PHASE NOISE MEASUREMENT APPLICATION

Specifications

R&S®FSW-K40
R&S®FSMR3-K40
R&S®FSV3-K40
R&S®FPS-K40
R&S®FSV-K40
R&S®FPL1-K40

Data Sheet
Version 08.00

ROHDE&SCHWARZ
Make ideas real

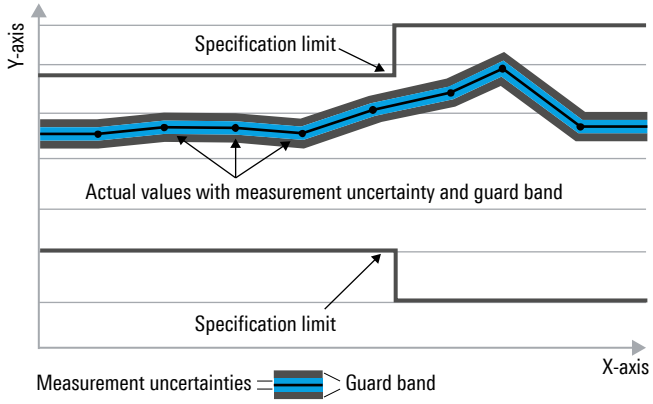
CONTENTS

Definitions

General
Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits
Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as <, ≤, >, ≥, ±, or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Non-traceable specifications with limits (n. trc.)
Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

Specifications without limits
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)
Characterizes product performance by means of representative information for the given parameter. When marked with <, > or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)
Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties
Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP/3GPP2 standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

Specifications

The specifications of the R&S®FSx-K40 phase noise measurement application are based on the data sheet specifications of the:

- R&S®FSW signal and spectrum analyzer
- R&S®FSMR3000 measuring receiver
- R&S®FSVA3000 signal and spectrum analyzer
- R&S®FSV3000 signal and spectrum analyzer
- R&S®FPS signal and spectrum analyzer
- R&S®FSVA signal and spectrum analyzer
- R&S®FSV signal and spectrum analyzer
- R&S®FPL1000 signal and spectrum analyzer

They have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are given as 95 % confidence intervals. The specified level measurement errors do not take into account systematic errors due to reduced signal to noise (S/N) ratio.

Frequency range	R&S®FSW-K40, RF input	same as R&S®FSW
	R&S®FSMR3-K40, RF input	same as R&S®FSMR3000
	R&S®FSV3-K40, RF input	same as R&S®FSVA3000/R&S®FSV3000
	R&S®FPS-K40, RF input	same as R&S®FPS
	R&S®FSV-K40, RF input	same as R&S®FSVA/R&S®FSV
	R&S®FPL1-K40, RF input	same as R&S®FPL1000
Offset frequency range		1 Hz to 1 GHz (9 decades)

Configuration

Measurement settings	frontend configuration	• nominal frequency and level • attenuator control (auto/manual) • electronic attenuator control (auto/manual) • coupling (AC/DC)
	verification and tracking functions	• frequency verification and tracking • level verification and tracking • frequency and level tolerance values
	phase noise measurement	• measurement range • sweep direction • sweep type (normal, fast, AVG, manual)
		for sweep type manual: setting of RBW, average count and mode individually for each half decade or globally
Result configuration	phase noise limit line	up to 5 ranges, configuration using: • thermal noise • range corner frequency and range slope
	limit lines	as in base instrument
	graphical	x-axis and y-axis scaling: automatic (once/always) or user-defined
	smoothing and spur removal	• trace smoothing factor • smoothing type (linear/logarithmic) • spur removal on/off, spur threshold
	trace configuration	• up to 6 traces • clear/write, max., min., average, view • smoothing on/off
	numeric: residual noise	residual FM, residual PM, RMS jitter four measurement ranges: • one complete measurement range or user-definable range • three user-definable ranges with assignable trace
	numeric: spot noise	• measurement on all 10^x Hz offset • five user-definable offset frequencies
	markers	four markers (normal/delta) with assignable trace

Display		• phase noise plot (dBc (1 Hz) versus logarithmic frequency) • residual noise table • spot noise table
Remote control		• GPIB • LAN (VXI-11) • control via SCPI command set and application-specific extensions

Results

R&S®FSW-K40: phase noise sensitivity (typical values) without noise correction, input level > 0 dBm, operating mode: averaged, with R&S®FSW-B4 OCXO precision frequency reference option								
Input frequency	Frequency offset, values in dBc (1 Hz)							
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	200 kHz	1 MHz	10 MHz
100 MHz	–90	–110	–125	–137	–143	–145	–151.5	–158
500 MHz	–78	–106	–122	–135	–141	–145	–150.5	–157
1 GHz	–72	–100	–116	–132	–140	–143	–149.5	–156
2 GHz	–66	–94	–110	–125	–134	–137	–145	–158
10 GHz	–52	–80	–96	–122	–133	–136	–144	–156
25 GHz	–44	–72	–88	–114	–125	–128	–136	–148
40 GHz	–40	–68	–84	–110	–121	–124	–130	–142
60 GHz	–36	–64	–80	–106	–117	–120	–128	–140
80 GHz	–34	–62	–78	–104	–115	–118	–126	–136

R&S®FSMR3-K40: phase noise sensitivity (typical values) without noise correction, input level > 0 dBm, operating mode: averaged, with R&S®FSMR3-B4 OCXO precision frequency reference option								
Input frequency	Frequency offset, values in dBc (1 Hz)							
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	200 kHz	1 MHz	10 MHz
100 MHz	–90	–110	–125	–137	–143	–145	–151.5	–158
500 MHz	–78	–106	–122	–135	–141	–145	–150.5	–157
1 GHz	–72	–100	–116	–132	–140	–143	–149.5	–156
2 GHz	–66	–94	–110	–125	–134	–137	–145	–158
10 GHz	–52	–80	–96	–122	–133	–136	–144	–156
25 GHz	–44	–72	–88	–114	–125	–128	–136	–148
50 GHz	–38	–66	–82	–108	–119	–122	–129	–141

R&S®FSV3-K40 on R&S®FSVA3000: phase noise sensitivity (typical values) without noise correction, input level > 0 dBm, operating mode: averaged							
Input frequency	Frequency offset, values in dBc (1 Hz)						
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
1 GHz	–80	–106	–120	–125	–128	–138	–152
2 GHz	–65	–93	–114	–121	–124	–137	–151
10 GHz	–58	–83	–108	–119	–122	–136	–150
25 GHz	–55	–80	–103	–113	–116	–130	–144
40 GHz	–53	–76	–100	–109	–112	–124	–138
50 GHz	–50	–73	–97	–107	–110	–122	–136
< 30 MHz	–97	–120	–131	–135.5	–137	–139	–153

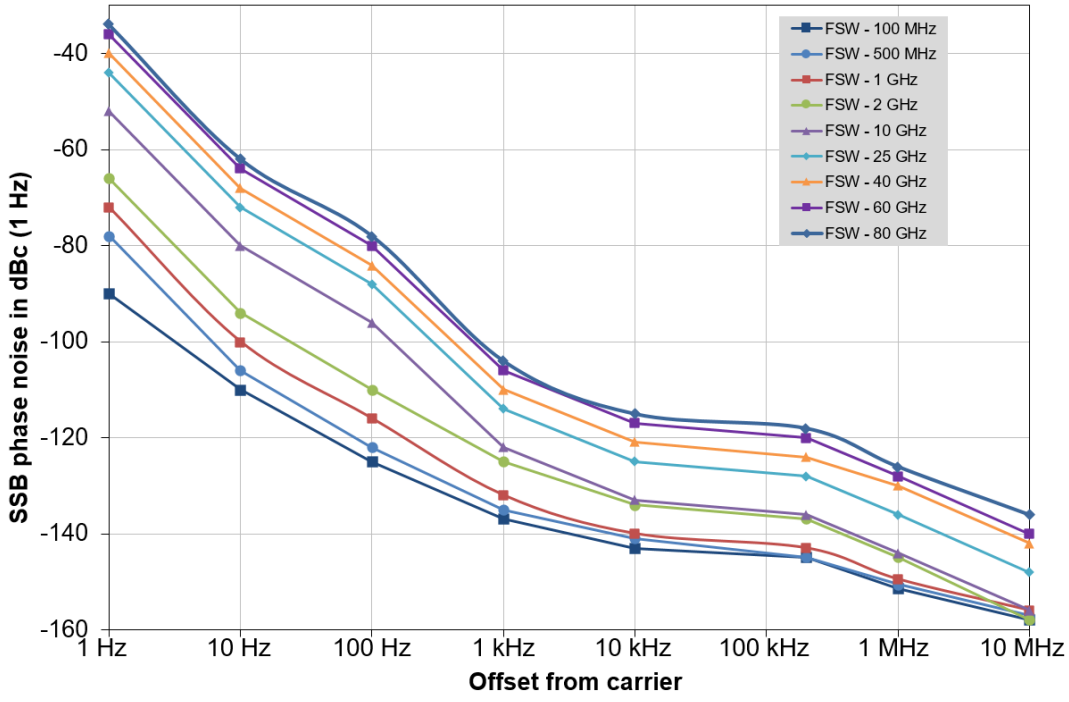
R&S®FSV3-K40 on R&S®FSV3000: phase noise sensitivity (typical values) without noise correction, input level > 0 dBm, operating mode: averaged							
Input frequency	Frequency offset, values in dBc (1 Hz)						
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
1 GHz	–75	–97	–109	–114	–119	–135	–150
2 GHz	–65	–90	–104	–111	–116	–134	–148
10 GHz	–58	–84	–100	–110	–115	–133	–147
25 GHz	–55	–79	–95	–105	–110	–127	–141
40 GHz	–51	–75	–91	–100	–105	–122	–136
50 GHz	–48	–71	–88	–97	–102	–119	–133

R&S®FPS-K40: phase noise sensitivity (typical values) without noise correction, input level > 0 dBm, operating mode: averaged						
Input frequency	Frequency offset, values in dBc (1 Hz)					
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
200 MHz	–90	–102	–110	–116	–135	–150
500 MHz	–90	–102	–110	–116	–135	–150
1 GHz	–88	–101	–110	–115	–135	–150
3 GHz	–76	–98	–108	–115	–135	–150
6 GHz	–70	–96	–105	–115	–135	–150
12 GHz	–64	–90	–102	–115	–135	–150
24 GHz	–58	–84	–96	–109	–129	–145
38 GHz	–54	–80	–92	–105	–125	–141
< 20 MHz	–118	–134	–142	–145	–145	–

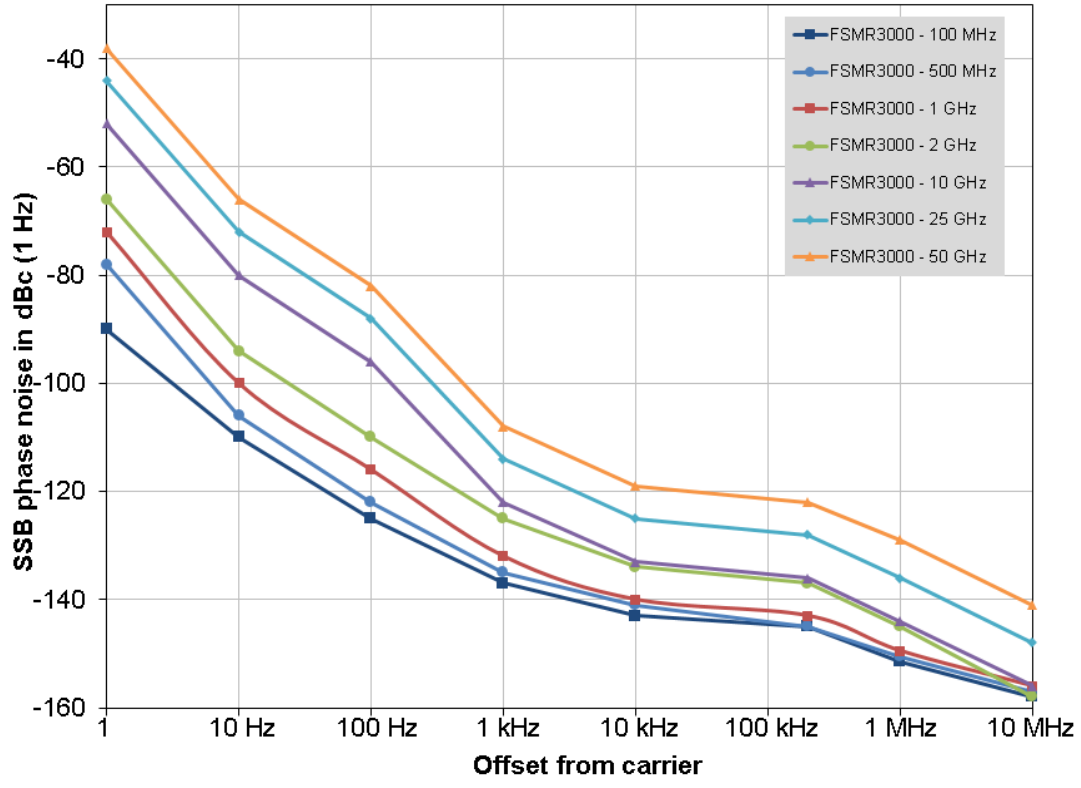
R&S®FSV-K40 on R&S®FSVA: phase noise sensitivity (typical values) without noise correction, input level > 0 dBm, operating mode: averaged						
Input frequency	Frequency offset, values in dBc (1 Hz)					
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
200 MHz	–101	–112	–118	–119	–141	–150
500 MHz	–97	–112	–118	–119	–141	–150
1 GHz	–91	–112	–118	–119	–141	–150
3 GHz	–82	–110	–116	–117	–141	–150
6 GHz	–78	–107	–114	–116	–141	–150
12 GHz	–74	–101	–114	–116	–144	–150
24 GHz	–68	–95	–108	–110	–138	–147
38 GHz	–64	–92	–104	–106	–134	–143
< 20 MHz	–118	–134	–142	–145	–145	–

R&S®FSV-K40 on R&S®FSV: phase noise sensitivity (typical values) without noise correction, input level > 0 dBm, operating mode: averaged						
Input frequency	Frequency offset, values in dBc (1 Hz)					
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
200 MHz	–90	–102	–110	–116	–135	–150
500 MHz	–90	–102	–110	–116	–135	–150
1 GHz	–88	–101	–110	–115	–135	–150
3 GHz	–76	–98	–108	–115	–135	–150
6 GHz	–70	–96	–105	–115	–135	–150
12 GHz	–64	–90	–102	–115	–135	–150
24 GHz	–58	–84	–96	–109	–129	–145
38 GHz	–54	–80	–92	–105	–125	–141
< 20 MHz	–118	–134	–142	–145	–145	–

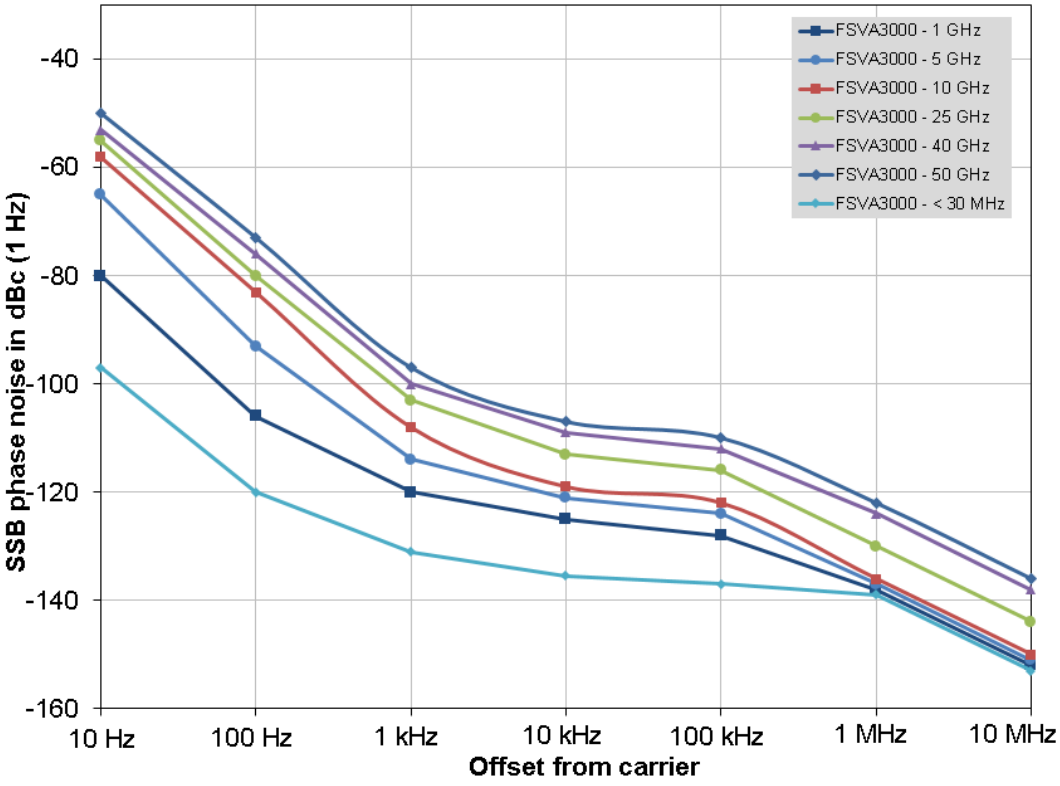
R&S®FPL1-K40 on R&S®FPL1000: phase noise sensitivity (typical values) without noise correction, input level > 0 dBm, operating mode: averaged					
Input frequency	Frequency offset, values in dBc (1 Hz)				
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
100 MHz	–108	–116	–111	–117	–137
1 GHz	–98	–107	–108	–116	–137
3 GHz	–78	–100	–105	–116	–137
6 GHz	–73	–93	–102	–115	–132
< 2 MHz	–123	–132	–146	–148	–150



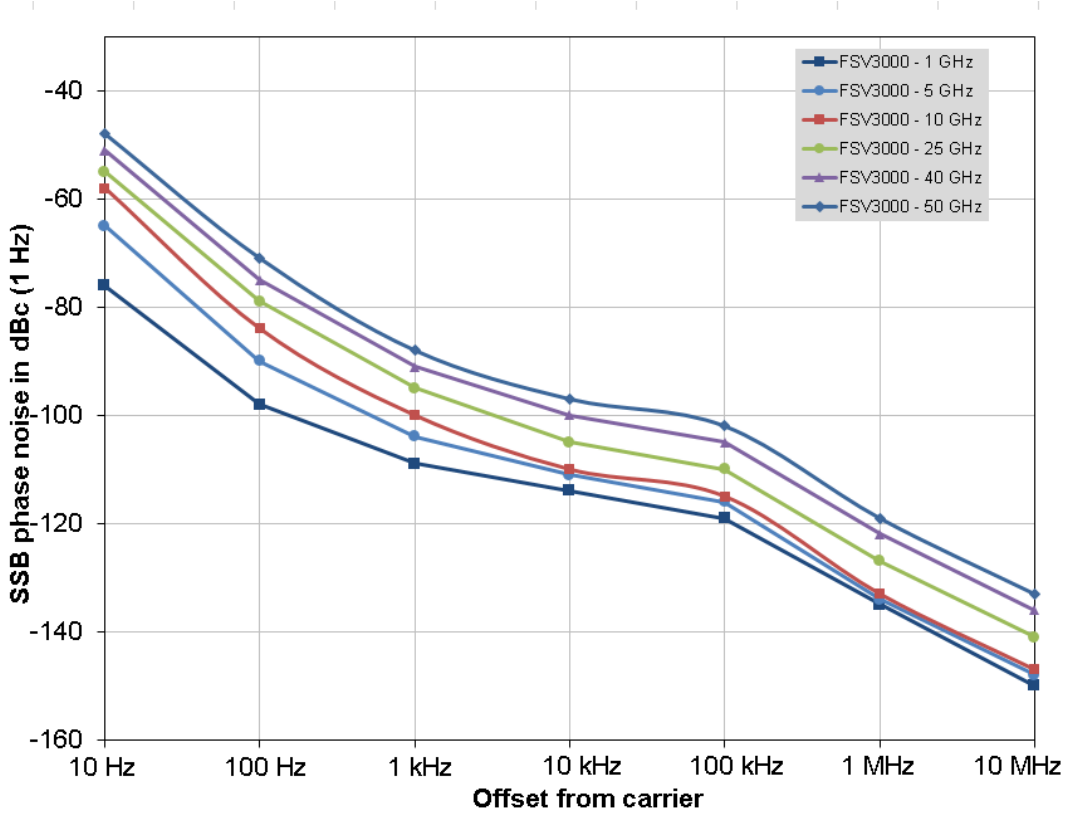
R&S®FSW-K40: typical phase noise at different center frequencies (with the R&S®FSW-B4 option for offsets ≤ 10 Hz)



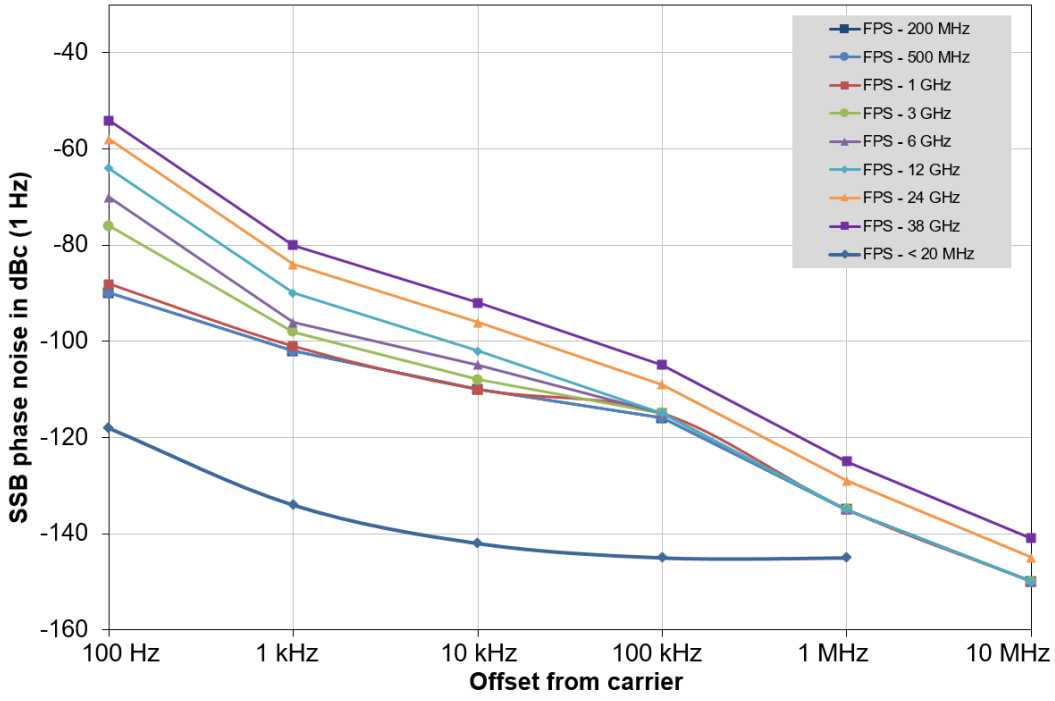
R&S®FSMR3-K40: typical phase noise at different center frequencies (with the R&S®FSMR3-B4 option for offsets ≤ 10 Hz)



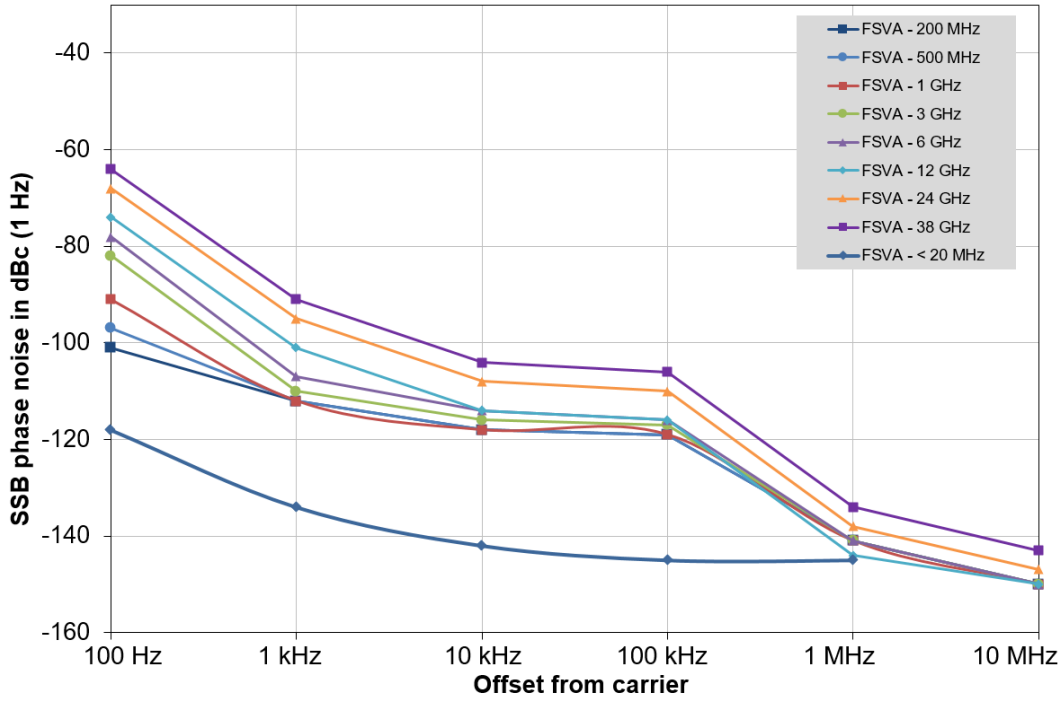
R&S®FSV3-K40 with R&S®FSVA3000: typical phase noise at different center frequencies



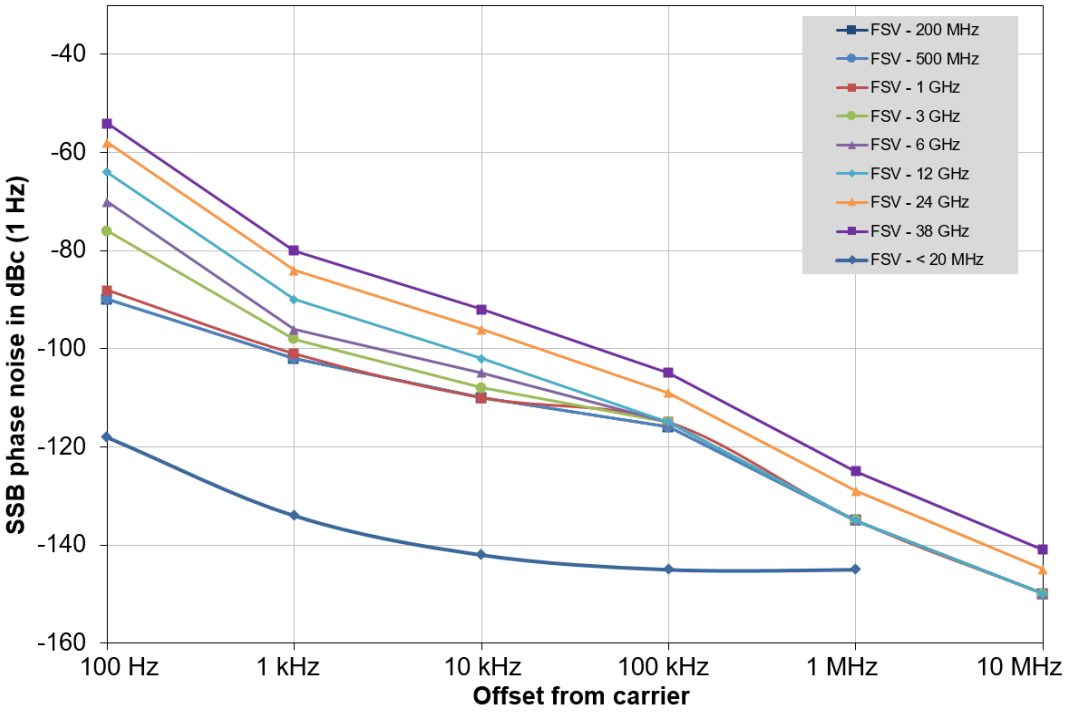
R&S®FSV3-K40 with R&S®FSV3000: typical phase noise at different center frequencies



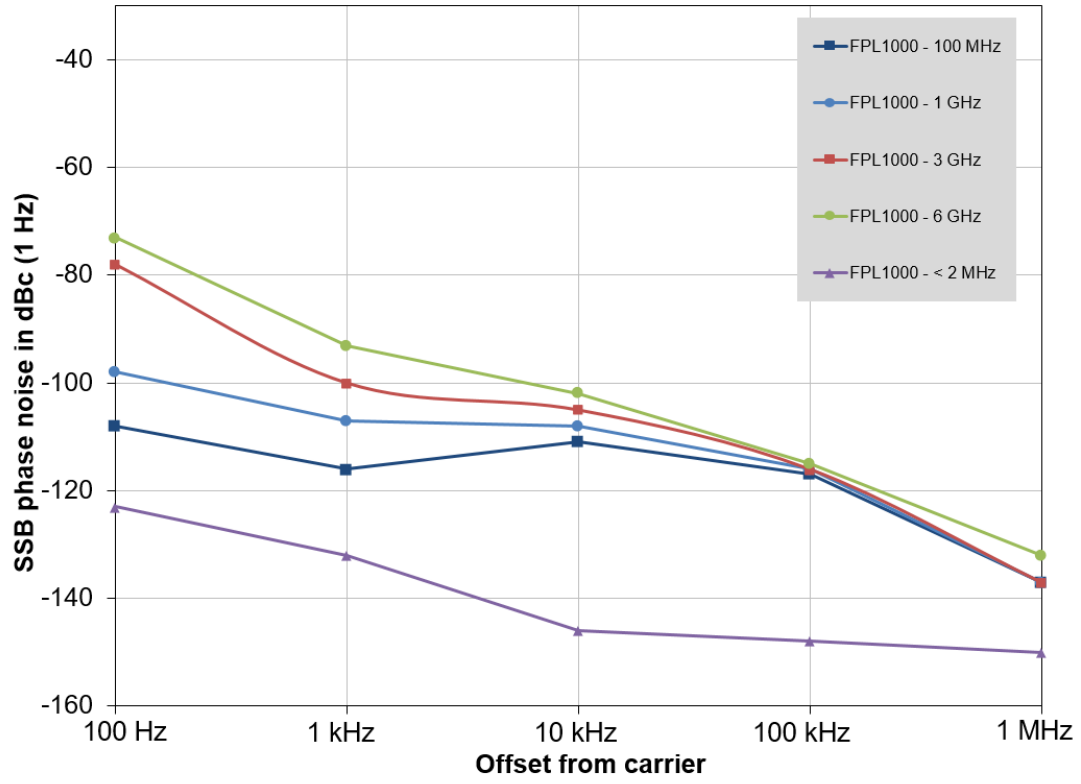
R&S®FPS-K40: typical phase noise at different center frequencies



R&S®FSV-K40 with R&S®FSVA: typical phase noise at different center frequencies



R&S®FSV-K40 with R&S®FSV: typical phase noise at different center frequencies



R&S®FPL1-K40 with R&S®FPL1000: typical phase noise at different center frequencies

Ordering information

Designation	Type	Order No.
Phase noise measurement application	R&S®FSW-K40	1313.1397.02
Phase noise measurement application	R&S®FSMR3-K40	1345.3620.02
Phase noise measurement application	R&S®FSV3-K40	1330.5051.02
Phase noise measurement application	R&S®FPS-K40	1321.4110.02
Phase noise measurement application	R&S®FSV-K40	1310.8403.02
Phase noise measurement application	R&S®FPL1-K40	1323.1831.02

For R&S®FSW product brochure, see PD 5215.6749.12
For R&S®FSW data sheet, see PD 5215.6749.22

For R&S®FSMR3000 product brochure, see PD 3608.5741.12
For R&S®FSMR3000 data sheet, see PD 3608.5741.22

For R&S®FSVA3000 product brochure, see PD 5216.1211.12
For R&S®FSVA3000 data sheet, see PD 5216.1211.22

For R&S®FSV3000 product brochure, see PD 5216.1334.12
For R&S®FSV3000 data sheet, see PD 5216.1334.22

For R&S®FPS product brochure, see PD 3606.9433.12
For R&S®FPS data sheet, see PD 3606.9433.22

For R&S®FSVA product brochure, see PD 3607.2790.12
For R&S®FSVA data sheet, see PD 3607.2790.22

For R&S®FSV product brochure, see PD 3606.7982.12
For R&S®FSV data sheet, see PD 3606.7982.22

For R&S®FPL1000 product brochure, see PD 5214.6974.12
For R&S®FPL1000 data sheet, see PD 5214.6974.22

and www.rohde-schwarz.com

Service that adds value

- ► Worldwide
- ► Local and personalized
- ► Customized and flexible
- ► Uncompromising quality
- ► Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

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

www.training.rohde-schwarz.com

Rohde&Schwarz customer support

www.rohde-schwarz.com/support

PD 3607.2510.22 | Version 08.00 | July 2022 (jr)
Phase Noise Measurement Application
Data without tolerance limits is not binding | Subject to change

3607251022
3607.2510.22 08.00 PDP/PDW 1 en