

2 Adjustment

NOTICE

Risk of erroneous measurement results

Adjustment must be carried out exclusively by qualified personnel since any change can considerably affect the instrument's measurement accuracy.

2.1 Measuring Equipment

Table 2-1: Measuring Equipment and Accessories for Manual Adjustment of the R&S FSV Reference Oscillator

Item	Type of equipment	Recommended Specifications	Recommended Equipment	R&S Order No.	Use
1	Signal generator	Frequency: 1 GHz Output level: >-20 dBm Uncertainty of frequency: 1×10^{-9}	R&S SMA100A		Frequency Accuracy of Reference Oscillator
2	Rubidium-frequency standard	10 MHz Frequency accuracy: $<5 \times 10^{-11}$	Symmetricon 8040C	1150.9650.12	B14, reference frequency accuracy

2.2 Adjusting the Frequency Accuracy

2.2.1 Instruments without R&S FSV-B4 and instruments with R&S FSV-B4 installed

Automatic adjustment of the reference oscillator without adjustment software: (Instruments with and without option R&S FSV-B4)..

Test equipment: Signal generator (chapter "Measuring Equipment and Accessories", item. 1):

- Frequency: e.g. 1000 MHz
- Level: -15 dBm
- Frequency accuracy: $<1 \times 10^{-9}$

If the frequency accuracy of the test transmitter is insufficient, the transmitter can be set to the correct frequency with the aid of the frequency counter prior to the measurement.

Test setup: Connect RF output of the signal generator to RF input of the R&S FSV.

R&S FSV settings: • [SETUP: MORE: SERVICE: PASSWORD: 894129]



Warming up the reference oscillator

Before the following measurement, the R&S FSV must be on for at least ten minutes with an internal reference, so that the reference oscillator is warmed up.

Measurement: • Start automatic adjustment by entering the service function:

[SETUP : MORE : SERVICE : SERVICE FUNCTION : 2.3.12]

The instrument performs the automatic adjustment. The new tuning values are stored in the EEPROM automatically.

2.2.2 Instruments with R&S FSV-B14 installed

For adjusting the reference frequency with B14 installed, a signal generator providing a frequency accuracy better than 5×10^{-11} is needed! This high frequency accuracy can be provided by use of the rubidium frequency standard, listed in the measurement equipment, as the reference source for the signal generator.

Test equipment: Signal generator (chapter "Measuring Equipment and Accessories", item. 1) with rubidium frequency standard or a equivalent 10MHz frequency source as reference source (chapter "Measuring Equipment and Accessories", item. 2):

- Frequency: 1000 MHz
- Level: -10 dBm
- Frequency accuracy: $< 5 \times 10^{-11}$

Test setup: Connect RF output of the signal generator to RF input of the R&S FSV.

R&S FSV settings: • [SETUP: MORE: SERVICE: PASSWORD: 894129]



Warming up the reference oscillator

Before the following measurement, the R&S FSV must be on for at least ten minutes with an internal reference, so that the reference oscillator is warmed up.

Measurement:

- Measure the reference Frequency error:

- [**PRESET**]
 - [**FREQ** : CENTER : **1 GHz**]
 - [**SPAN** : **1 kHz**]
 - [**BW** : RES BW MANUAL : **100 Hz**]
 - [**AMPT** : REF Level : **-8 dBm**]
 - [**SETUP** : REFERENCE INT / EXT]
 - [**MKR** : SIGNAL COUNT]
 - [**MKR** : **NEXT** : CNT RESOL 1 mHz]

The frequency is displayed in the marker field by the reading 'Count'.

Repeat the measurement 10 times and calculate the average value.

- Adjustment of the reference oscillator:

- [**SETUP** : MORE : SERVICE : SERVICE FUNCTION : **2.22.1.0.1**]

wait for about 30 seconds

calculate the frequency error: 1000MHz – measured frequency

Adjust the oscillator:

- [**SETUP** : MORE : SERVICE : SERVICE FUNCTION : **2.22.1.4.XXX**]

where XXX is the calculated error multiplied by -1 and divided by 1×10^{-15} .
 Maximum value is 20000000.

- Repeat the measurement described above: measurement result: 1 GHz $\pm$ 0.5 Hz (corresponds 5E-10)

- If frequency error is not within tolerance repeat adjustment.

- If frequency error is in tolerance save the adjustment:

- [**SETUP** : MORE : SERVICE : SERVICE FUNCTION : **2.22.1.6**]

- [**SETUP** : MORE : SERVICE : SERVICE FUNCTION : **2.22.1.0.0**]

2.3 Troubleshooting Automatic Adjustment

Checking the input signal:

The automatic adjustment routine checks the power level of the input signal. The adjustment is aborted if the input level is not within the range from -10 dBm to -20 dBm.

The automatic adjustment is also aborted if the input signal is not within the nominal frequency range:

- Model without OCXO (option R&S FSV-B4): 1.0 GHz $\pm$ 1 kHz
- Model with OCXO (option R&S FSV-B4): 1.0 GHz $\pm$ 100 Hz

For verification proceed as follows:

R&S FSV settings: • [SETUP : REFERENCE : INT]

Toggle to internal reference.

Signal generator settings: Frequency: as above (e.g. 1000 MHz)

R&S FSV settings: [PRESET]
 [FREQ : 1 GHz]
 [SPAN : 100 kHz]
 [BW : RES BW MANUAL: 10 kHz]
 [MKR FUNC : SIGNAL COUNT]

Measurement:

- Read out the power level of the marker and check whether the input level is within the range from -10 dBm to -20 dBm.
- Read out the frequency value (Count:) of the marker and check whether the input signal frequency is in the nominal frequency range as shown above.

Checking appropriate warm-up of the instrument:

The automatic adjustment routine checks the drift of the internal reference oscillator. If there is too much drift (warming up is not completed) the adjustment is aborted.

Checking the R&S FSV-B4 option

Disconnect the instrument from all power supplies, remove option R&S FSV-B4, connect the power again and perform the automatic adjustment as described above. If this works correctly, most likely the R&S FSV-B4 option is defective.