

# 20 GHz APLC VS Keysight and R&S



# APLC single and multi-channel models



The APLCxx is a series of phase-coherent, single or multi-channel, ultra-fast switching and ultra-low phase noise signal generators with a frequency range up to 12, 20, 40, and 54 GHz. It is ideally suited for a wide range of applications, where good signal quality, accurate and wide output power ranges, and very stable phase coherence among all channels are required. Excellent phase noise is combined with good spurious, harmonic rejection and optionally leading-edge switching speed of 15  $\mu$ s.



Model	APLC12,APLC20	E8257D	N5183B	SMA100B
<b>Frequency range and Max. power</b>				
<b>Frequency range</b>	10 MHz to 12.75, 20 GHz from 9 kHz optional 9K	250 kHz to 13, 20 GHz	9 kHz to 13, 20 GHz	8 kHz to 12.75, 20 GHz
<b>Number of channels</b>	1-4	1	1	1
<b>Min. power</b>	-20 dBm, -120 dBm option PE2	-20 dBm, -120 dBm option 1E1	-20 dBm, -120 dBm option 1E1	-20 dBm, -120 dBm B120, B112
<b>Type of attenuator</b>	Mechanical	Mechanical	Mechanical	Electronic up to 20 GHz, mechanical
<b>Max. power (typ.)</b>	Std PE2	Std 1EU 1E1 1EU+1E1	Std 1EA	Std K33 B34+atten
<b>1 GHz</b>	20 +19	15 23 15 23	18 +23	27 32 36
<b>5 GHz</b>	+22 +20	15 23 14 23	18 +20	27 27 33
<b>10 GHz</b>	+22 +20	15 23 14 22	18 +20	25 25 30
<b>20 GHz</b>	+22 +19	15 23 14 21	15 +19	25 25 28



Model	APLC12,APLC20	E8257D	N5183B	SMA100B
Frequency switching speed	500 $\mu$ s, 15 $\mu$ s option FS (5 $\mu$ s typical.)	9 ms, 9 ms, 24 ms- only typical values	5 ms, 1.15 ms (UNZ)	2.5 ms, 5 ms B711
Aging	1 ppm, 0.03 ppm, 0.02 ppm options LN and LN+	0.03 ppm	0.1 ppm	1 ppm, 0.1 ppm, 0.03 ppm
Syntesiser typ.	VCO	YIG	VCO	YIG
Phase noise level 10 GHz, dBc/Hz	Std   LN, LN+	Std   UNX   UNY   HY2	Std   UNY	Std   B709   B710   B711
10 Hz	-   -85	-   -72   -76   -76	-   -82	-   -63   -83   -83
1 kHz	-122   -122	-   -109   -107   -115	-   -116	-   -108   -119   -120
20 kHz	-131   -131	-113   -114   -126   -128	-116   -129	-120   -120   -125   -132
100 kHz	-133   -133	-   -115   -125   -128	-   -126	-   -118   -123   -134
1 MHz	-131   -131	-   -   -   -137	-   -	-   -124   -130   -146
Amplitude noise at 10 GHz, dBc/Hz				
1 kHz	-130	-135	-135	-135
20 kHz	-140	-140	-140	-141
100 kHz	-150	-142	-140	-145
1 MHz	-160	-148	-150	-152
10 MHz	-165	-155	-160	-160



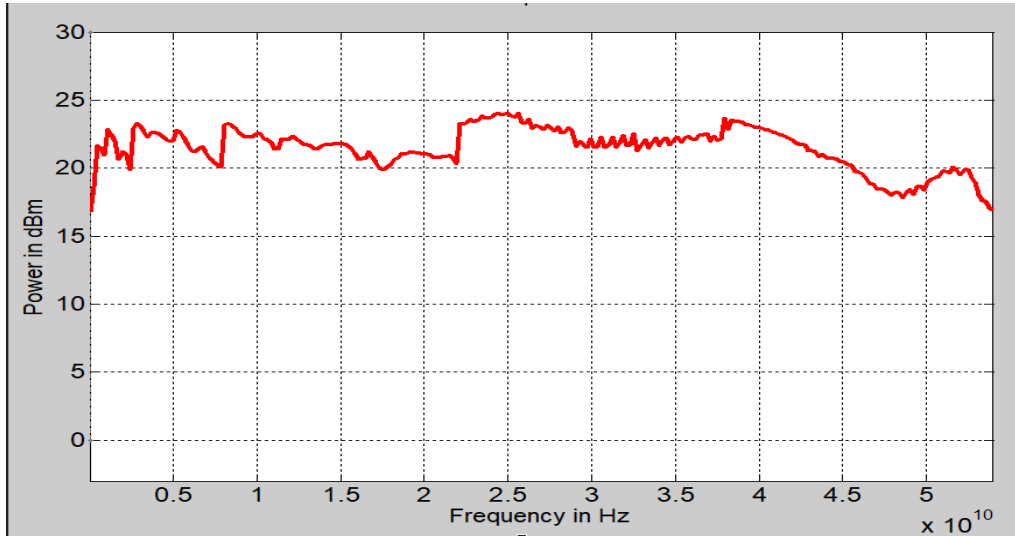
Model	APLC12,APLC20	E8257D	N5183B	SMA100B
<b>Harmonics</b>	-40 dBc, f>12 GHz -50 dBc	-55 dBc	-55 dBc	-55 dBc
<b>Sub-Harmonics, dBc</b>				
<b>f&lt;11.3 GHz</b>	-70 dBc	None	-67 dBc	-85, -95 B711
<b>f&gt;11.3 GHz</b>	-55 dBc	-60 dBc, -50 dBc	-53 dBc	-60
<b>Non-Harmonics, dBc</b>				
<b>5 GHz</b>	-80 (-90 typ.)	-62 (-70 typ.),-74 UNY	-60 -80 (-88 typ.) UNY	-80 -88 B711
<b>10 GHz</b>	-74 (-84 typ.)	-62 (-70 typ.),-64 UNY	-69  -74 (-80 typ.) UNY	-74  -82 B711
<b>20 GHz</b>	-68 (-80 typ.)	-56 (-64 typ.),-64 UNY	-63 -68 (-75 typ.) UNY	-68 -76 B711
<b>Pulse modulation</b>	Option MOD	Option UNW	Option UNW	Option
<b>Pulse width</b>	15 ns	20 ns	20 ns	20ns, rise fall 20 ns
<b>ON/OFF ratio</b>	80 dB, typical 100	80 dB (UNW)	>80 dB typ	> 80 dB
<b>Rise/Fall time</b>	5 ns (3 ns. Typ)	10 ns (6 ns typ.)	10 ns, 7 ns (typ)	10 ns, 5 ns typ



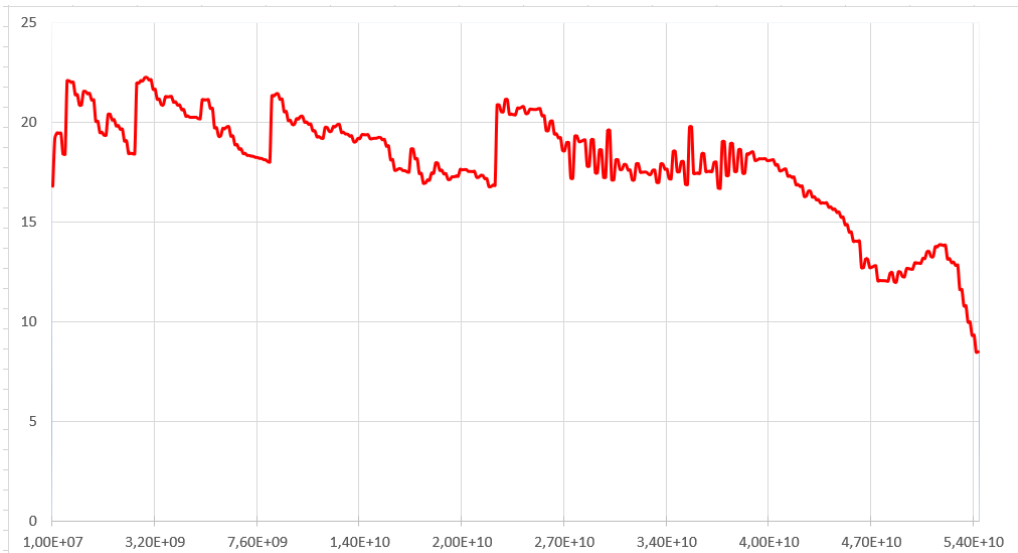
Model	APLC12, APLC20	E8257D	N5183B	SMA100B
Analog Modulations	AM,FM,PM option MOD	AM,FM,PM option UNT	AM,FM,PM option UNT	AM,FM,PM option K720
Ramp modulation	No	Yes	No	Yes
Operation from an external battery	Yes	No	No	No
Power consumption	80 W	450 W	280 W	380 W

# Max. power APLC vs Keysight E8257D

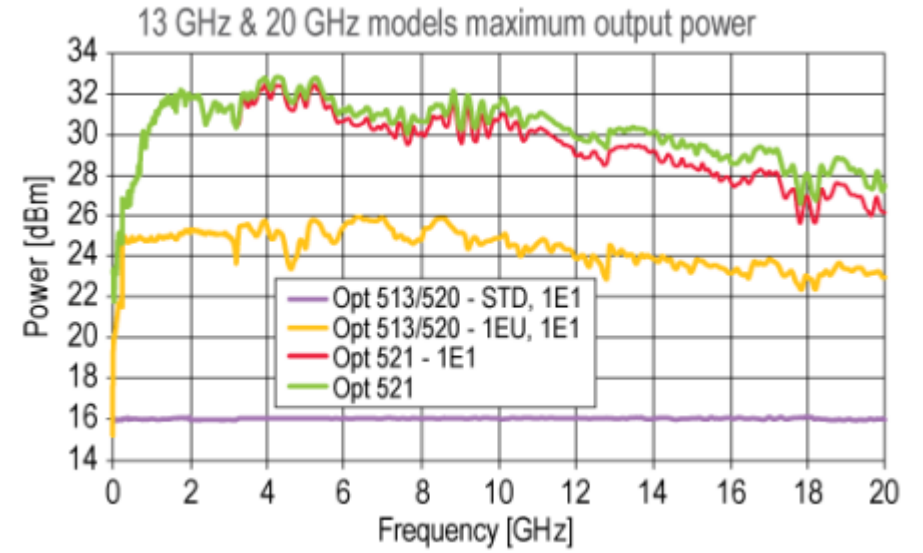
AnaPico APLC w/o attenuator



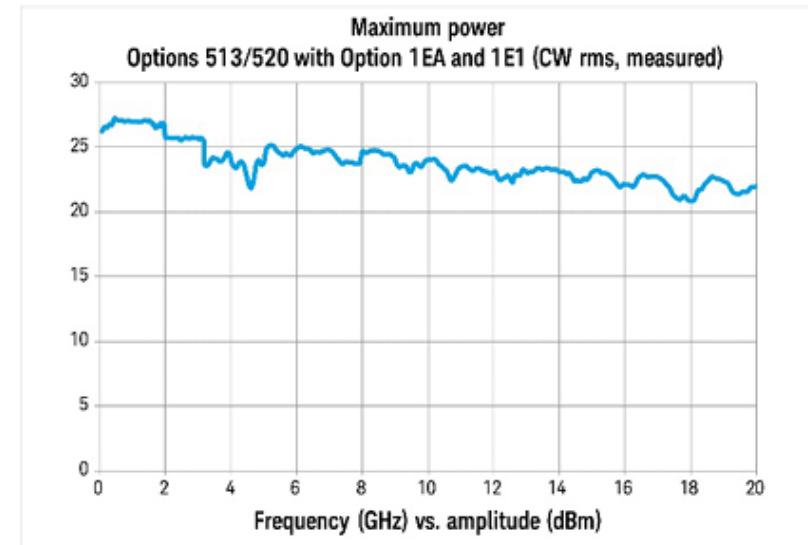
AnaPico APLC with attenuator PE2



Keysight E8257D attenuator+amplifier

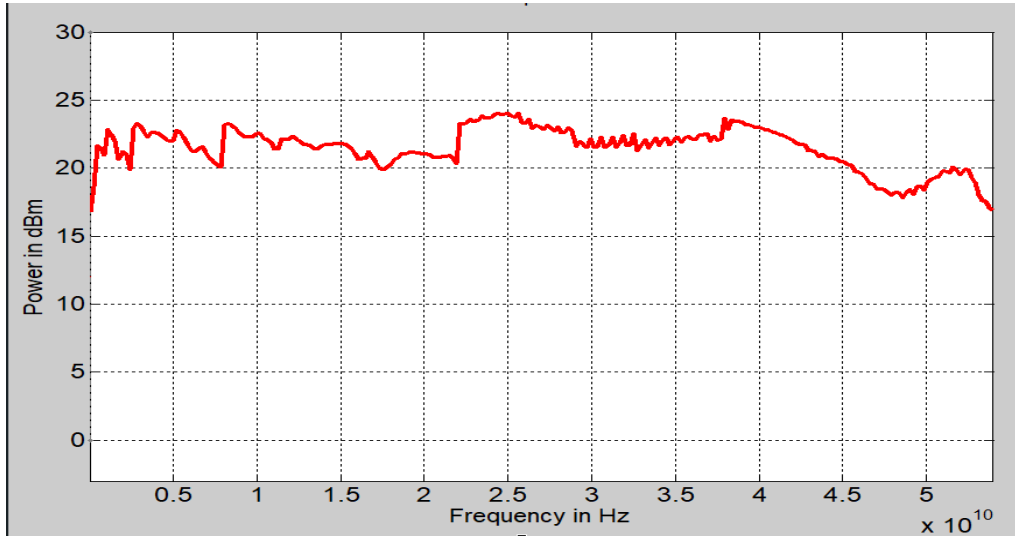


Keysight N5183B attenuator+amplifier

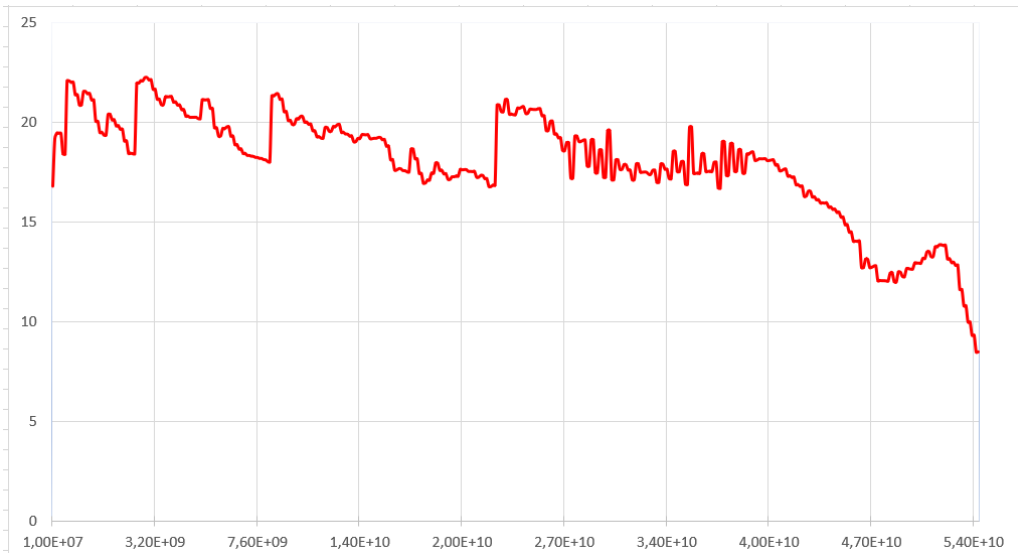


# Max. power APLC vs Keysight E8257D

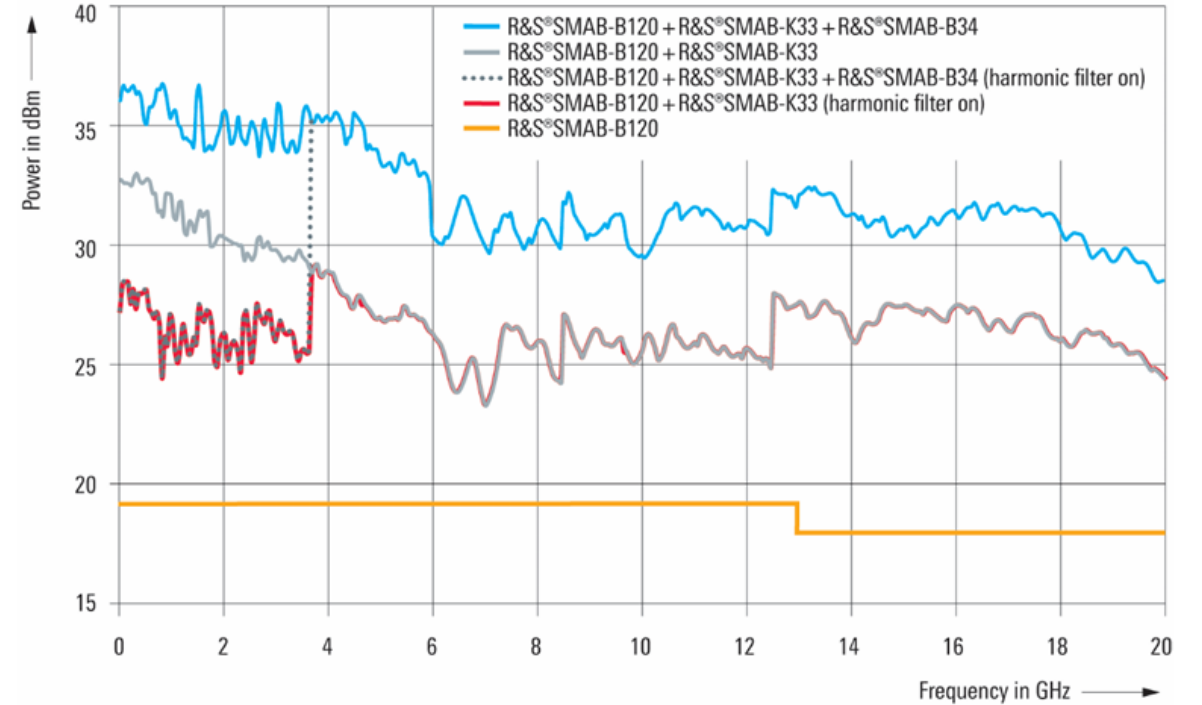
AnaPico APLC w/o attenuator



AnaPico APLC with attenuator PE2



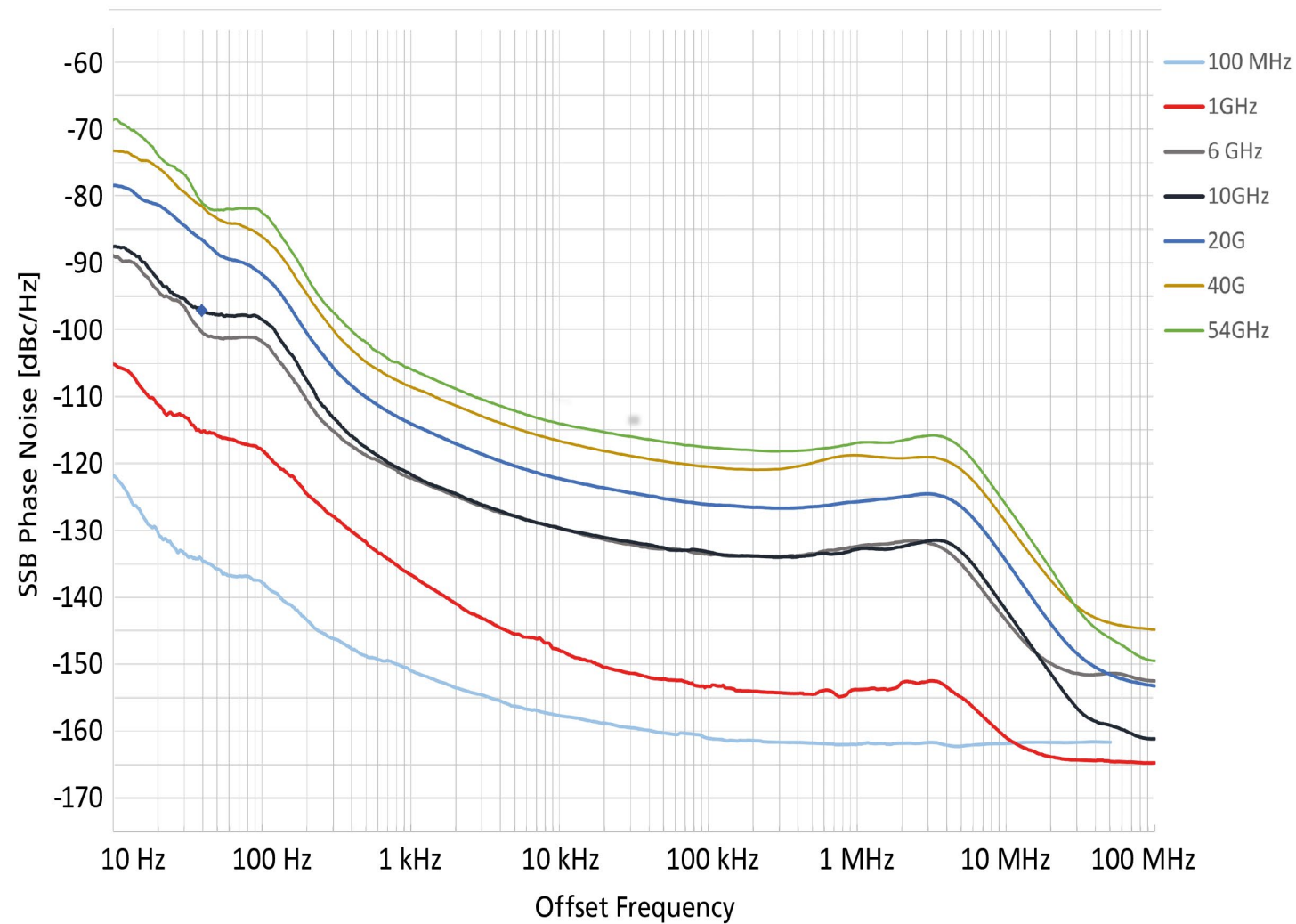
R&S SMA100B



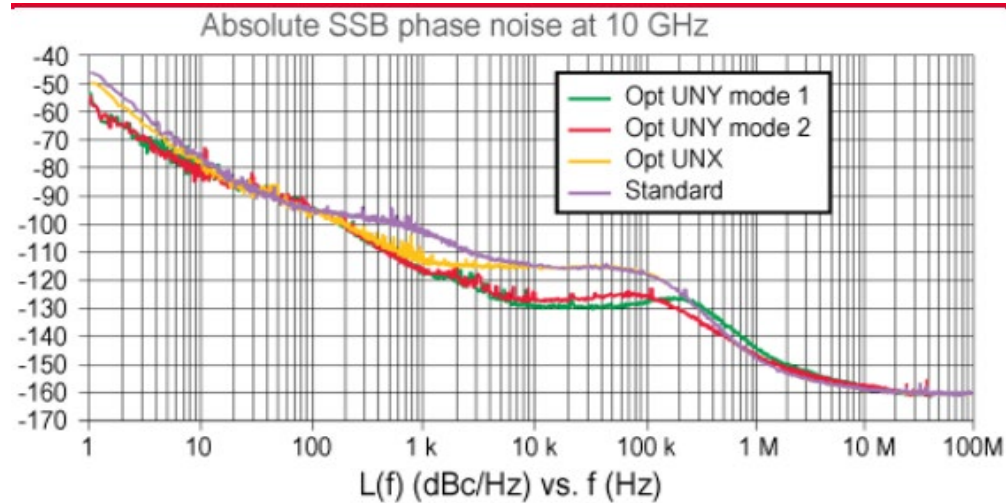
Measured maximum available output power versus frequency



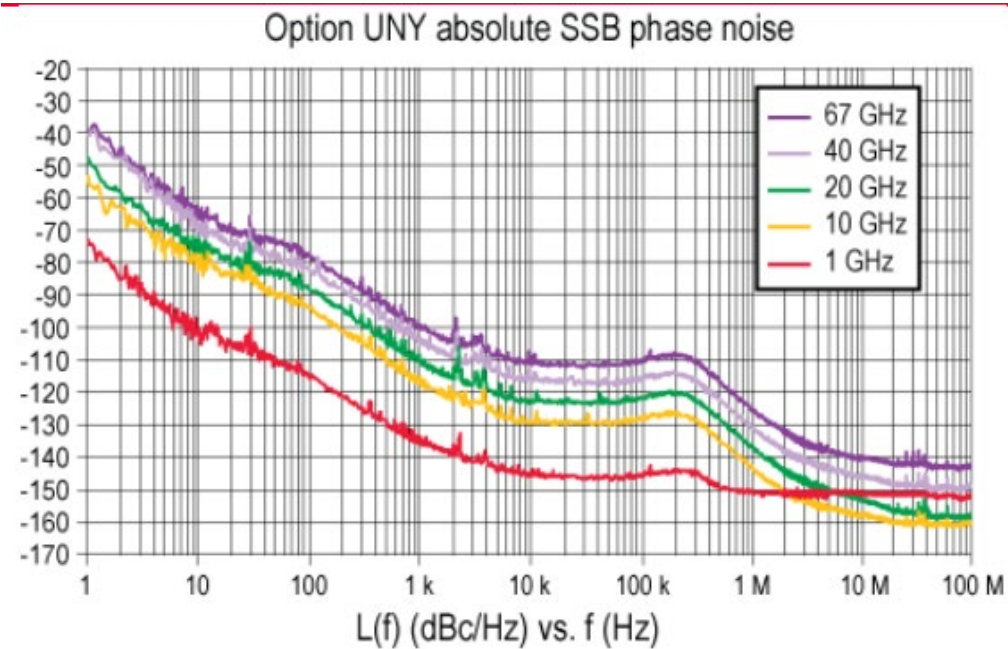
# SSB Phase noise APLC vs Keysight E8257D



## Keysight E8257D-10GHz-UNX-UNY

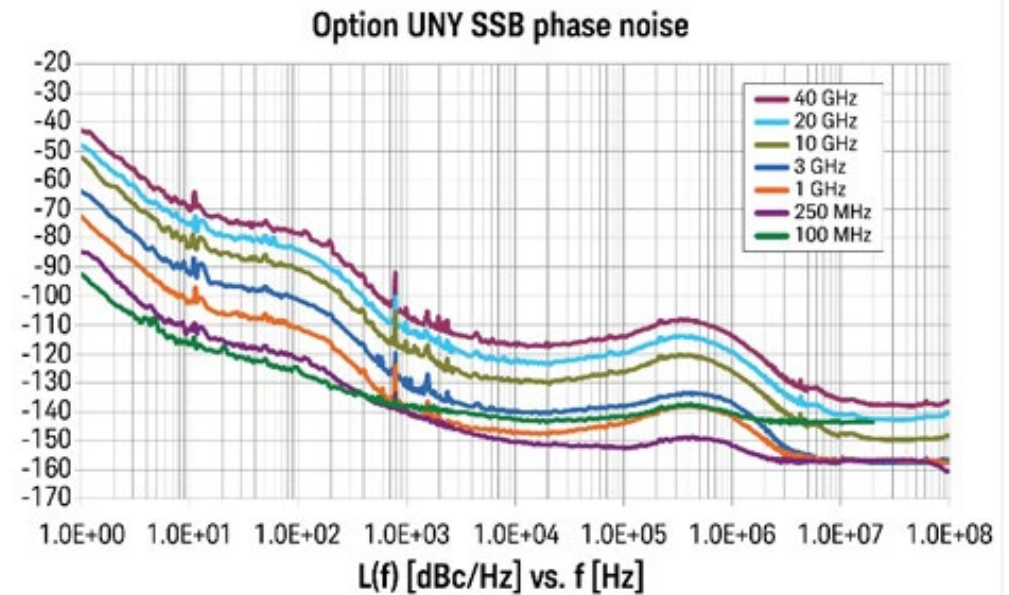
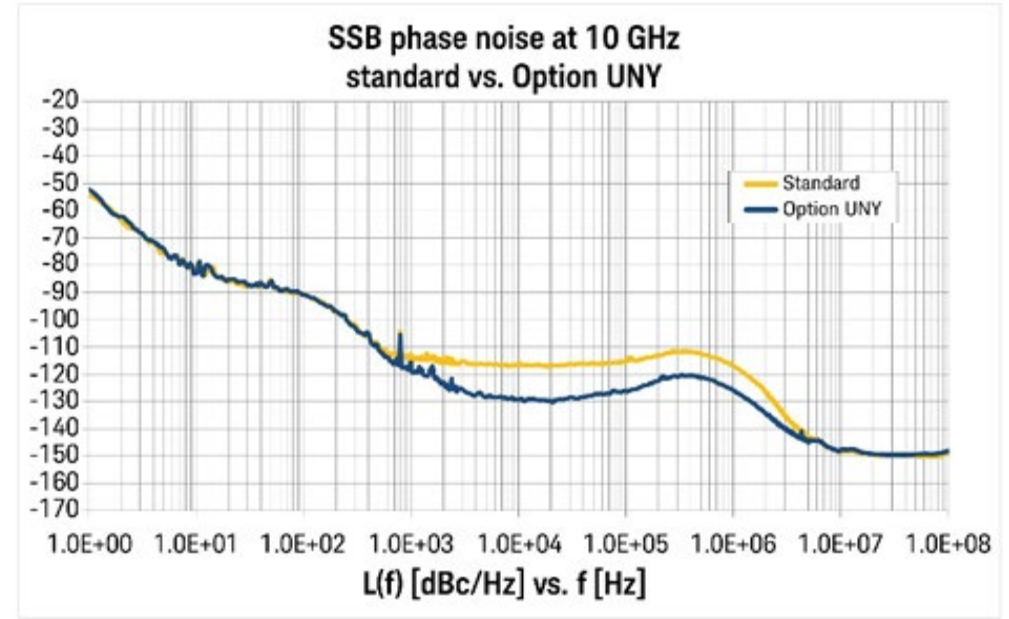
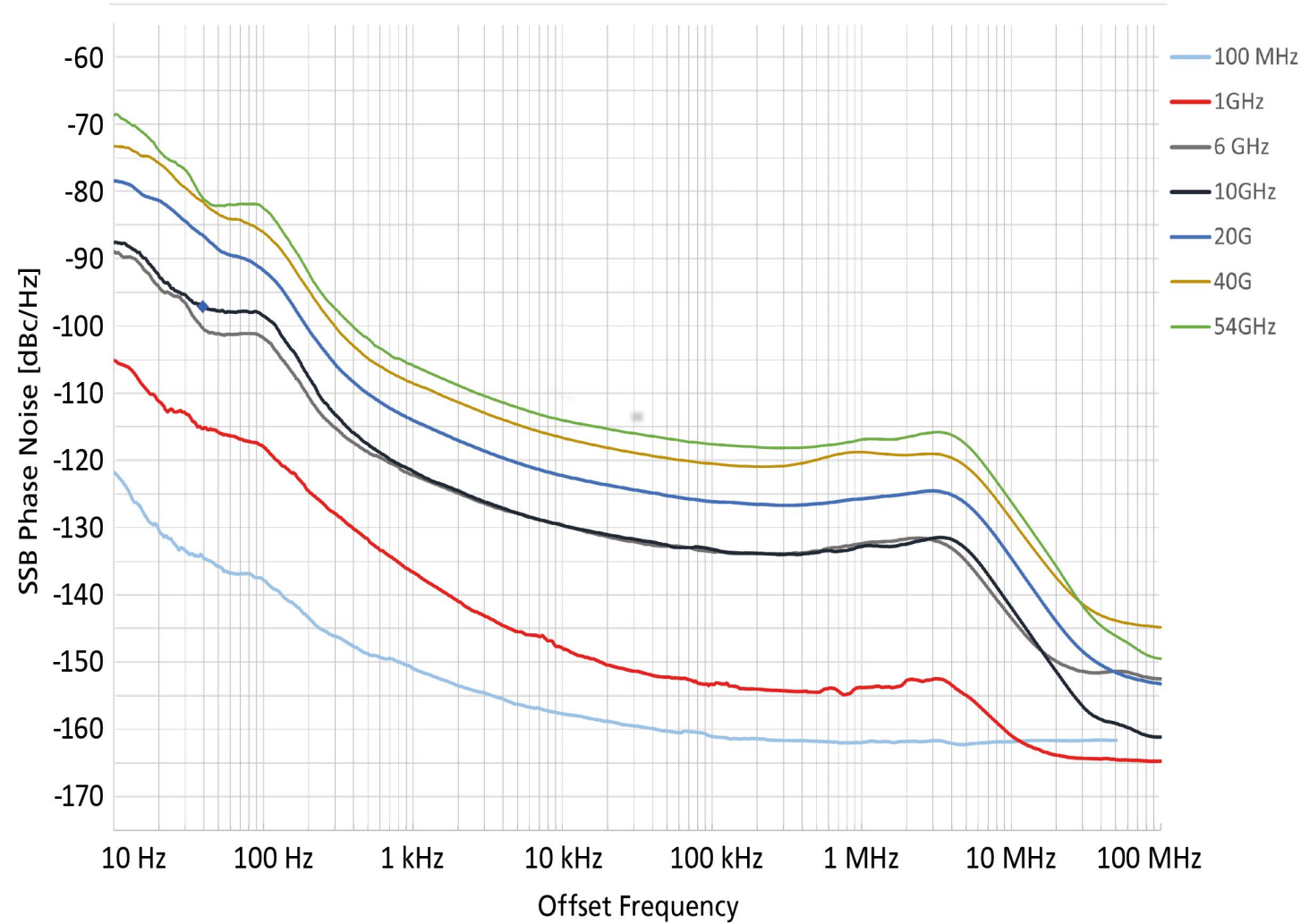


## Keysight E8257D-UNY



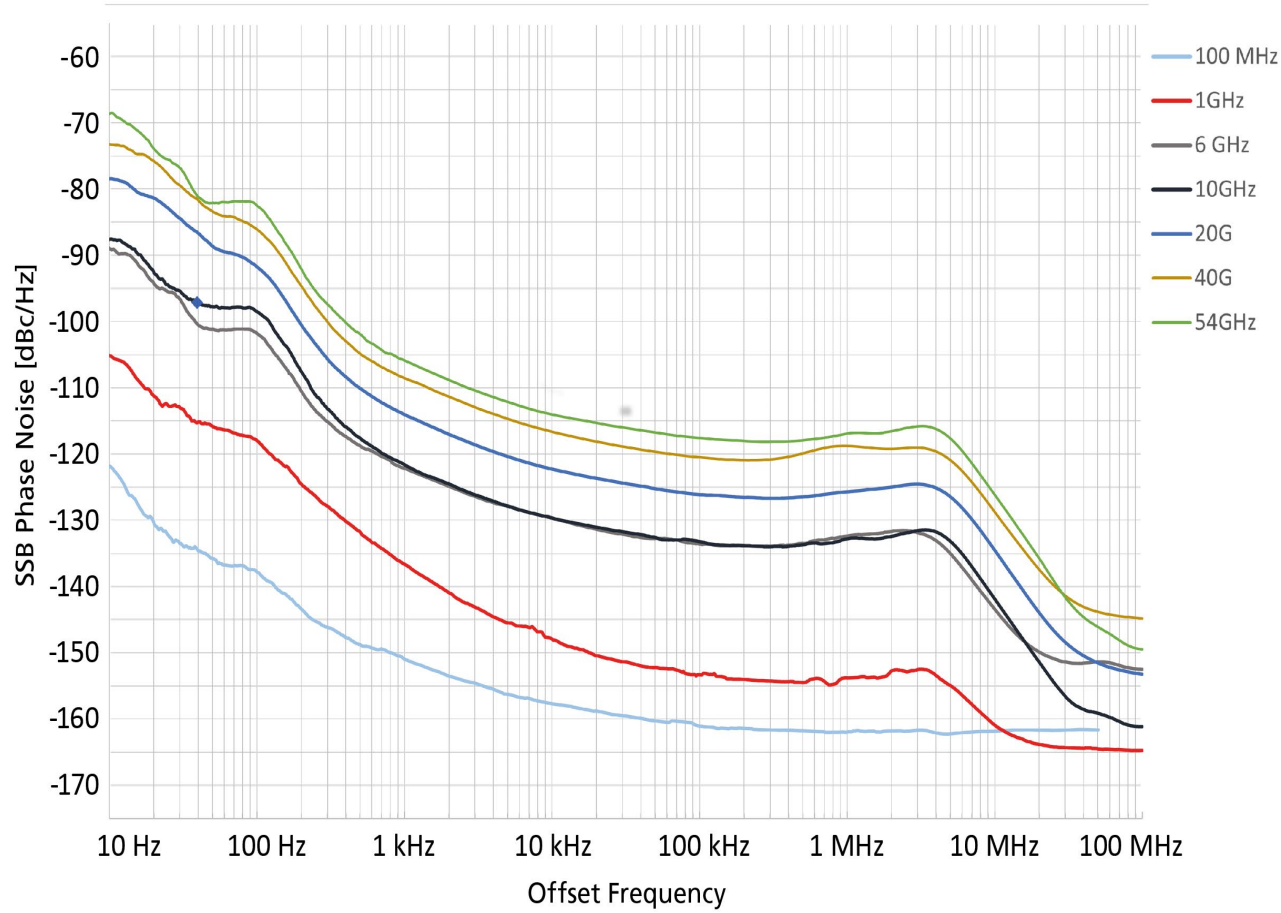
# SSB Phase noise APLC vs Keysight N5183B

Keysight N5183B

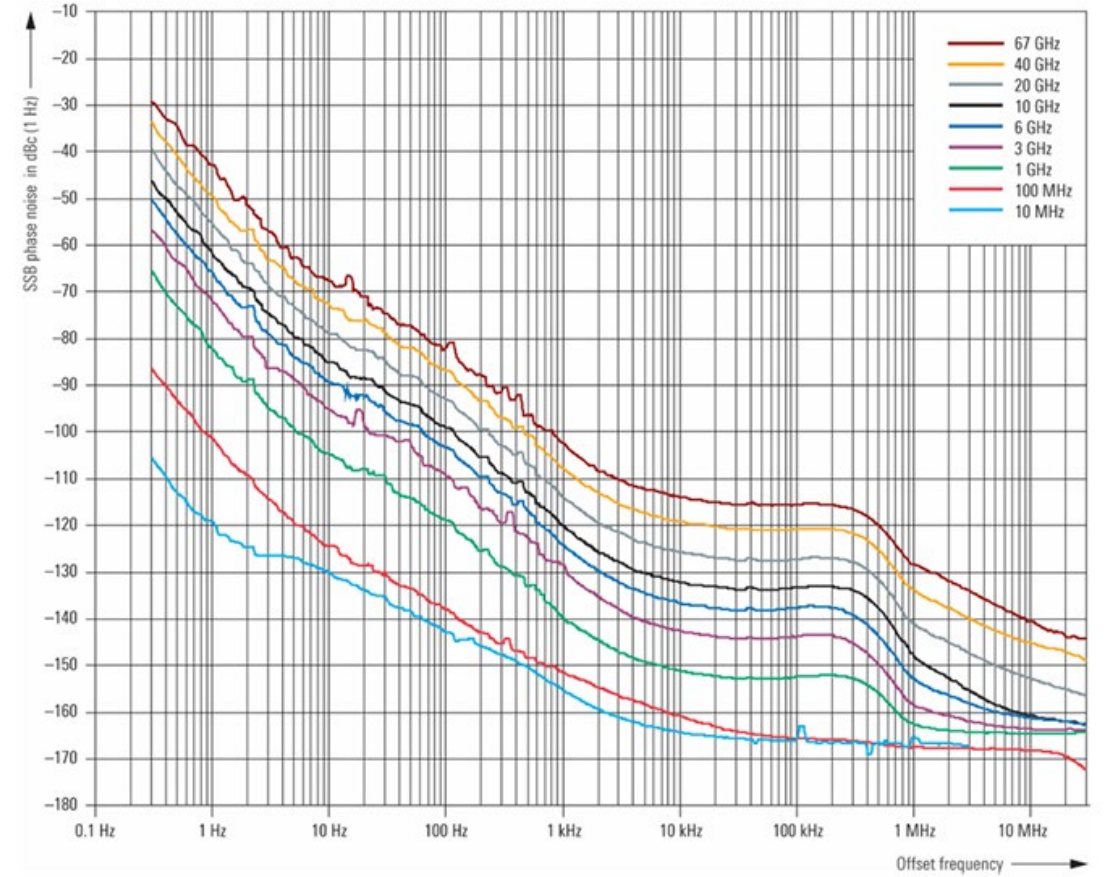


# SSB Phase noise APLC vs R&S SMA100B

AnaPico APLC



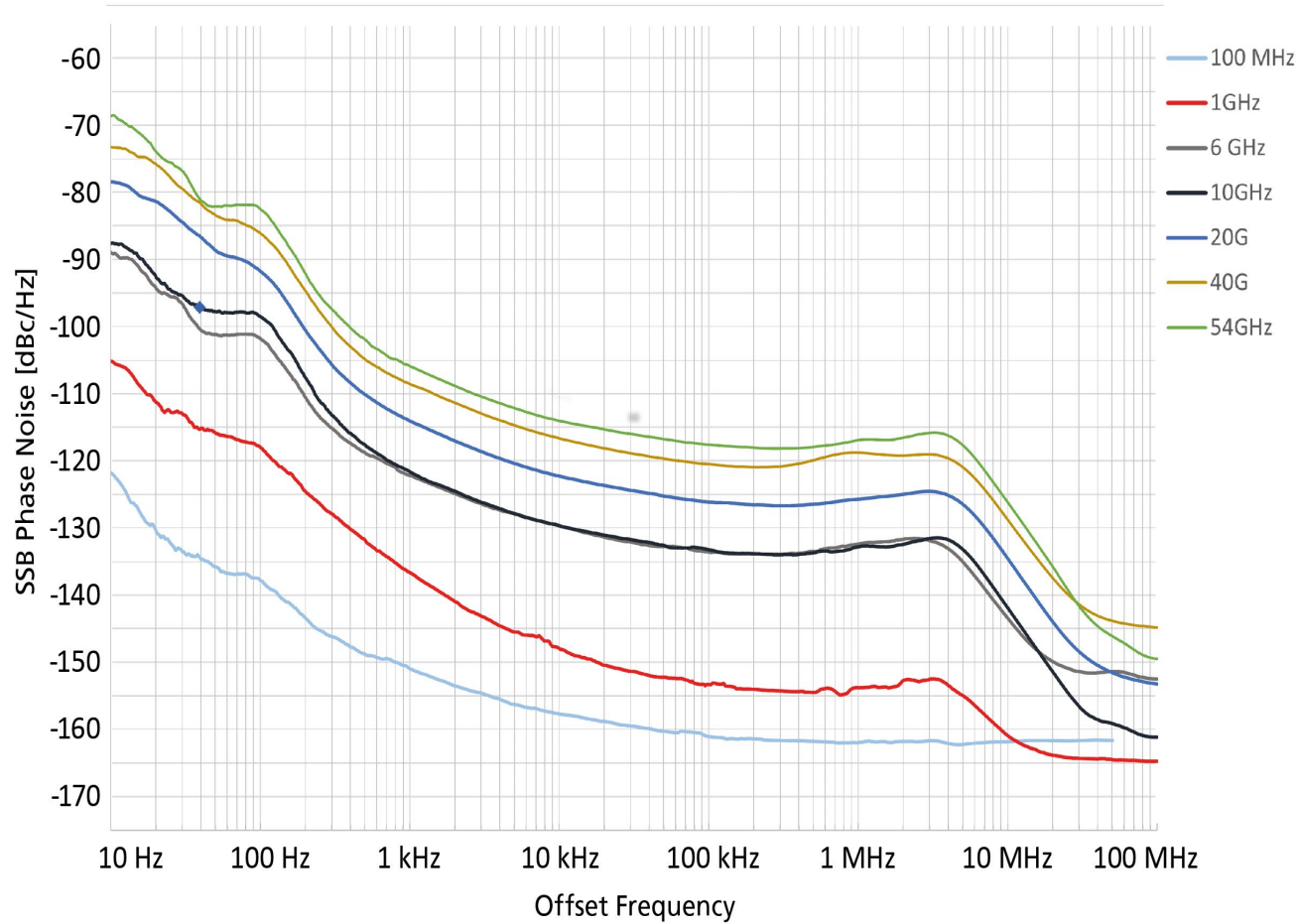
R&S SMA100B



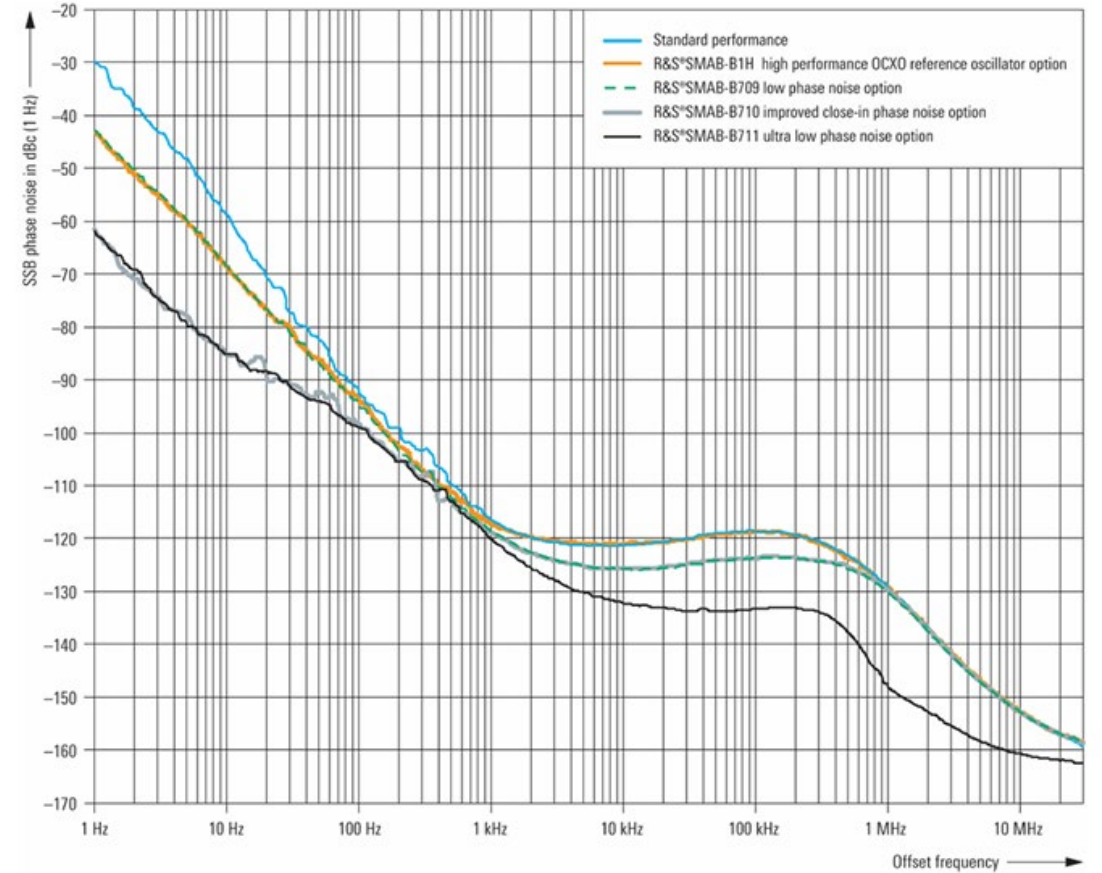
*Measured SSB phase noise with the R&S<sup>®</sup> SMAB-B711(N) option*

# SSB Phase noise APLC vs R&S SMA100B

AnaPico APLC



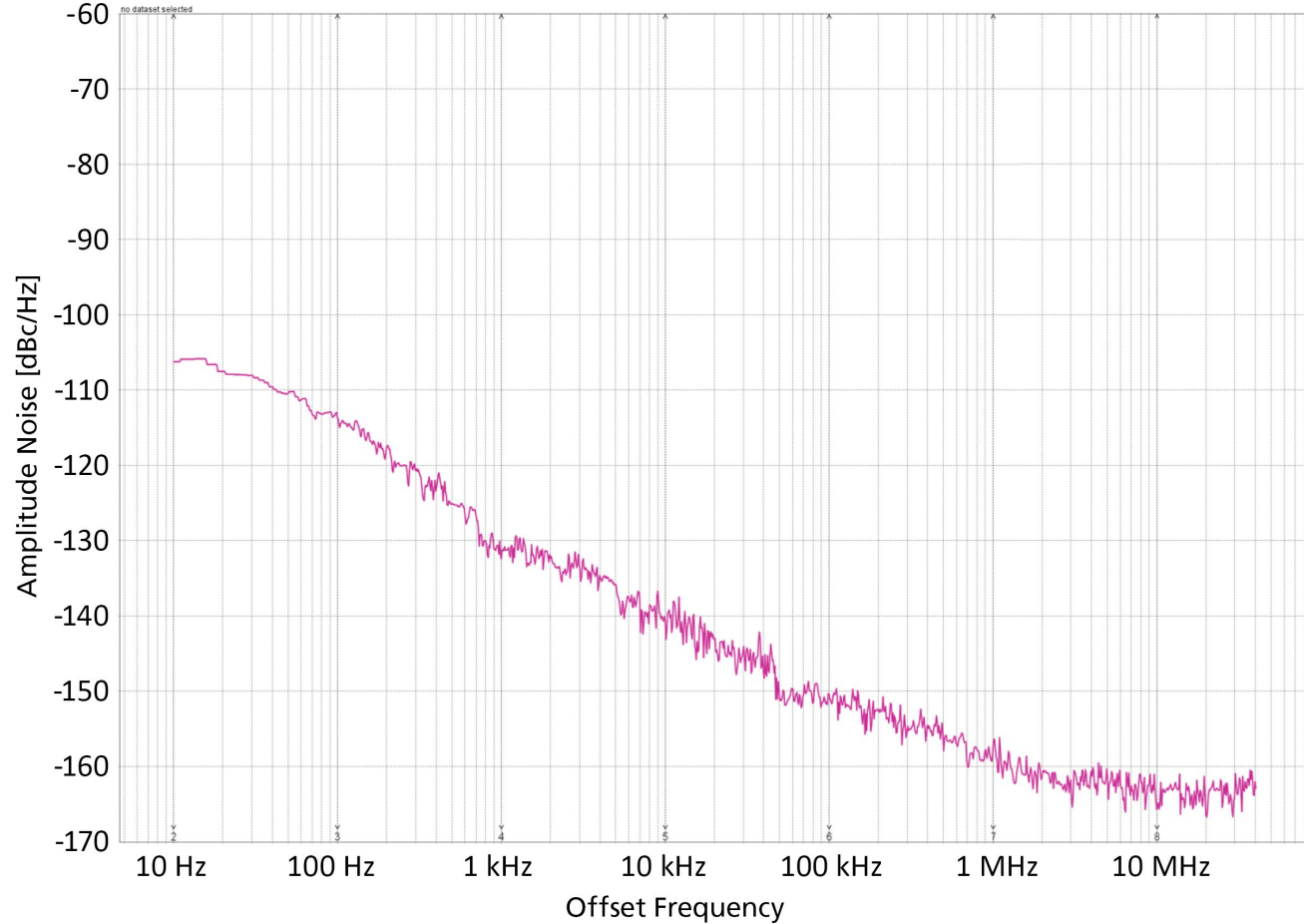
R&S SMA100B, 10 GHz all options



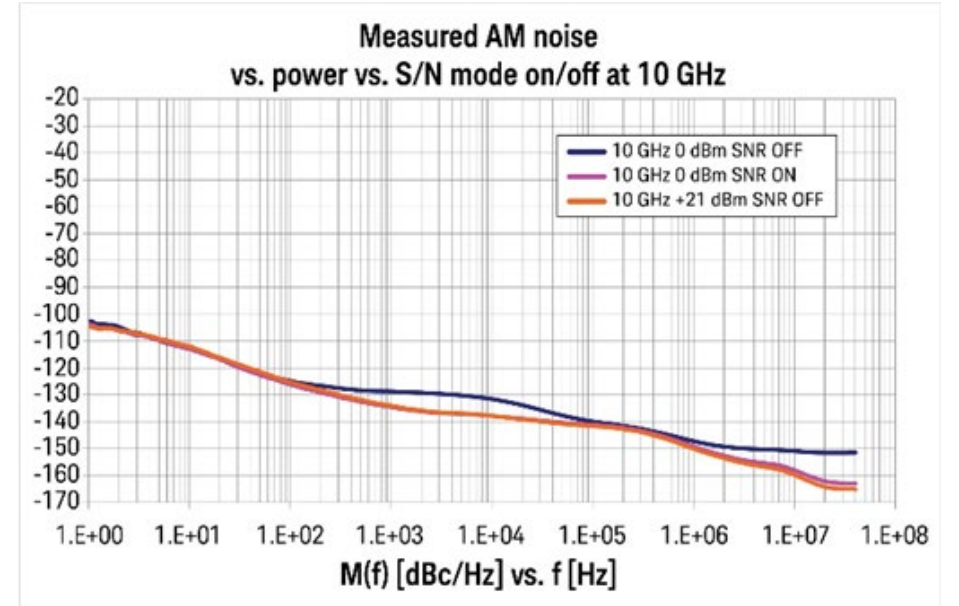
Measured SSB phase noise at  $f = 10$  GHz, standard performance versus the R&S SMAB-B1H, R&S SMAB-B709, R&S SMAB-B710 and R&S SMAB-B711 options

# Amplitude noise APLC vs Keysight

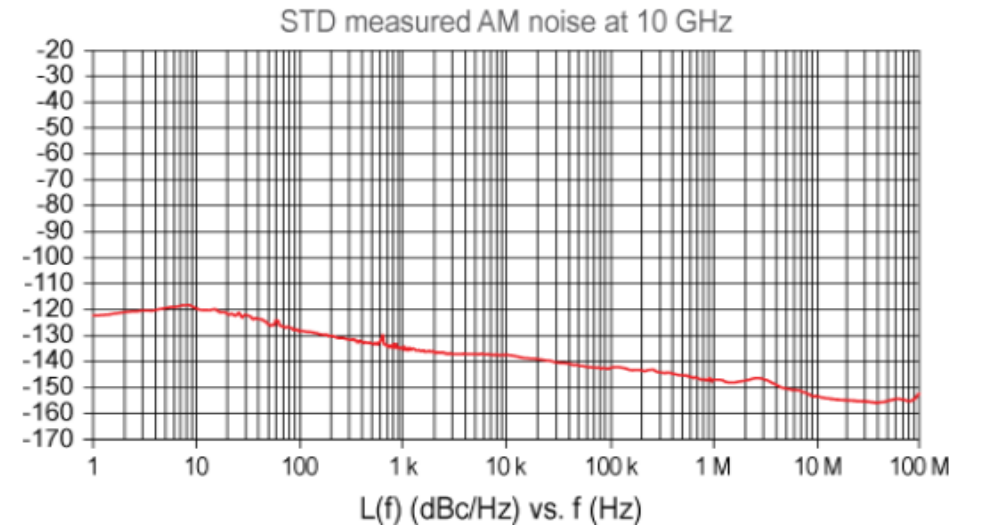
AnaPico APLC 10 GHz



Keysight N5183B, AM Noise

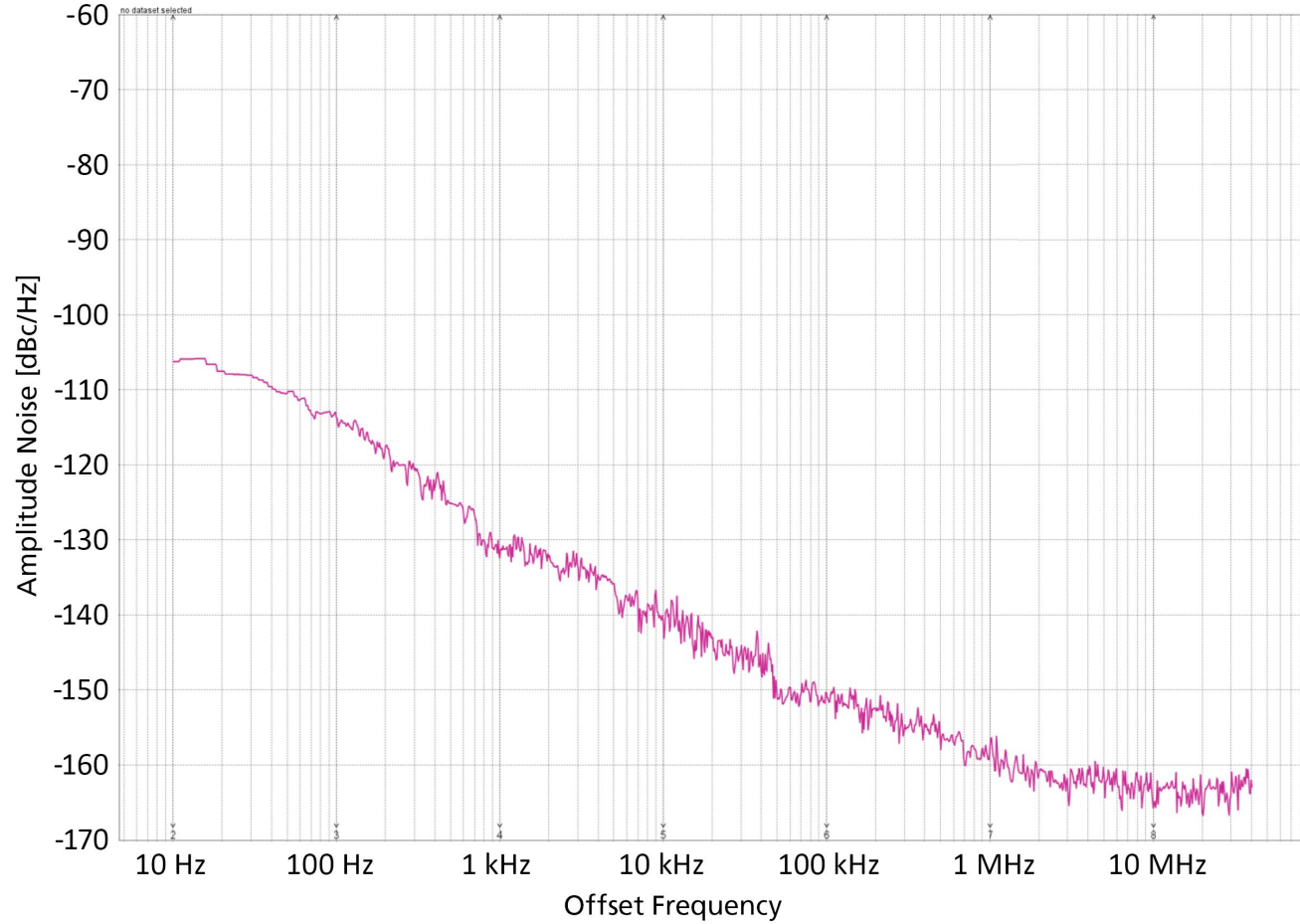


Keysight E8257D, AM Noise

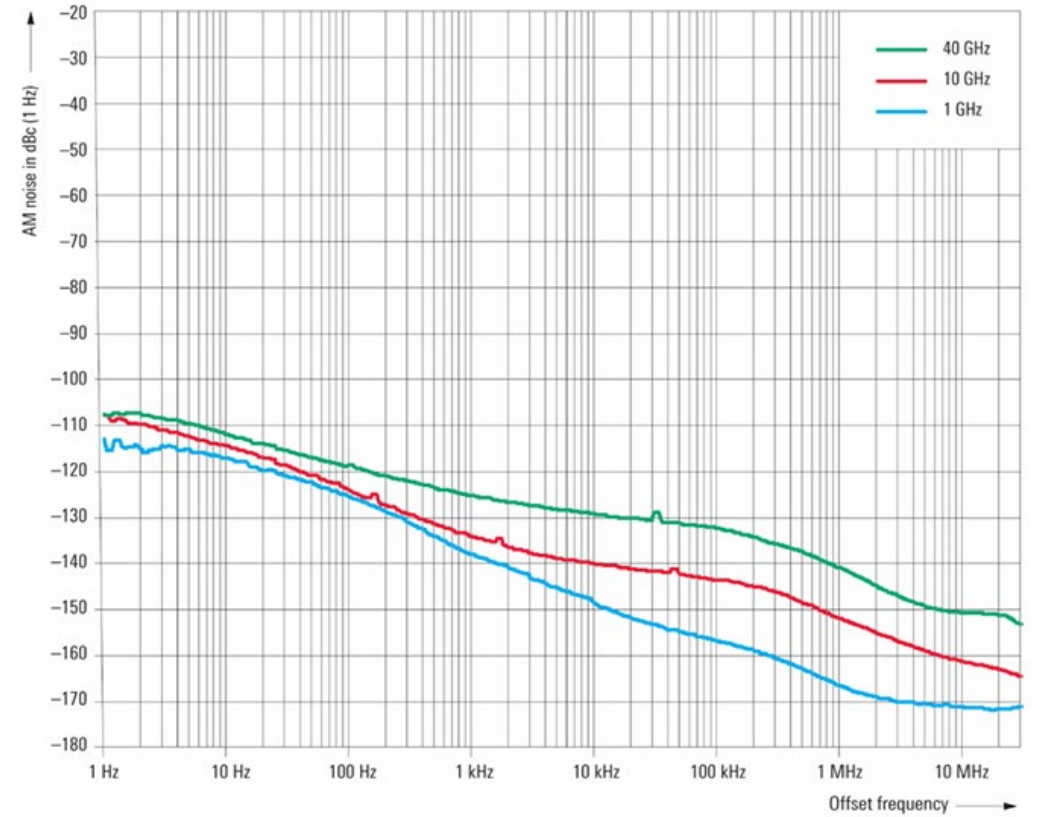


# Amplitude noise APLC vs R&S SMA100B

AnaPico APLC 10 GHz



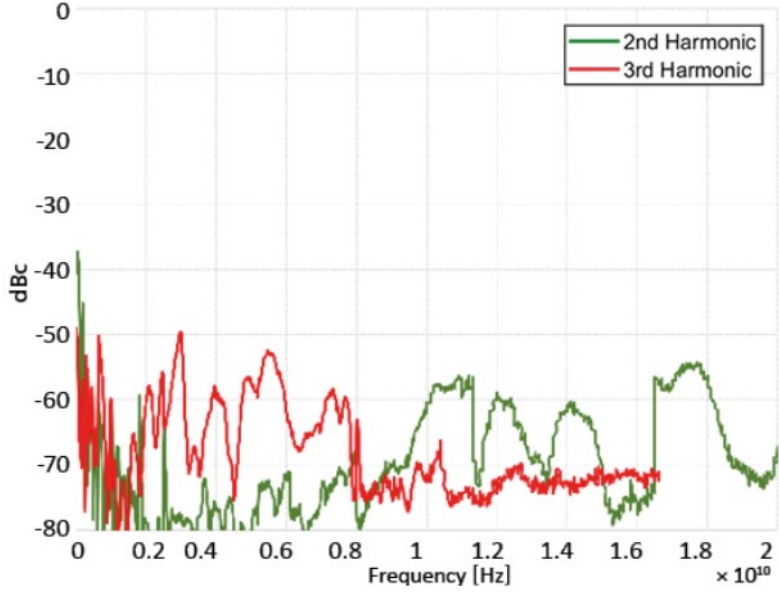
R&S SMA100B, AM Noise B711



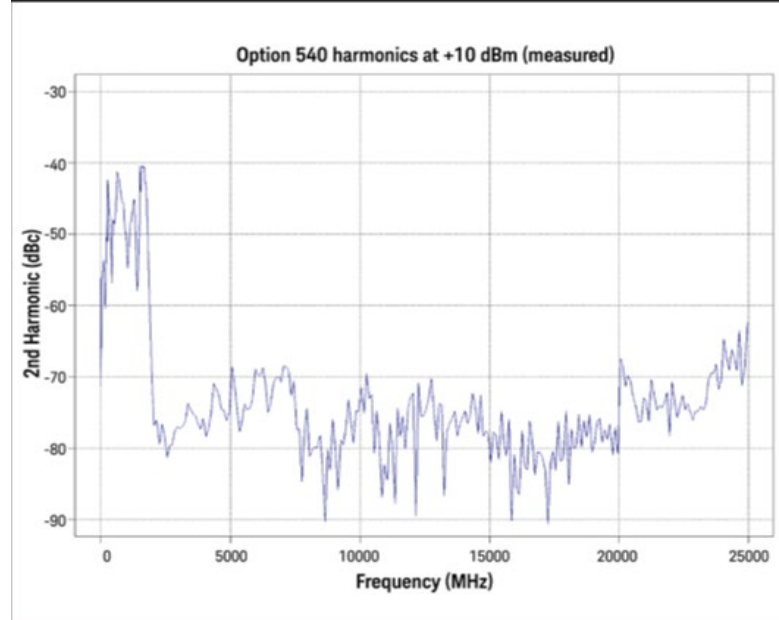
Measured AM noise at  $f = 1$  GHz, 10 GHz and 40 GHz with the R&S®SMAB-B711 option

# Harmonics AnaPico APLC vs Keysight N5183B, E8257D

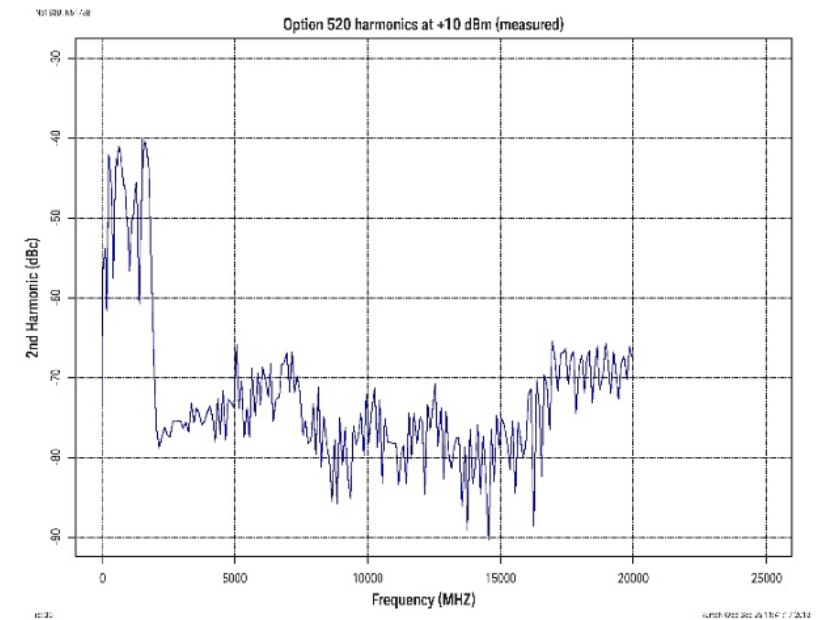
Harmonics APLC



Keysight harmonics N5183B

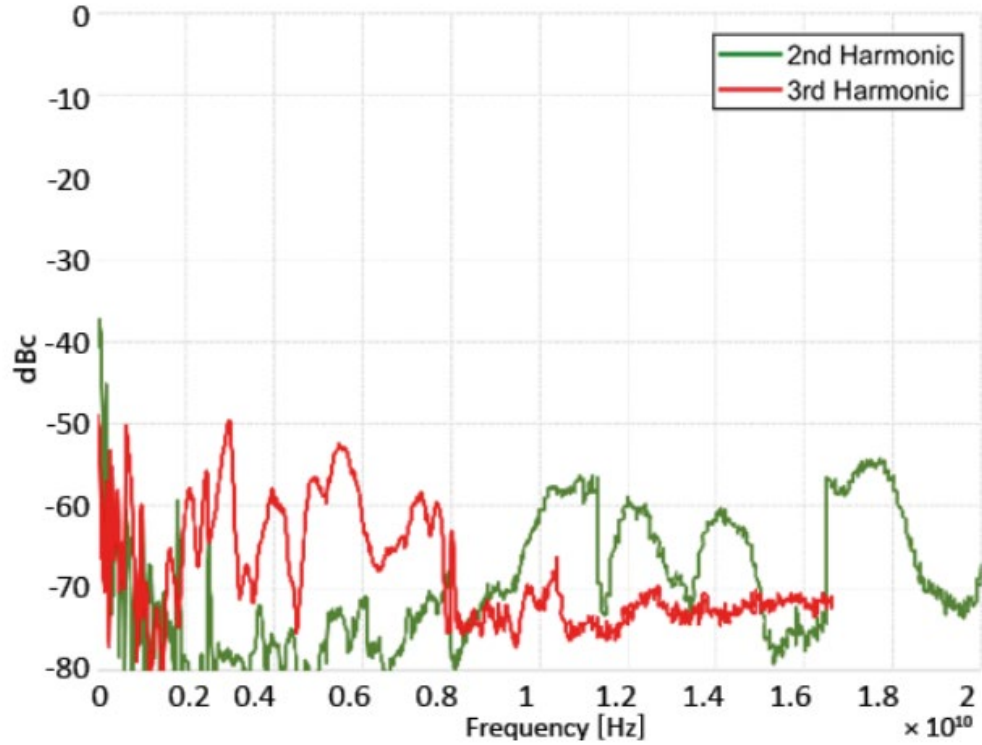


Keysight harmonics E8257D

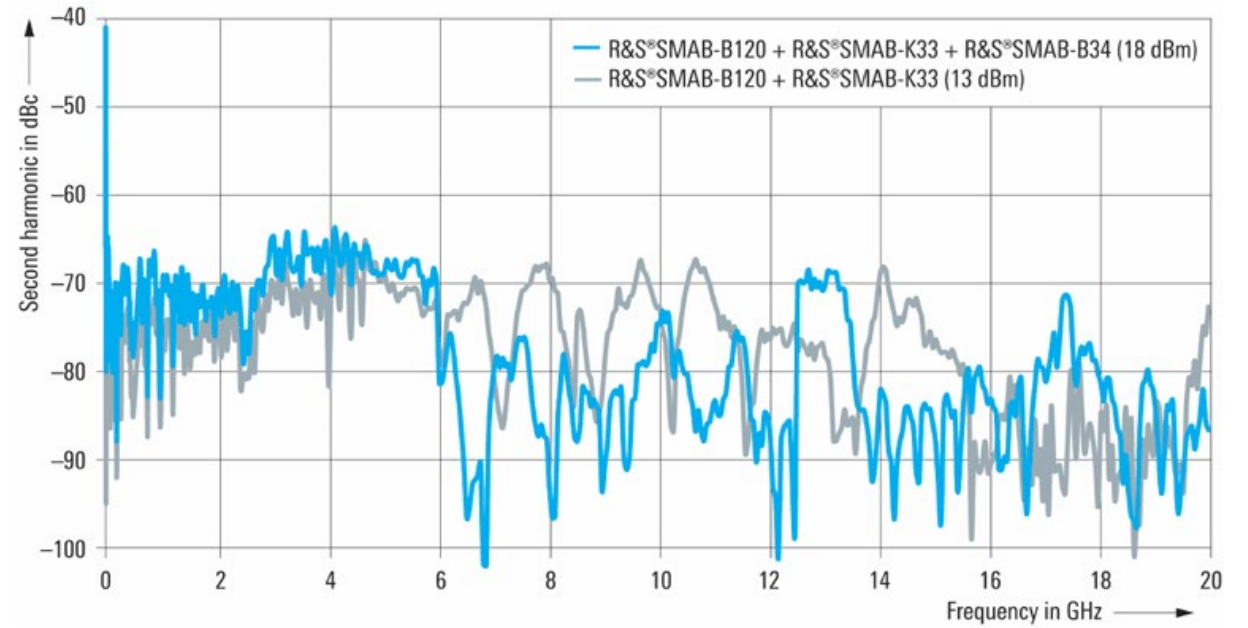


# Harmonics AnaPico APLC vs R&S SMA100B

Harmonics APLC



Harmonics SMA100B

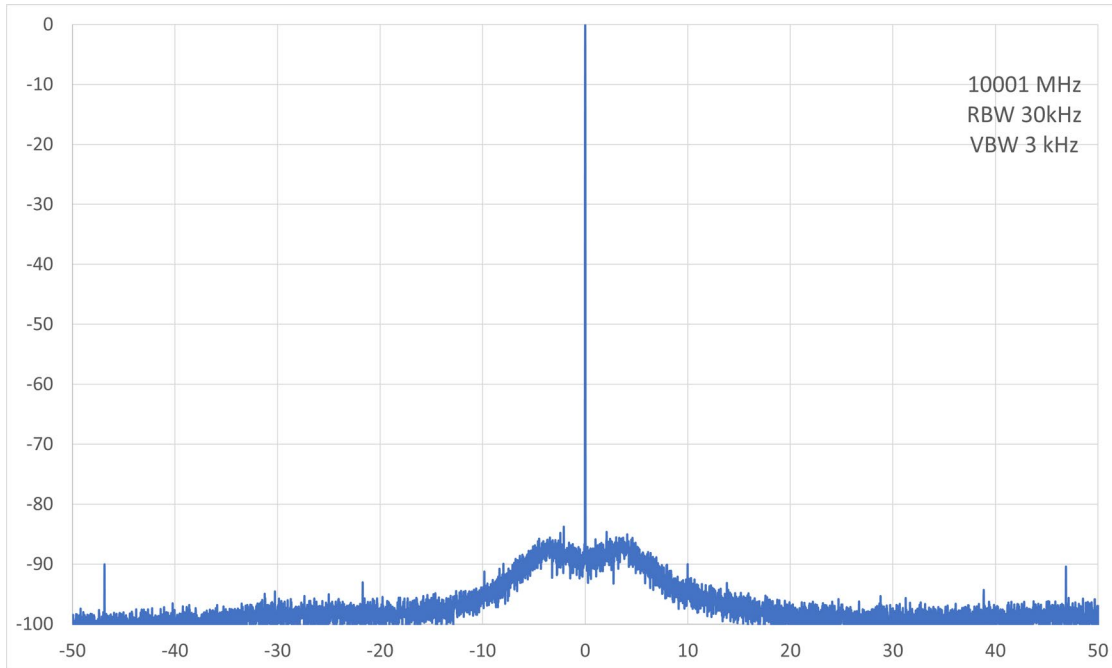


Measured harmonics versus carrier frequency with harmonic filter on for  $f \leq 3.7$  GHz

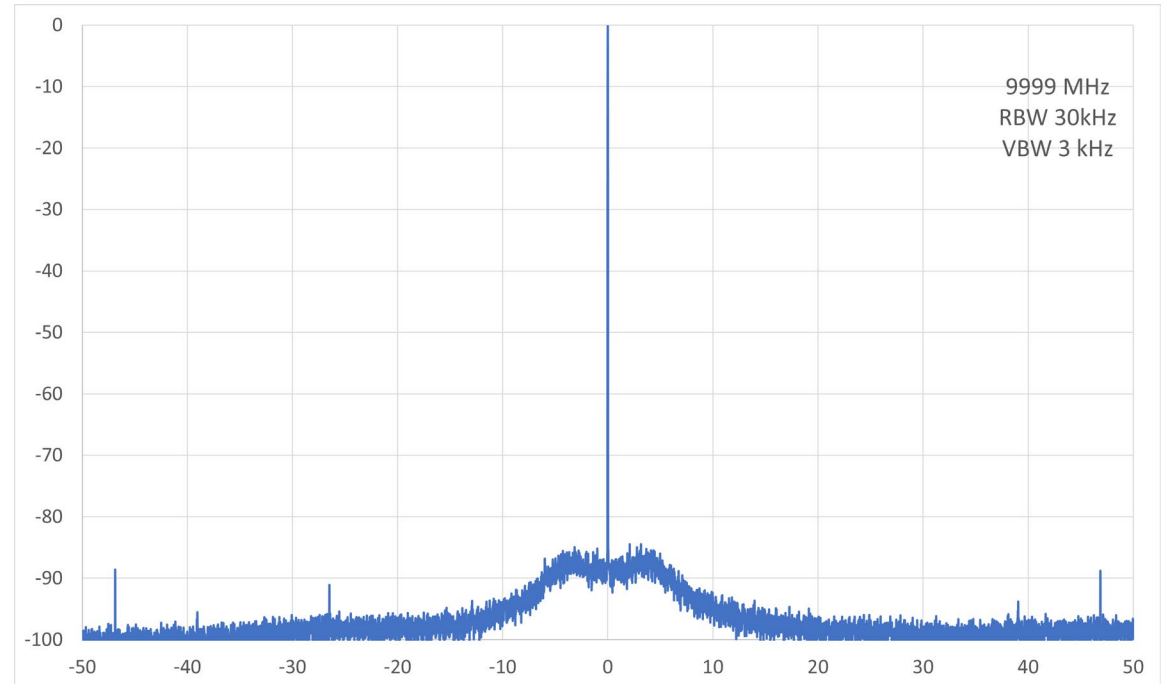


# Nonharmonics AnaPico APLC

AnaPico APLC Spectrum 10 001 MHz



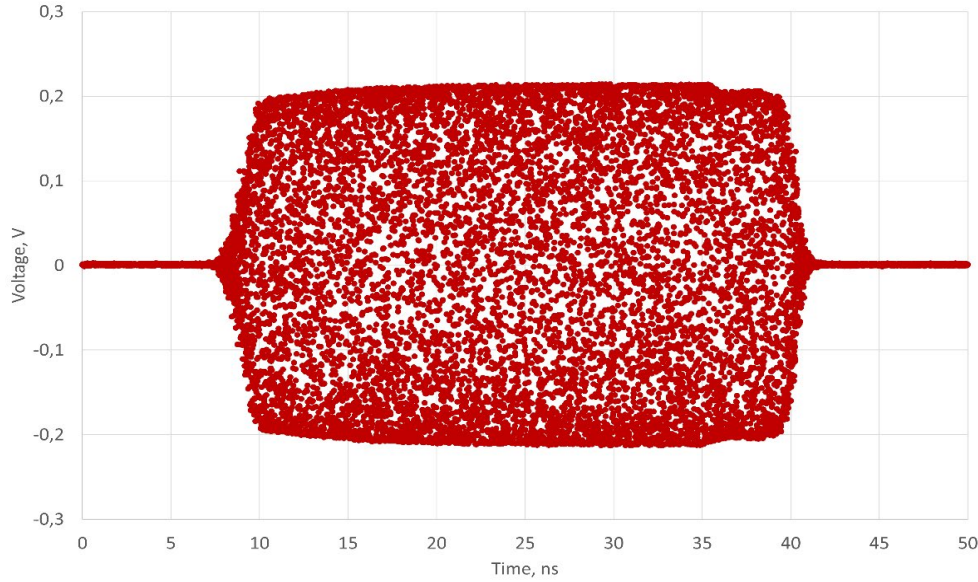
AnaPico APLC Spectrum 9 999 MHz



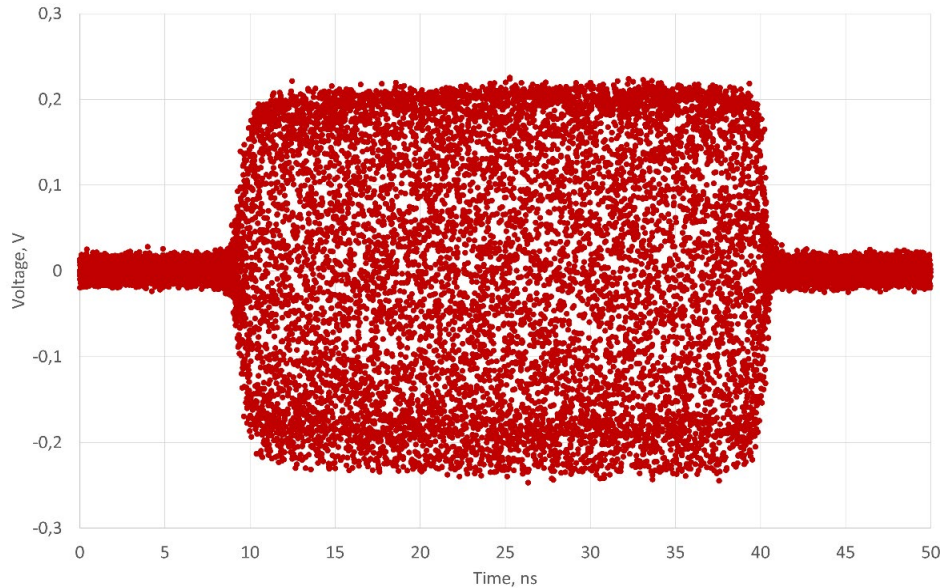
The level of nonharmonics depends on the frequency of the signal, the best values are obtained when the signal frequency is a multiple of the reference frequency. Due to the flexible reference technology APLC demonstrates a low level of nonharmonics in the whole frequency range, which is especially important for such applications as LO-substitution and receiver test.

# Pulse modulations AnaPico APLC vs Keysight

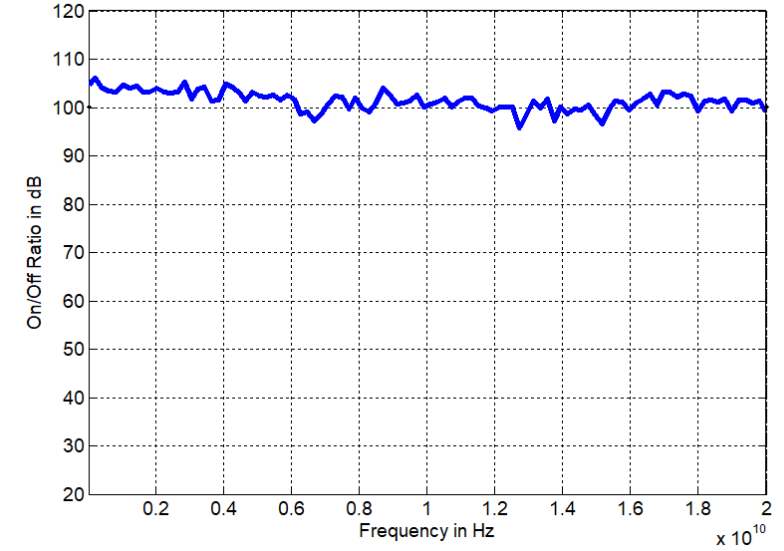
AnaPico APLC 10 GHz 30 ns



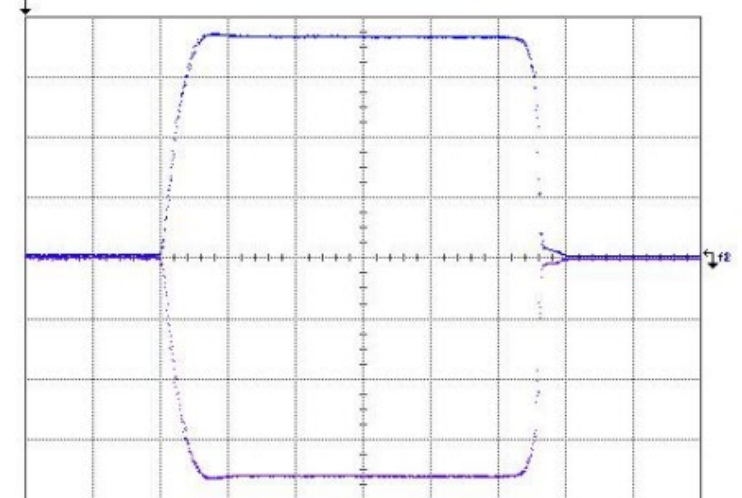
AnaPico APLC 50 GHz 30 ns



AnaPico APLC On/Off ratio Pulse modulation







Keysight E8257D 9 GHz, 10ns/div.



Measured pulse modulation envelope

Frequency = 9 GHz, amplitude = 10 dBm, ALC Off, 10 ns/div

## Price comparison, price EXW country of origin

AnaPico APLC20	Keysight E8257D	Keysight N5153B	R&S SMA100B
			
<p>APLC20- Frequency range 20 GHz LN+- low phase noise + frequency stability PE2- Step attenuator MOD- Analog+narrow pulse modulation</p>	<p>E8257D-520 frequency range 20 GHz 40 484 \$ 1EU-High power 9 637 \$ 1E1-Step attenuator 5 473\$ UNY- Low phase noise 22 745 \$ UNT- analog modulation 5694 \$ UNW- Narrow pulse modulation 11 051 \$</p>	<p>N5183B-520 frequency range 20 GHz 36 600 \$ UNW- pulse modulation 7246 \$ UNT Analog modulation 5048 \$ 1EA-High power 7246 \$ 1E1-Step attenuator 6061 \$ UNY- Low phase noise 17057 \$</p>	<p>SMA100B- 3200 EUR base unit B120- Frequency range 20 GHz 30 035 EUR B711- Low phase noise 19 255 EUR K33 High Power 6900 EUR B34 Ultra High power 18 700 EUR K22,K23,K27- Pulse modulation 7765 EUR K720-Analog modulation 2505</p>
<b>30-35% Cheaper</b>	Total 95 084 \$	Total 79 258 \$	Total 88 360 EUR

The price is an estimate, differences may occur due to price changes, sales and pricing policies in different fear.

# Conclusion

The APLC competes successfully among top-of-the-line instruments with the maximum number of options. The model has both technical and price advantages.

The following points should be noted in the competitive analysis.

1. The APLC platform allows to create both single-channel and multichannel generators up to 4 channels, which is an advantage for ATE Testing, LO-Substitution, Radar Simulation, Phase-coherence application tasks
2. The highest maximum power is achievable on the SMA100B generator, also this device has the best harmonic level in the class.
3. APLC competes with SMA100B in phase noise and non-harmonic distortion, both devices have an advantage over Keysight N5183B, E8257D generators.

The APLC is the best in class in a number of aspects.

1. Frequency tuning speed of 15 microseconds when other instruments take more than 1 ms.
2. Long-term frequency stability of 0.02 ppm per year
3. Pulse modulation parameters. best rise/fall time of 3-5 ns in class combined with high on/off ratio of 100 dB.
4. Unique combination of features Low phase noise, high frequency hopping speed and long-term stability, which are mutually exclusive in the class.