A Very Low Cost Test Solution On the UWB Spectrum Mask Testing With Bandwidth Limited ATE Instrument

Yongjun Hu
Advantest China

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Contents

- WSRF and WSWB introduction
- UWB spectrum mask
- UWB spectrum mask implementation in WSRF and WSWB
- Lab setup and results
- WSRF20ex solution
- Summary

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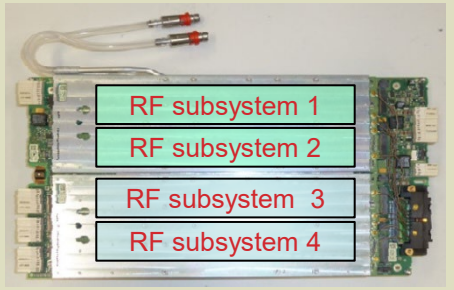
WSRF8 Features

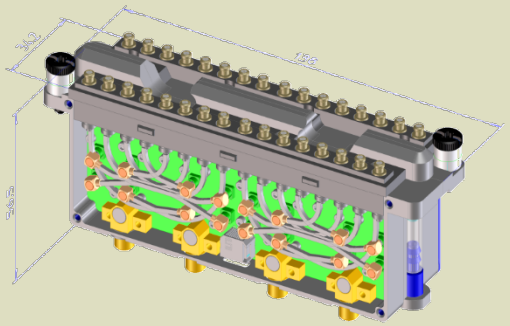
- Innovative integration: higher flexibility & density
  - Fits into smaller infrastructure
  - Allows higher multi-site e.g. 16x with native ATE resources
- One card has 4 independent RF subsystems providing a total of:
  - 32 RF ports (8 RF ports per subsystem)
  - 4 independent CW or modulated stims
  - 4 independent measurements

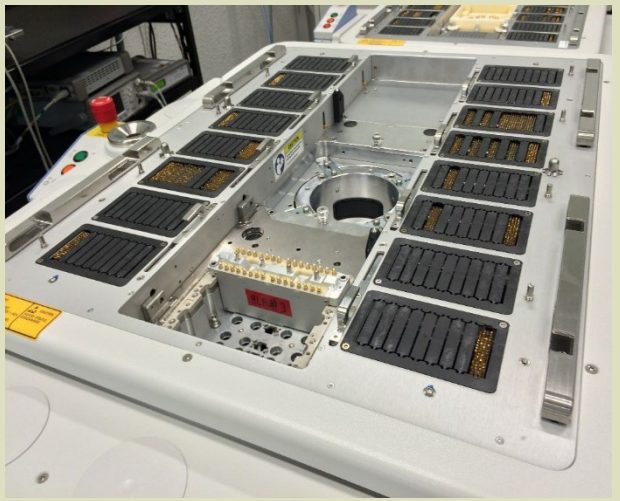


- Built-in RF calibration standards (RF Interface Module)
- RF performance:
  - Frequency coverage: 10 MHz – 8 GHz
  - Measurement Bandwidth: 200 MHz, 450 MHz (under-sampling)
  - Stim Modulation Bandwidth: 200 MHz
  - Dynamic range: 145 dB

WSRF8 - DUT Interface & RF Interface Module

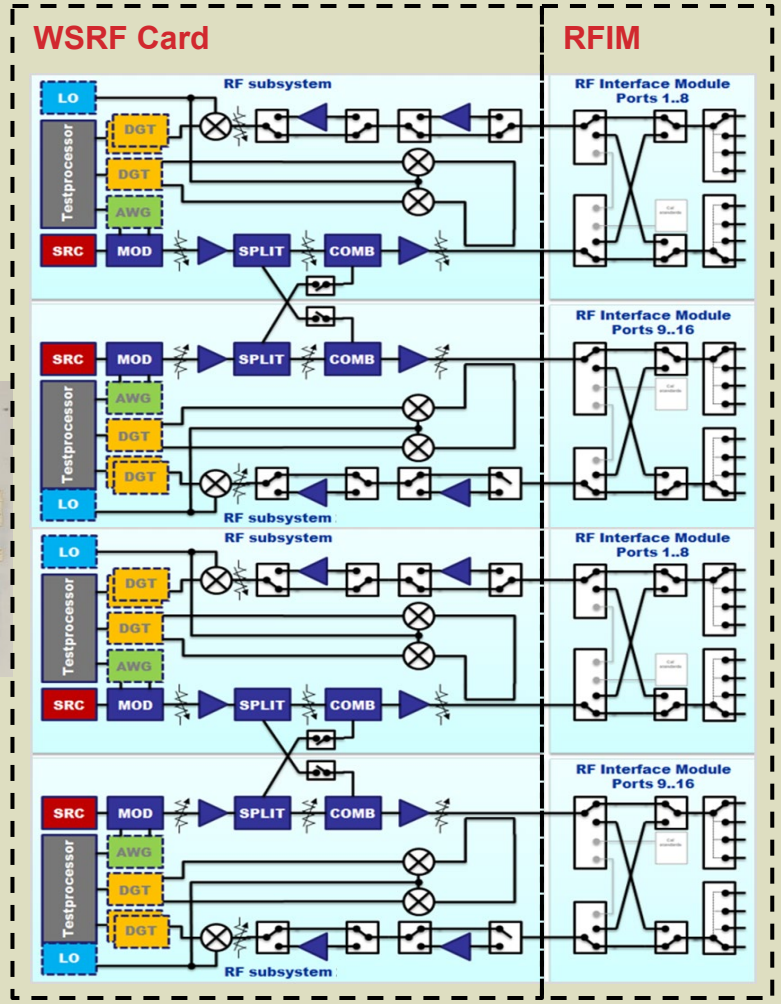
- Each WSRF card has a dedicated RFIM
- Up to 6 cards: 192 RF ports distributed on each side on the DUT Interface
- Typical 1 - 2 cards: 32 - 64 RF ports
- Compatible with purge and Direct Probe





WSRF8 - Card and RFIM8

WSRF Card



90101 - 90108

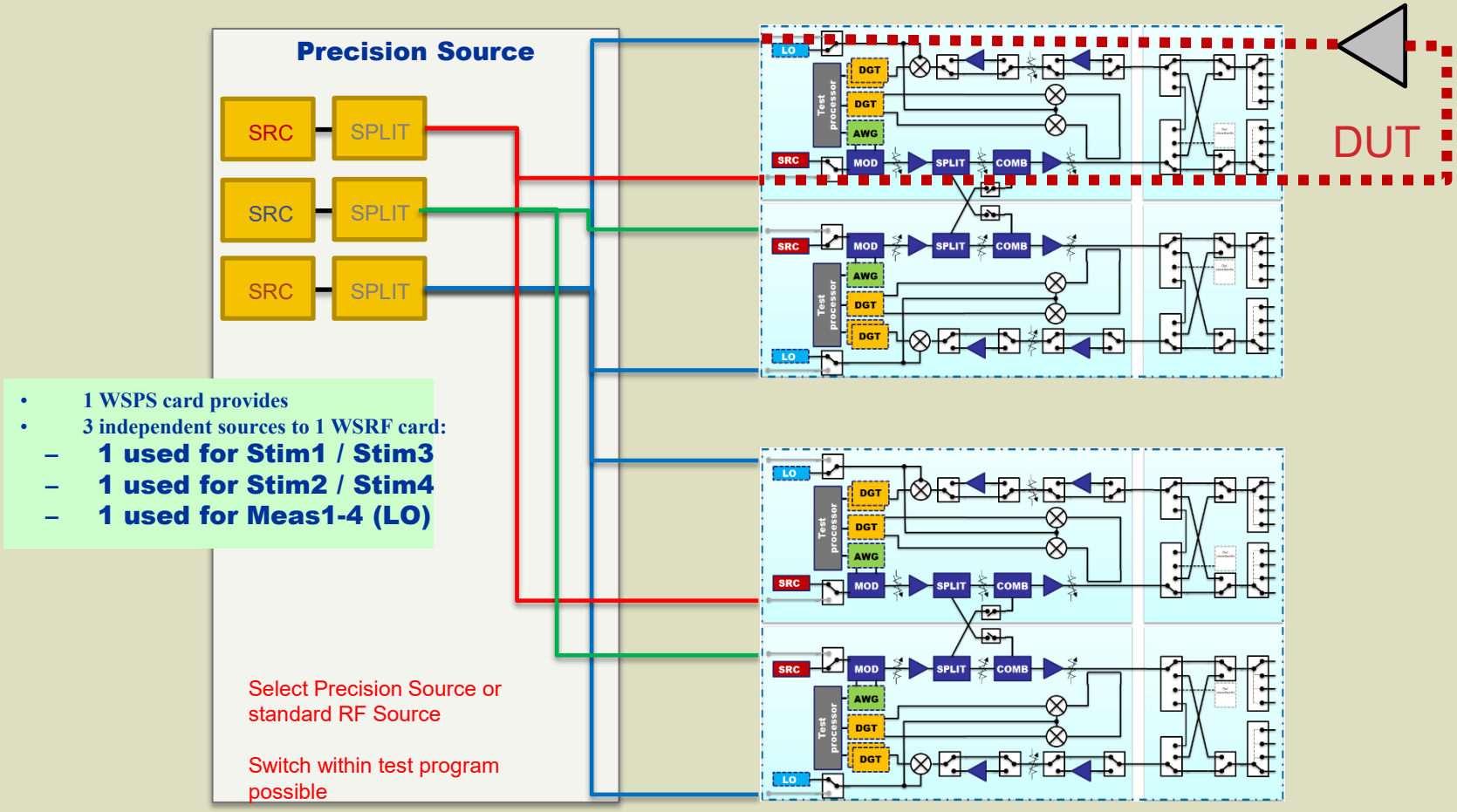
90109 - 90116

RFIM

90201 - 90208

90209 - 90216

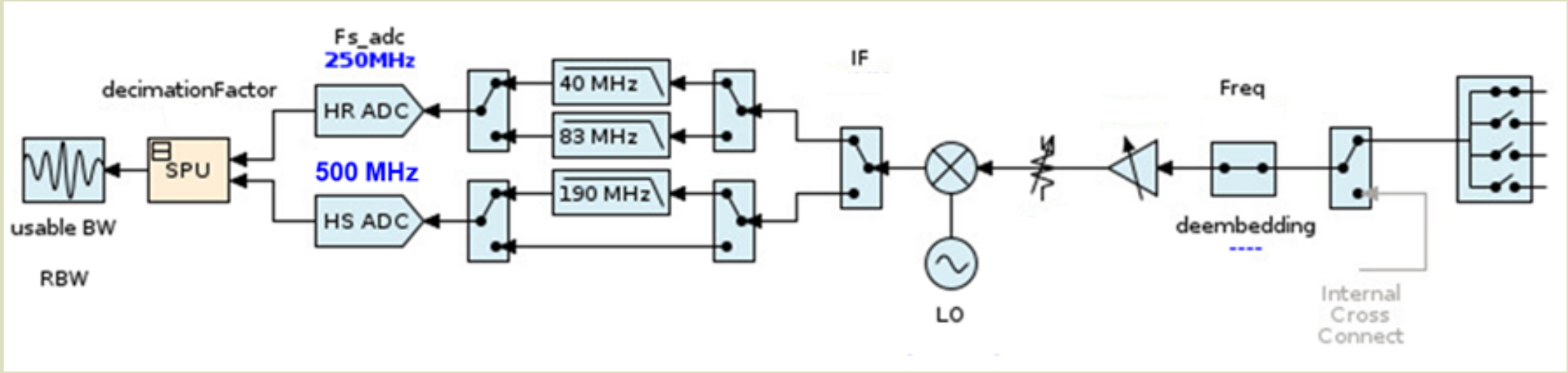
WSPS: Through WSRF8



- 1 WSPS card provides
- 3 independent sources to 1 WSRF card:
  - **1 used for Stim1 / Stim3**
  - **1 used for Stim2 / Stim4**
  - **1 used for Meas1-4 (LO)**

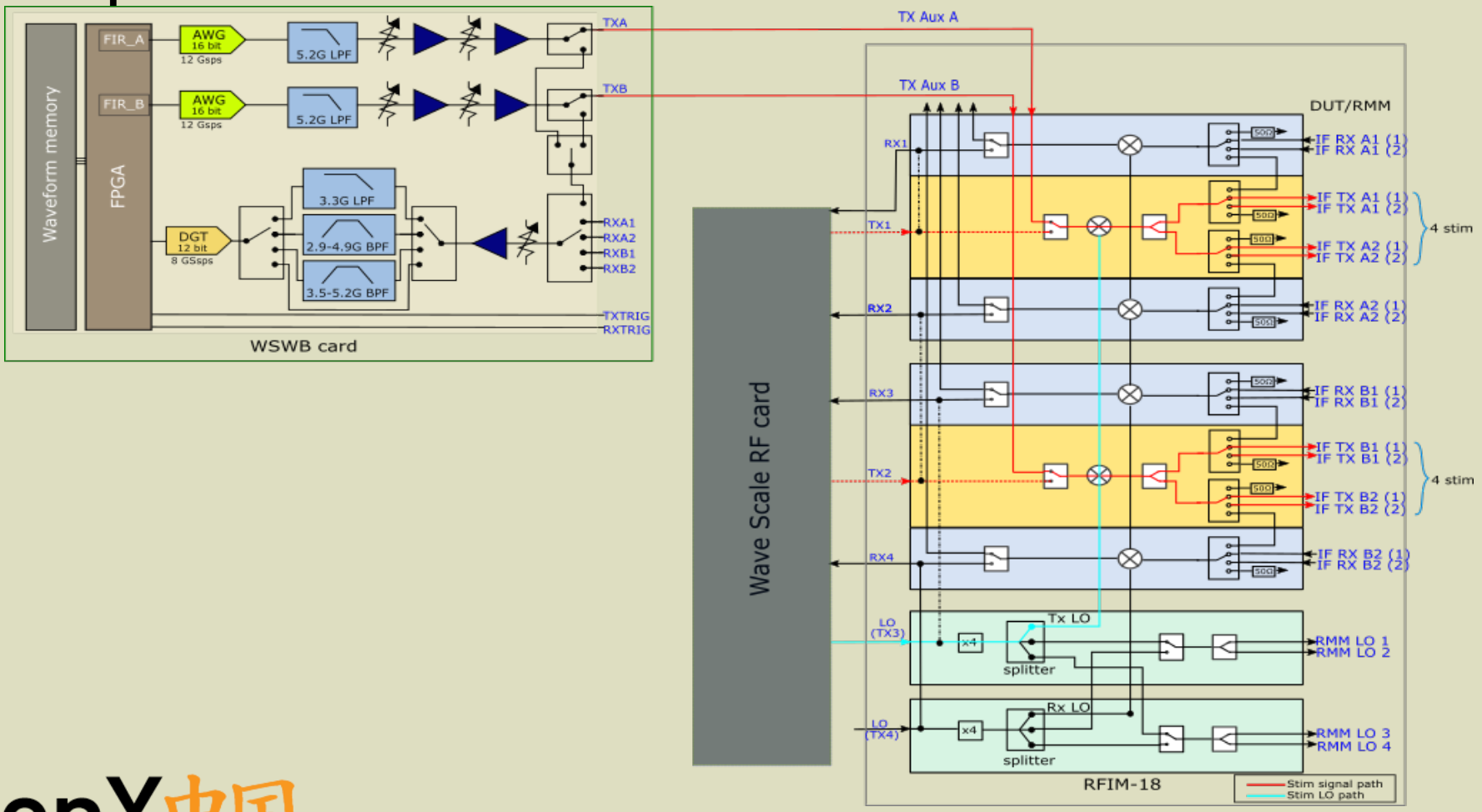
WSRF8: rfMeas

- Measurement properties that define the path and its settings:
  - *expectedMaxPower* and PAPR
  - *receiverPath*
  - *receiverAttenuation*



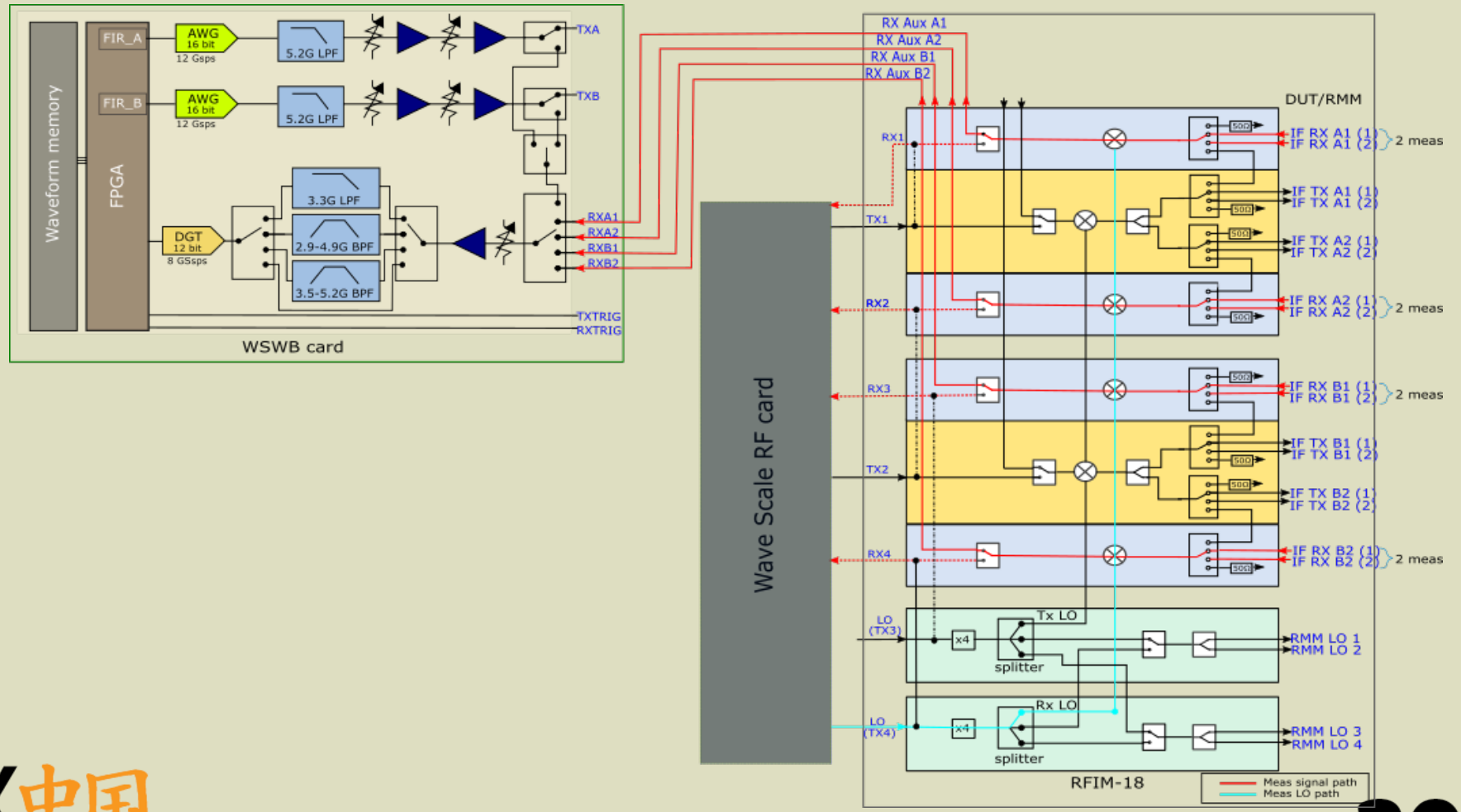
WSWB with WSRF18 – stimulus path

- Stimulus path



WSWB with WSRF18 – measure paths

- Measure paths



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UWB TX Spectral Density

- Regulatory

Regulatory norm	Designation
ETSI EN 303883	short range devices (SRD) and ultrawideband (UWB)
ETSI EN 302065	electromagnetic compatibility and radio spectrum matters (ERM); short range devices (SRD) using ultrawideband (UWB) technology
FCC CFR 47, part 15.250	operation of wideband systems in the 5925 MHz to 7250 MHz band
FCC CFR 47, part 15.5xx	UWB technical requirements and measurement techniques

- The maximum allowable output power spectral density of a UWB device should not exceed –41.3 dBm/MHz

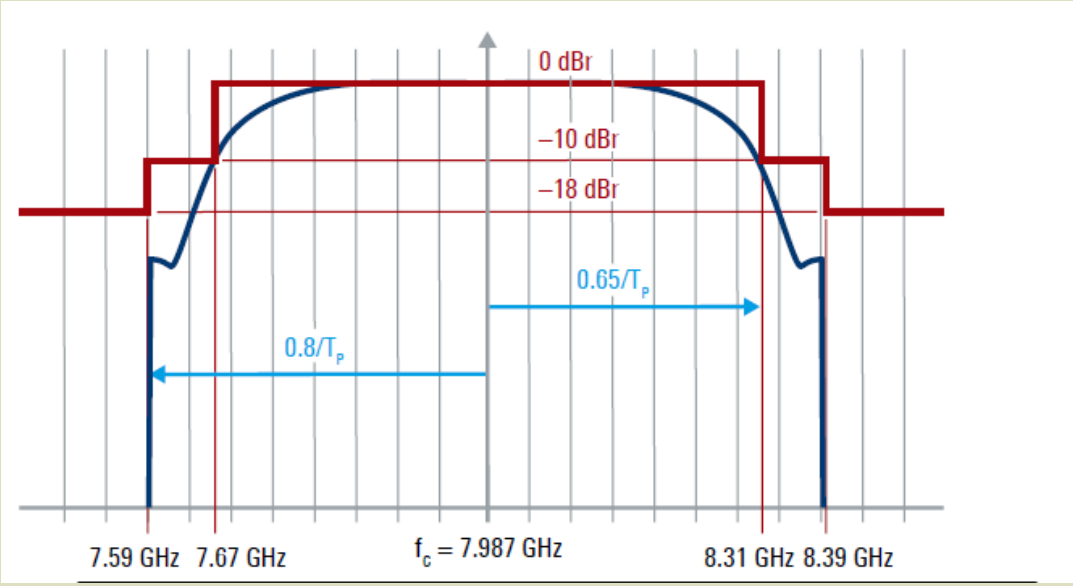
Source: Rohde & Schwarz

UWB TX Spectral Mask

- TX Spectral Density Mask

Channel number	Pulse duration, T_p	Mainlobe width, T_w
All (except 4, 7, 11 and 15)	2 ns	0.5 ns
7	0.92 ns	0.2 ns
4 and 11	0.75 ns	0.2 ns
15	0.74 ns	0.2 ns

T_P	$\lvert f_c - f \rvert$ –10 dBr	–18 dBr
2.00 ns	325 MHz	400 MHz
0.92 ns	705 MHz	870 MHz
0.75 ns	867 MHz	1067 MHz
0.74 ns	878 MHz	1081 MHz



f_c is the center frequency of the channel
T_p is the pulse duration of the associated channel
f_c for channel 9 is 7.987 GHz
2 ns for channel 9

Transmit power spectrum density (PSD) mask for channel 9

Source: Rohde & Schwarz

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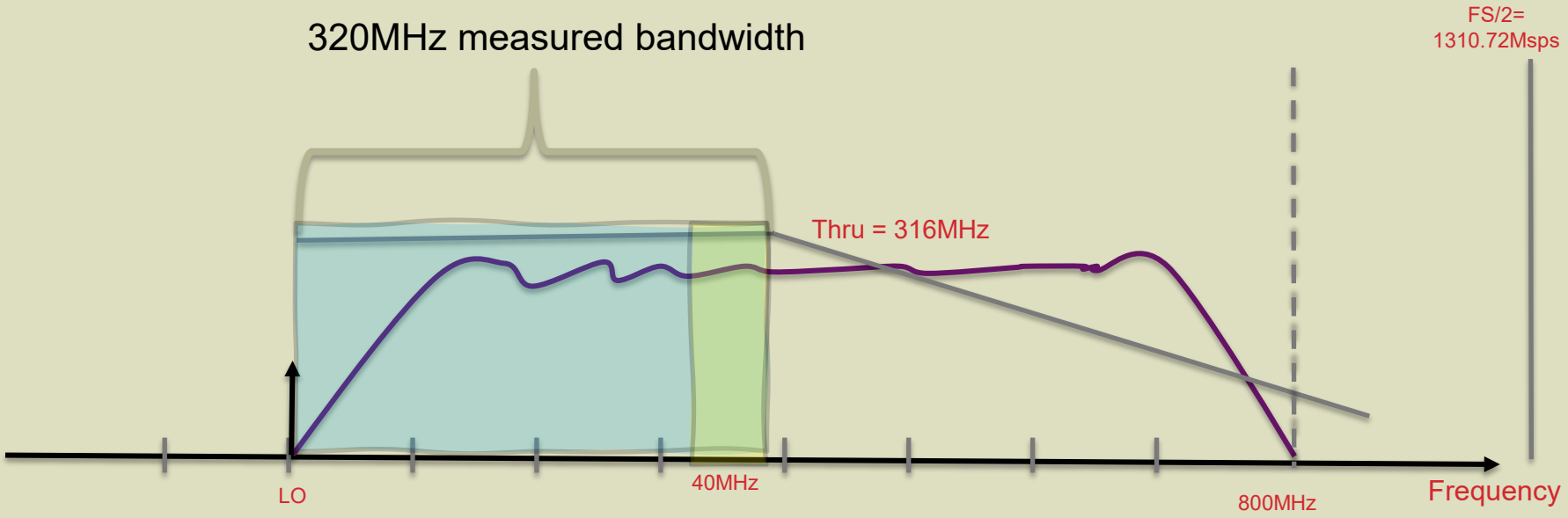
WSRF8 under-sampling measure diagram – step1

- Effective measure sample rate: 2621.437Msps;
- Measure setup : Filter = THRU

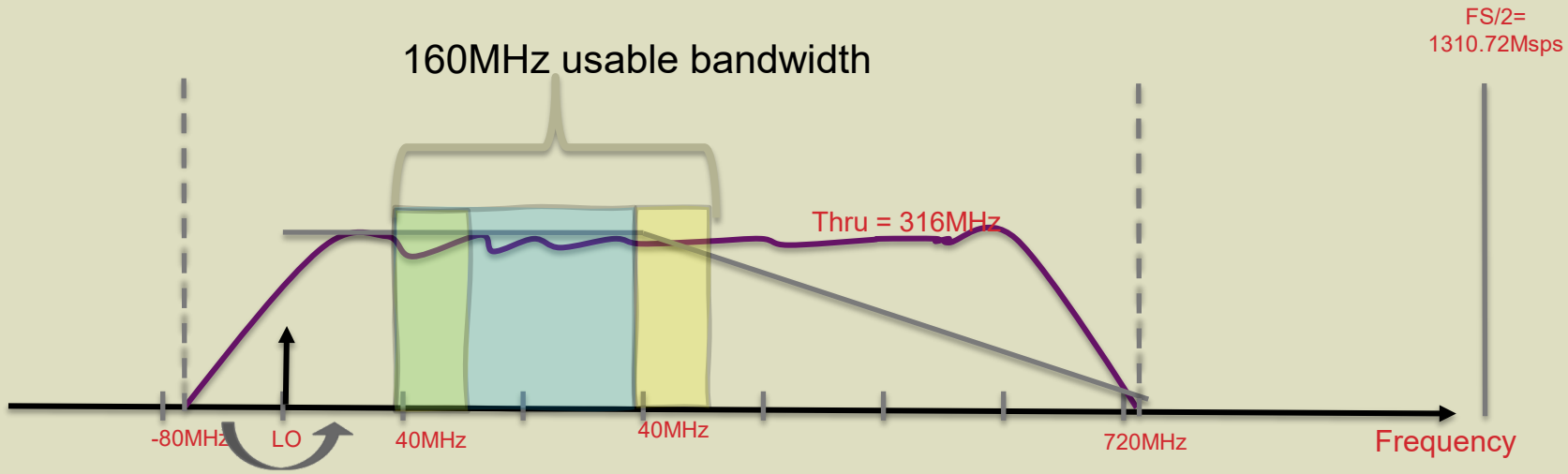


Signal covers the full 320MHz spectrum with 40MHz overlap

There are not any aliasing/image

WSRF8 under-sampling measure diagram – step2

- Effective measure sample rate: 2621.437Msps;
- Measure setup : Filter = THRU



the 160MHz usable spectrum with 40MHz overlap
There are 80MHz spectrum image

- For step 3 and step 4, it is similar above two steps and mirror process in spectrum

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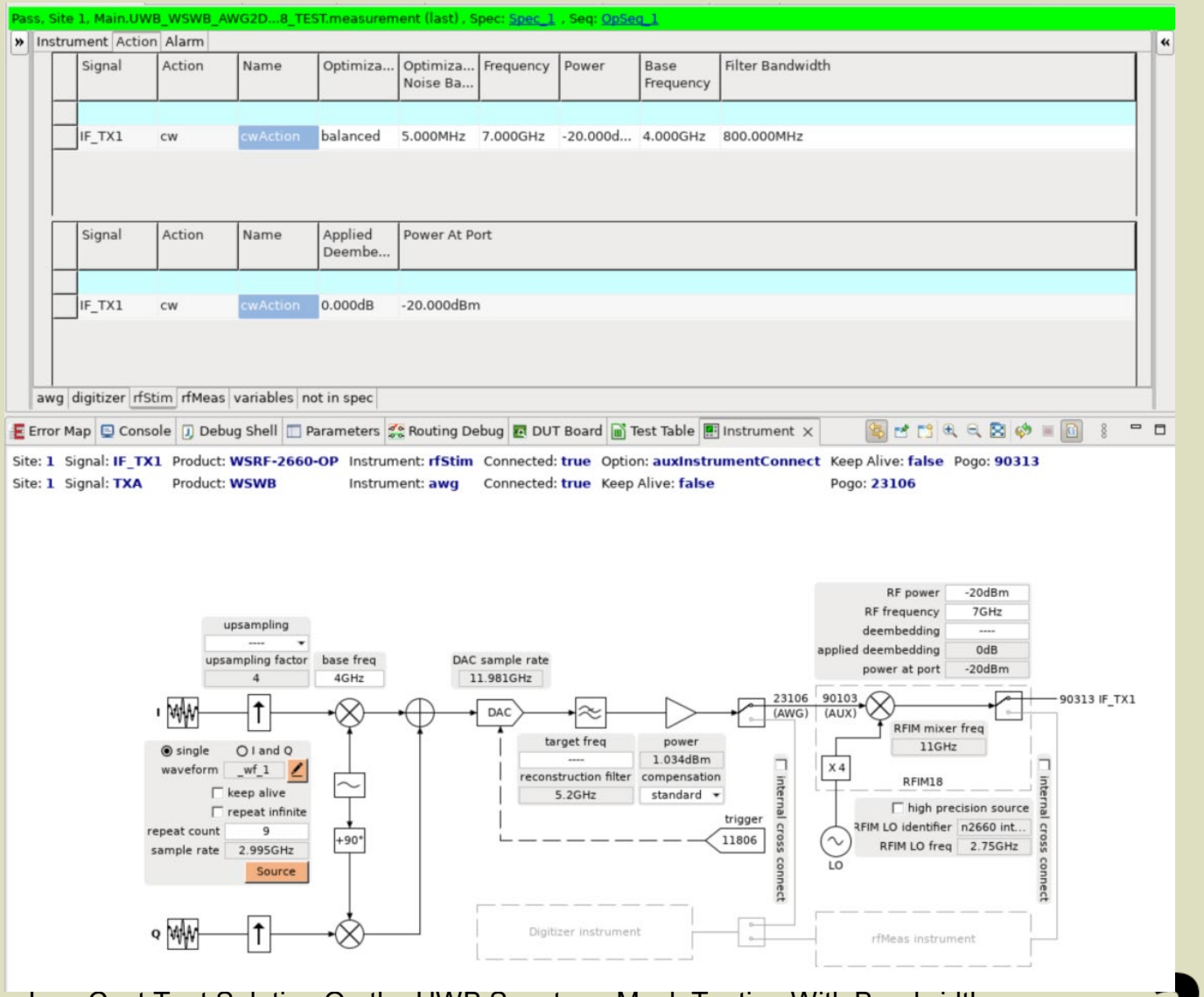
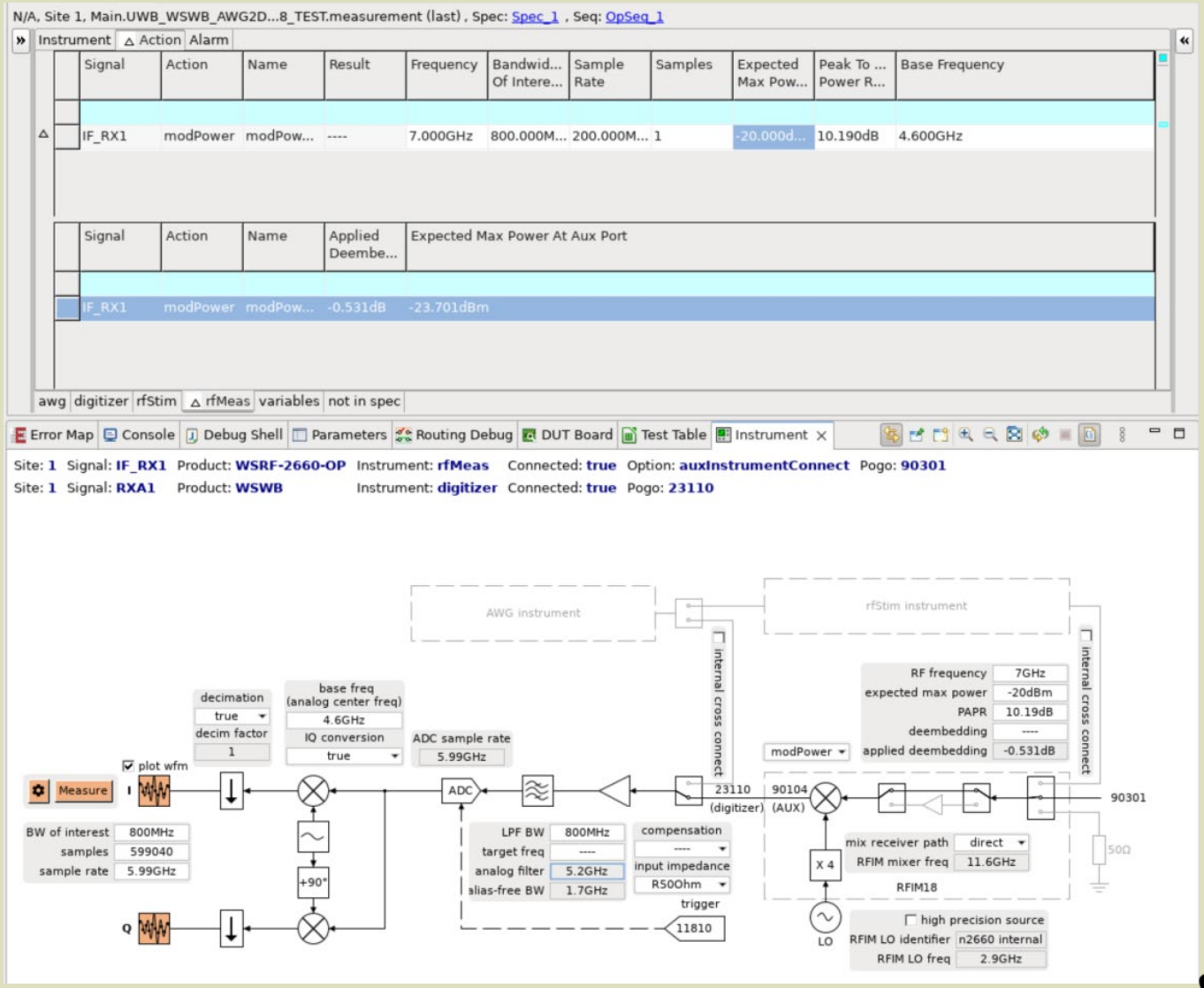
WSWB and WSRF18 generate UWB signal

- Stimulus setup
- Fc=7GHz
- Tp=2.0ns



WSWB and WSRF18 Measure UWB signal

- Measure setup

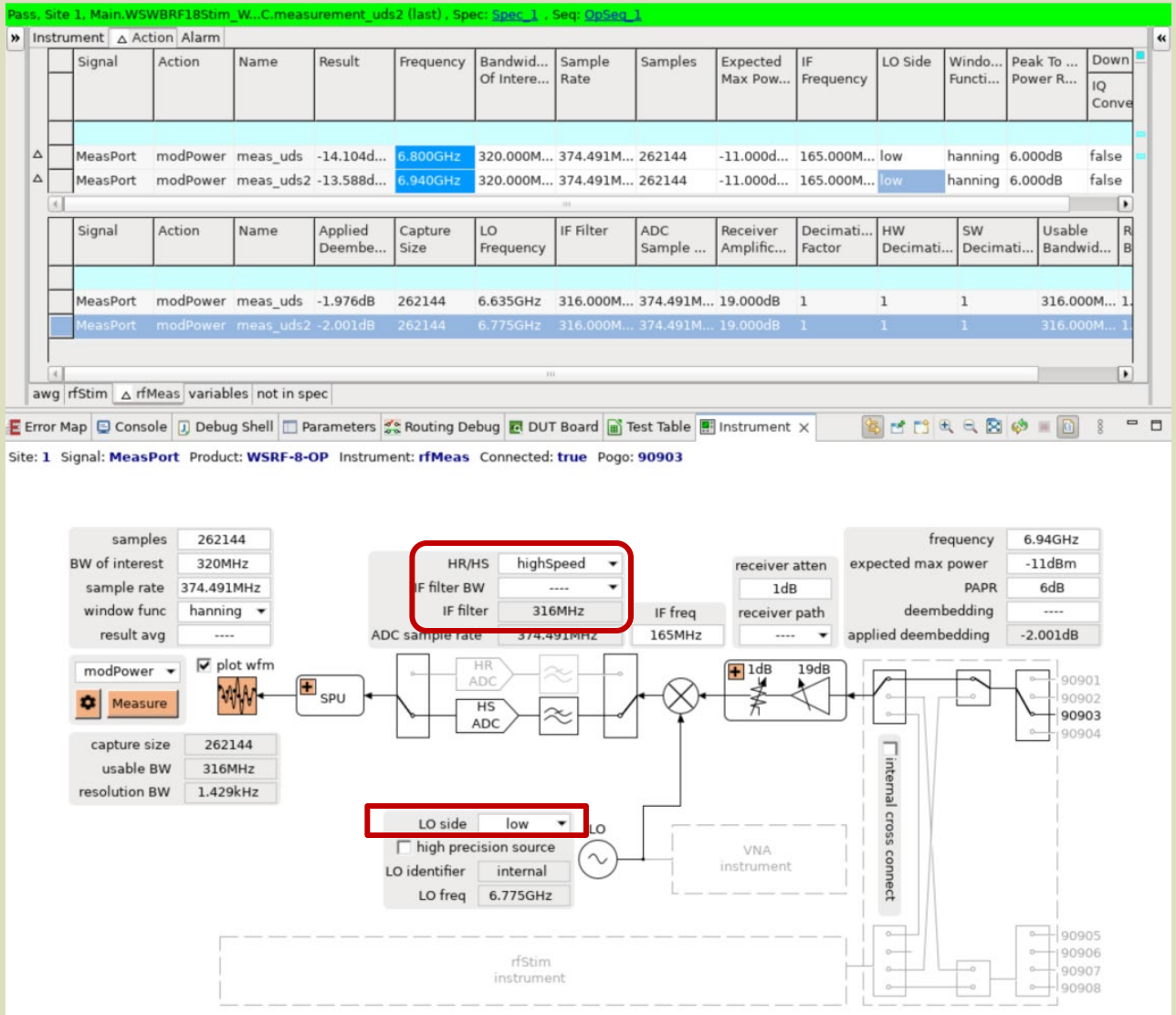


WSRF8 under-sampling measure setup parameters

- Meas real sample rate: 374.491Msps;
- Effective measure sample rate: 2621.437Msps;
- Capture samples: 262144;
- Effective measure BW: 320MHz (Left and Right), with 40MHz overlap with middle
- Middle measured BW: 160MHz(left) plus 160MHz(right) with 40MHz overlap with Left and Right capture
- Total measured BW = 800MHz BW;

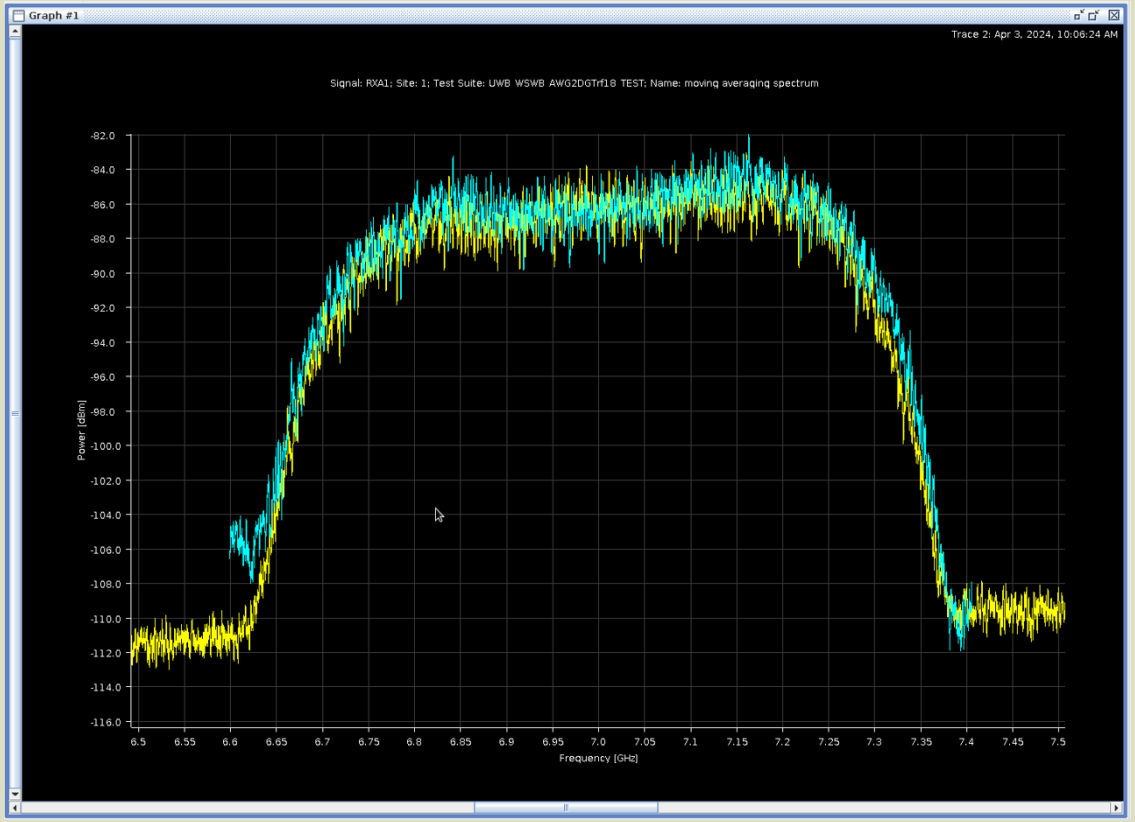
WSRF8 under-sampling measure UWB signal

- Step1 and step2
  - Measure setup;
    - Low side LO
- Step3 and step4
  - Measure setup;
    - High side LO



Results comparison

- Yellow: WSWB+WSRF18 Meas;
- Dark Teal: WSRF8＋under-sampling Meas;
- Middle Left: 2dB decrease;
- Middle right: 1.5dB decrease;
- Total spectrum: 4dB decrease;



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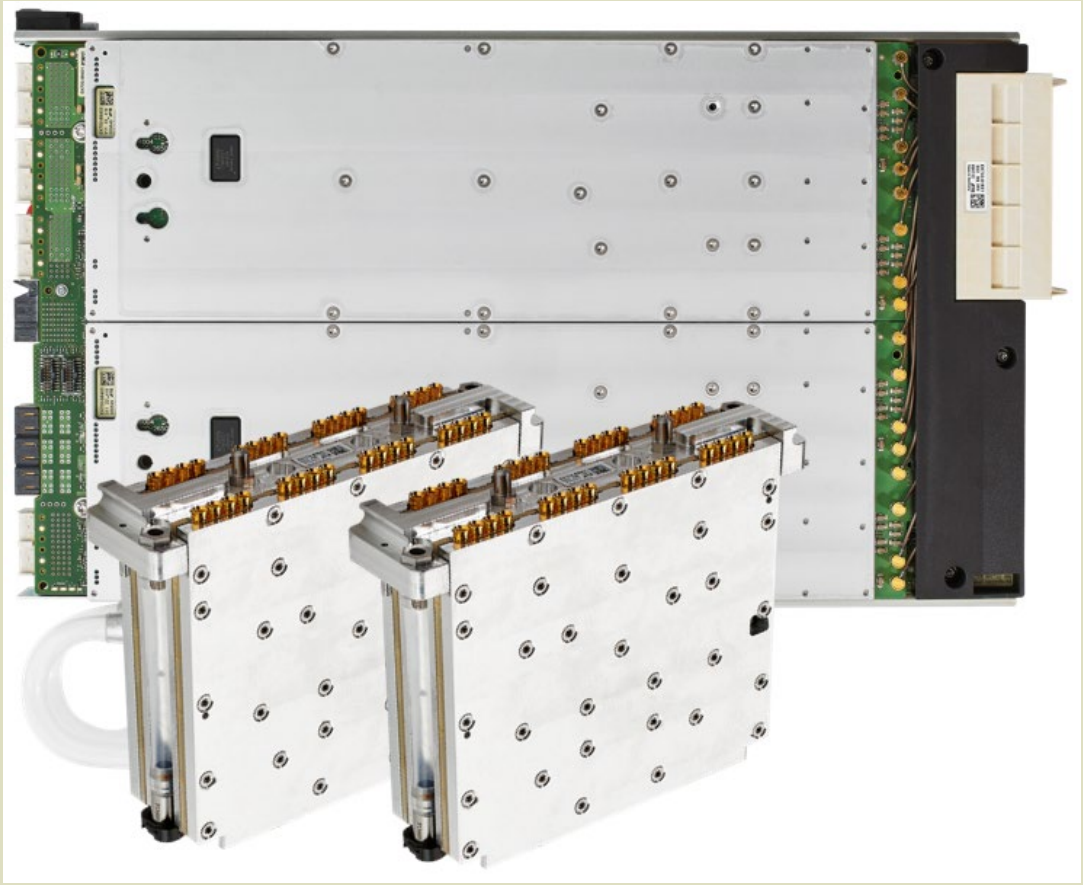
WSRF20ex – V93000 next RF generation

- Advantest's next generation RF test solution for V93000 EXA-Scale test platform.
- WSRF20ex provides extended capabilities and unmatched density:
  - **Frequency Coverage: 50 MHz – 20 GHz**
    - Programmable 50 MHz – 22 GHz
  - **Modulation Bandwidth: 2.01 GHz**
  - **RF Ports: 64 (Bidirectional)**
- Simple UWB EVM and power spectral density mask testing



Summary

- Introduce the WSRF8, WSRF18 and WSWB;
- UWB spectrum mask;
- WSRF18 and WSWB stimulus UWB signal and Measure UWB signal;
- WSRF8 under-sampling solution to measure the UWB spectrum mask is a possible low-cost solution compared to WSWB and WSRF18,but the carrier frequency is limit;
- Advantest proposal the WSRF20ex solution to test UWB device and SMT will provide the spectrum mask api;

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