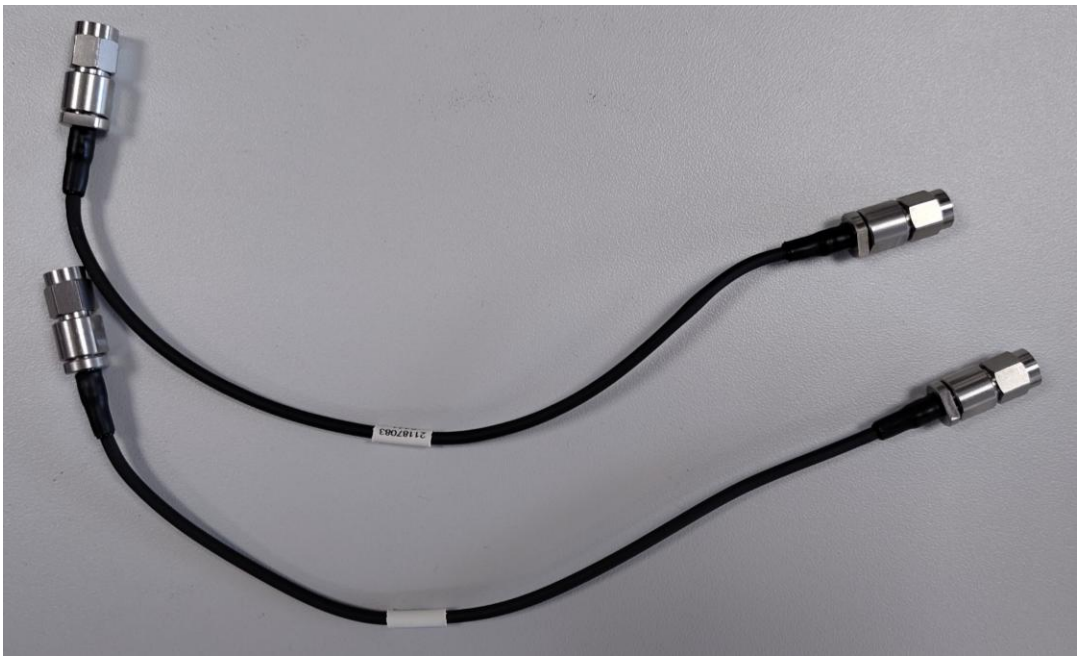
SMA cables for WFC725A Q output

ADC 226 differential input 1

ADC 226 differential input 2

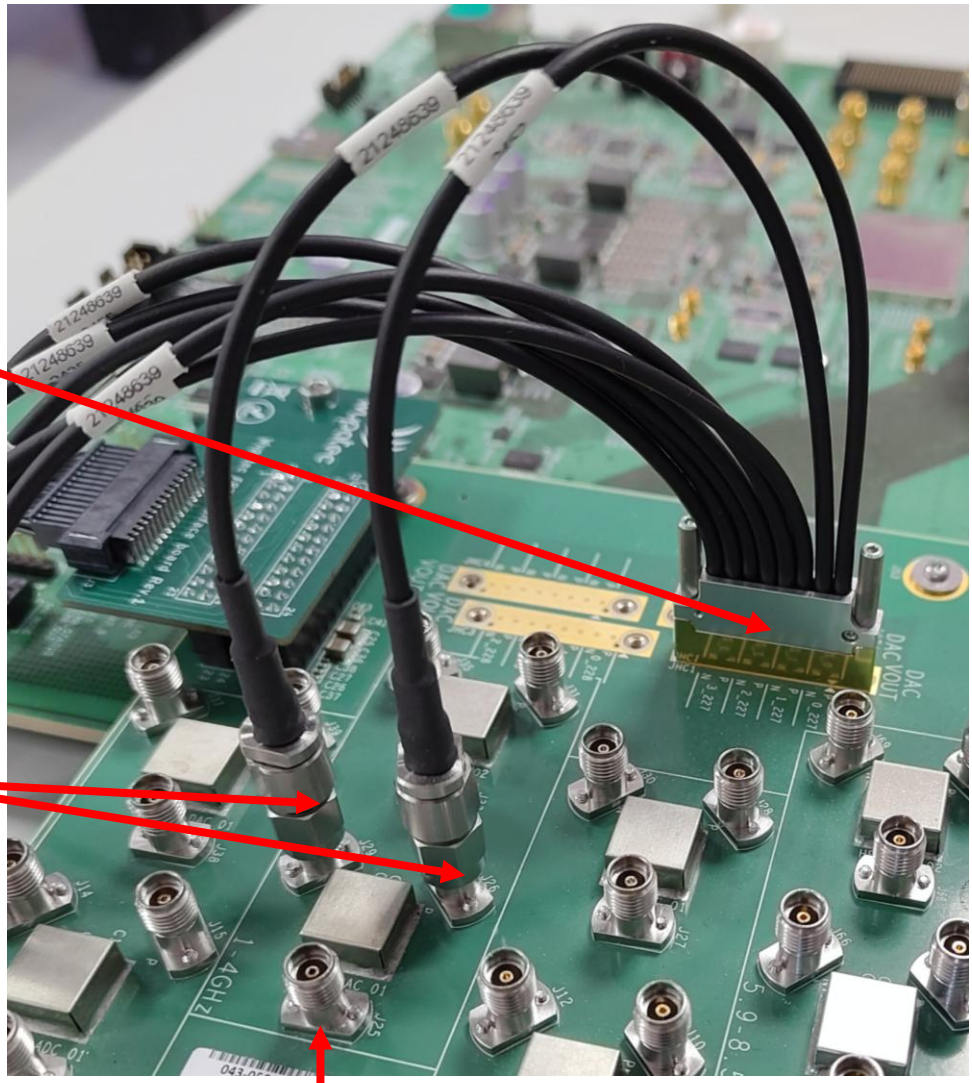
Quick start guide – Connection to ZCU670

The cables between the balun input ports and the WFC725A IF output ports must be tightly matched for best performance. You can use the two SMA cables provided in the AMD ACU670 kit.



Quick start guide – Connection to ZCU670

Wupatec VST firmware uses Quad DAC 227 connected through the 1-4GHz baluns on the XM755 balun board.
Use the provided short SMA cable between the balun output port and the WFC725A IF input port.

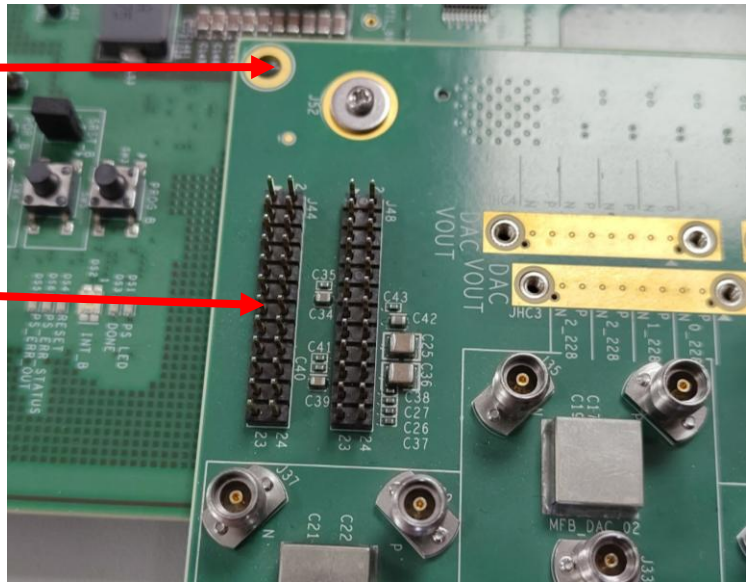


Quick start guide – Connection to ZCU670

The Digital IO connection is performed through the headers available on the balun board

Hole used by the spacer

J44 & J48 Connectors

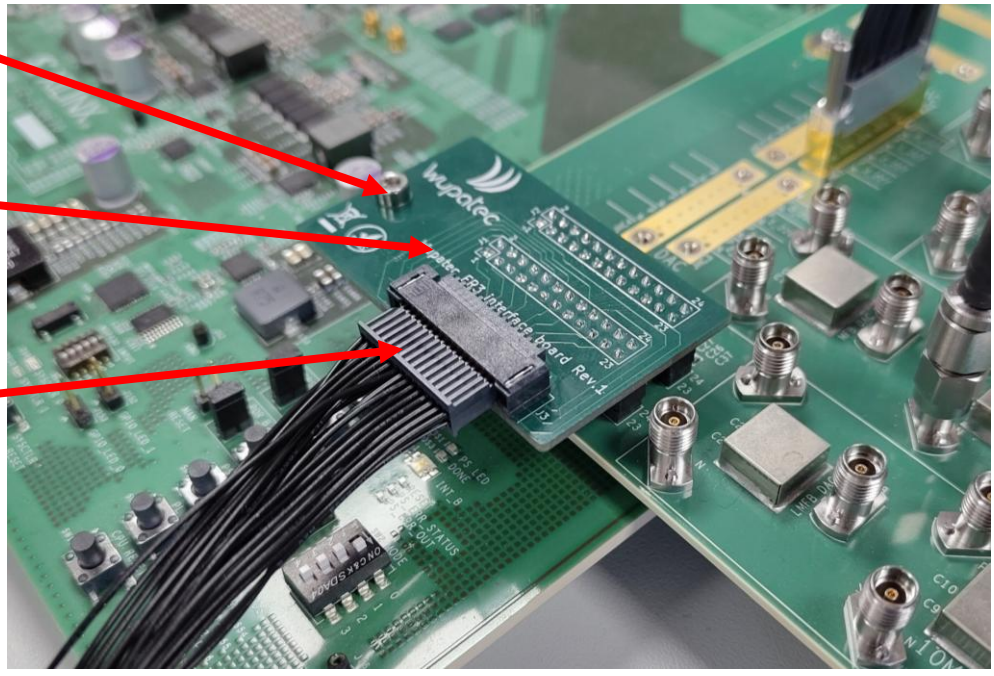


After removing any jumper plugged into J44 or J48, plug the adapter board provided by Wupatec. The spacer indicates the correct orientation :

Spacer

Wupatec WFC725A Digital IO adapter board

Wupatec Digital IO cable to WFC725A



Quick start guide

After starting up the platform, the Status LED is illuminated with a red color during its initialization:

When the Status and LO lock LEDs color turns green, the frequency extender is fully initialized and ready to be used

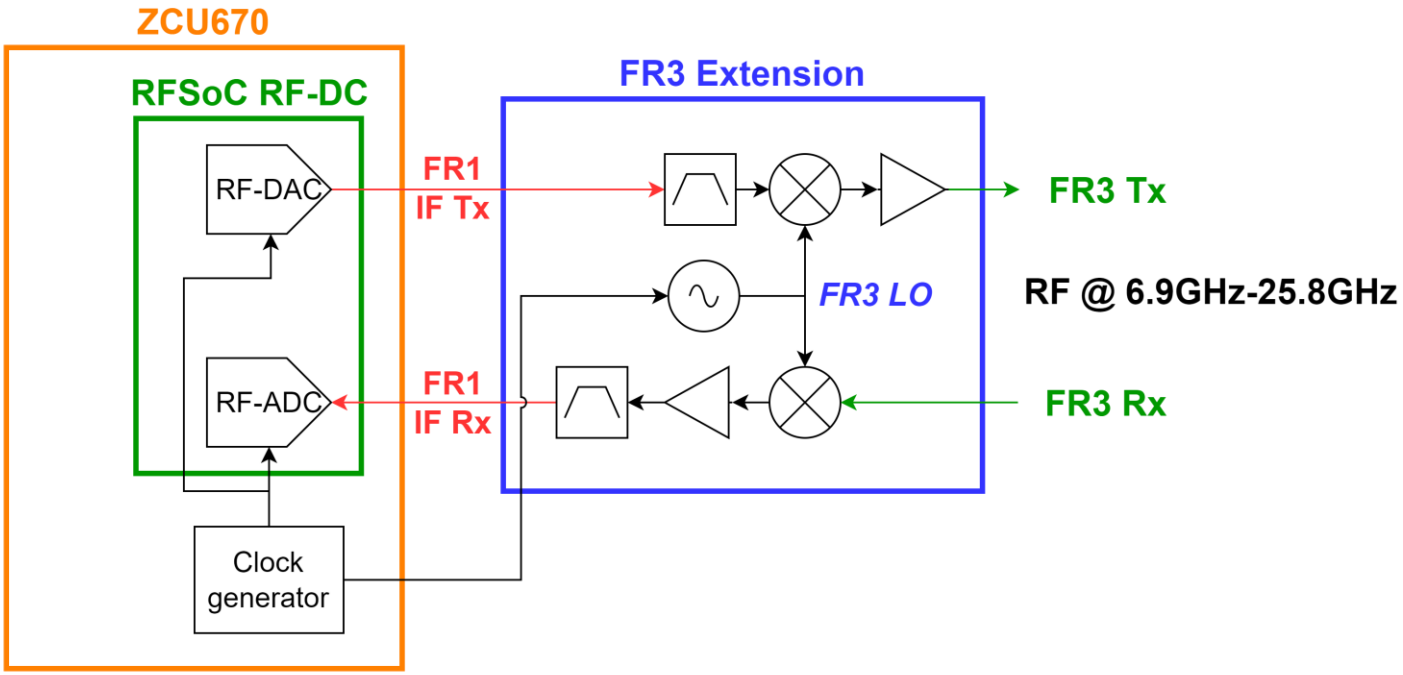
Troubleshooting:

- If the LEDs never turns green, verify the connection of the LO Reference input.
- If the LEDs never turn red or green, verify the connection of the digital I/O

Theory of operation

Operation principle:

The Frequency extender enhances VST measurement capabilities by extending the RF frequency range to FR3 using frequency transposition from an intermediate frequency compatible with the AMD RFSoC DFE



The frequency extender is controlled by the Wupatec VST firmware embedded in the AMD ZCU670 board.

The Wupatec VST firmware automatically detects and configures the Frequency extender when connected, enabling VST measurements from 10MHz (Frequency extender not in use) up to 25.8GHz without any additional configuration needed by the user.

Theory of operation

External input/output filters:

The Frequency extender does not integrate adaptative filters at RF input/output ports. If the specified harmonics level is too high at the RF output port, appropriate external SMA/3.5mm/2.92mm filters can be plugged into the output RF ports made of 3.5mm connectors.

Filtering on the RF input port is not required thanks to the high selectivity of the receiver.

Do not over-tighten the SMA connectors, use proper torque wrench for 3.5mm RF connectors.

Theory of operation

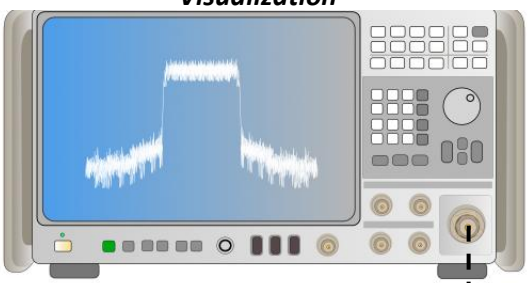
Typical setup:

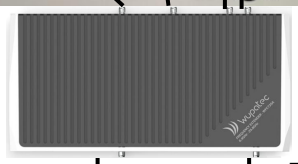
The complete FR3 VST is capable of high-speed and accurate measurements of modulated signals to evaluate Power Amplifier performances with LTE/5G modulation scheme.

The test platform can be used with all DPD techniques and algorithms available in IVCAD Suite (including embedded AMD and Wupatec DPD) to verify that the Power Amplifier under test can be linearized with different levels of DPD complexity.

AMD ZCU670 with Wupatec Vector Signal Transceiver firmware

Additional spectrum for Visualization





WFC725A

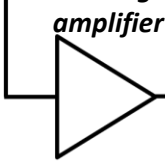
RF Output

RF Input

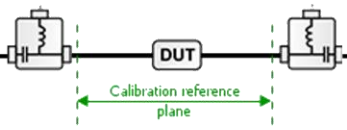
Output Power sensor

Input Power sensor

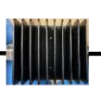
Driving amplifier



Dir. Coupler



Power attenuator



3-way splitter

Warranty

Any WUPATEC product comes with a two-year parts and labour warranty, when returned to our workshops. A phone support service is also available for the same period.
At the end of the initial two-year period, a further contract can be subscribed, including:

- a preventive functional check and calibration of the modules (on site or in our workshop)
- a further two-year warranty period

Quality Regulations & Environment

WUPATEC Systems and all modules are compliant to the applicable European directive and hold the CE mark.

- Products are designed and manufactured in France.
- Serial number-based life cycle management
- All products are 100% tested (test reports on demand)
- To ensure a correct operation, the fans must not be obstructed
- Maintenance will only be performed by the manufacturer WUPATEC. Do not allow anyone to perform electrical maintenance on the VST.
- WUPATEC only uses RoHS compliant components and does not use substances banned by the COSHH regulation.
- WUPATEC complies with the relevant national regulations related to the safety and health of its employees against hazardous substances.
- As we are always seeking to improve our products, the information in this document gives only a general indication of the product capacity, performance and suitability, none of which shall form part of any contract. We reserve the right to make design changes without notice.

Contact WUPATEC

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