
AnaPico
of Switzerland
AnaPico Products
For Radar and EW
www.anapico.com

AnaPico Products

SINGLE-CHANNEL RF / MW SIGNAL GENERATORS

APSINX010/APSINXX: single-channel RF/MW SGs up to 2, 4, 6, 12, 20, 26 GHz, analog modulations

APULNXX: high-performance MW SGs up to 12, 20, 26, 40 GHz, analog modulations

APLCXX: high-purity MW SGs up to 12, 20, 40, 54 GHz, analog modulations

APVSGXX: ultra-agile, vector RF and MW SG up to 4, 6, 12, 20, 40 GHz, digital modulations

MULTI-CHANNEL RF / MW SIGNAL GENERATORS

APMS-X: up to 4 fully independently adjustable, phase-coherent and phase memory, up to 6, 12, 20, 33, 40 GHz

APLC-X: up to 4 fully independently adjustable, phase-coherent, up to 12, 20, 40, 54 GHz

APVSG-X: up to 4 fully independently adjustable, phase-coherent, 4, 6, 12, 20, 40 GHz

FREQUENCY SYNTHESIZERS SINGLE- / MULTI-CHANNELS

APSYN420(-X) / APSYN140(-X): single- and multi-channel frequency synthesizers up to 20, 40 GHz

APUASYN20(-X): up to 20 GHz, 1/2/3/4 channels, phase-coherent

APMSYN22 / APMSYN40: up to 22 / 40 GHz, multi-channel configurable

APMQS20: NI QuickSyn FSW-0020 replacement and upgrade

SIGNAL SOURCE ANALYZERS / PHASE NOISE TESTERS

APPH: versatile, broadband instruments up to 7, 26, 40 GHz with multiple measurement modes and high measurement sensitivity

RF & MW Signal Sources Relevant for Radar & EW

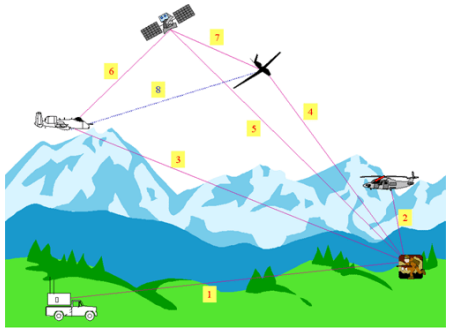
Enabling Features:

- Compact size and low power consumption
- Single- and multi-channel configurability
- Fast Power and Frequency Switching
- Low Phase Noise and High Signal Purity
- Multi-Channel Sources:
  - Phase Coherence
  - Phase-Coherent Switching
  - Channel-Individual Phase Adjustment
  - APVSG-X:
    - * PDW (Pulse Descriptor Word) Playback and Streaming
    - * Waveform and Time Base Synchronization
    - * Phase Calibratable Mode

RADAR & EW Application Scenarios

Vehicle- Submarine- and Air-Borne Radar Systems

Communication and Jamming



Radar Path Calibration w/ Powerbank Operated SGs

Single- and Multi-Channel RF/MW VSGs

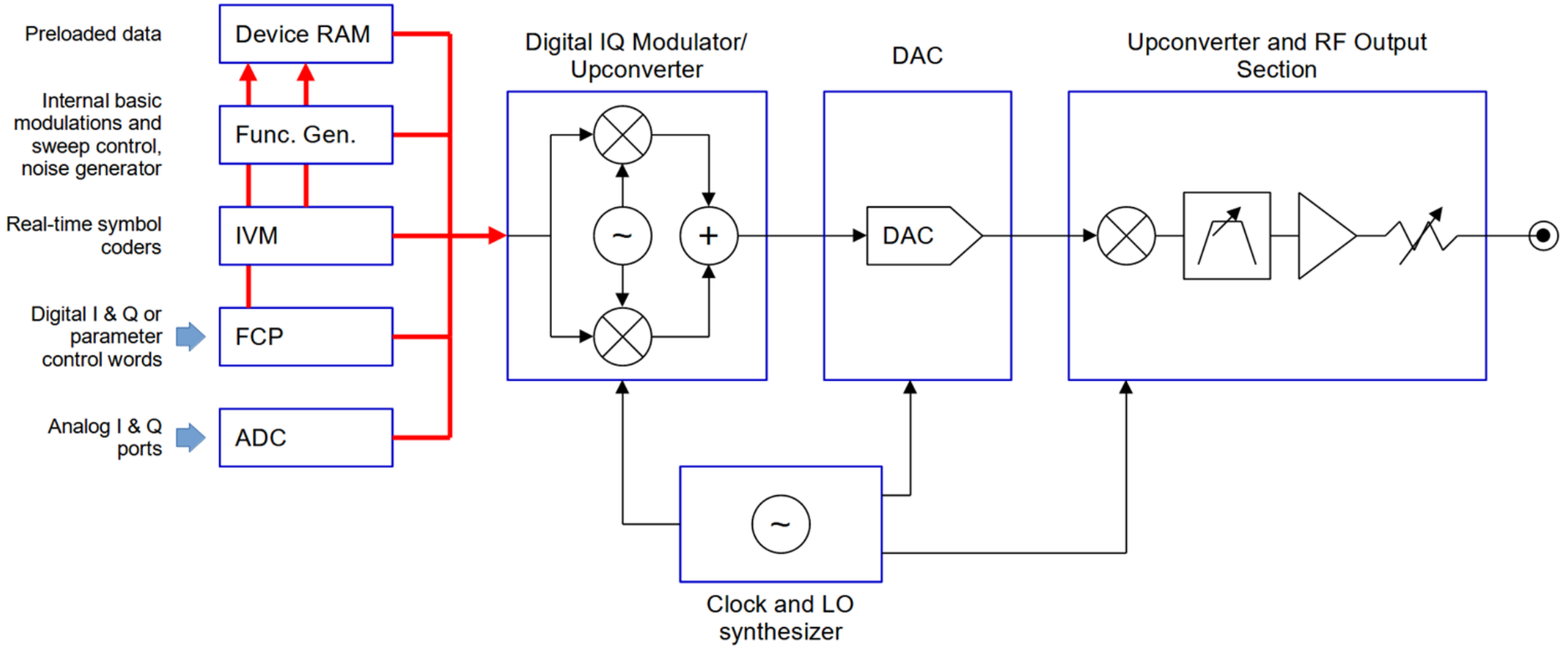
Wideband I/Q modulation, ultra-agile switching / sweeping / chirping.
Internal AWG. I/Q data playback and streamimg, fast control port, …

Models	Description	Output Power
APVSG04	10 MHz to 4 GHz	-120 to +17 dBm
APVSG06	10 MHz to 6 GHz	-120 to +15 dBm
APVSG12	10 MHz to12 GHz	-120 to +15 dBm
APVSG20	10 MHz to 20 GHz	-120 to +19 dBm
APVSG40	10 MHz to 40 GHz	-120 to +14 dBm

Features

- Ultra-fast switching: <1 us within mod BW; 2 us wide-band.
- Low phase noise: -145 dBc/Hz at 1 GHz, 20 kHz offset
  -115 dBc/Hz at 40 GHz, 20 kHz offset
- 400 MHz digital and 100 MHz analog modulation bandwidth
- Internal baseband SG: 500 MHz sampling, 512 MSa memory

APVSG: Function Diagram



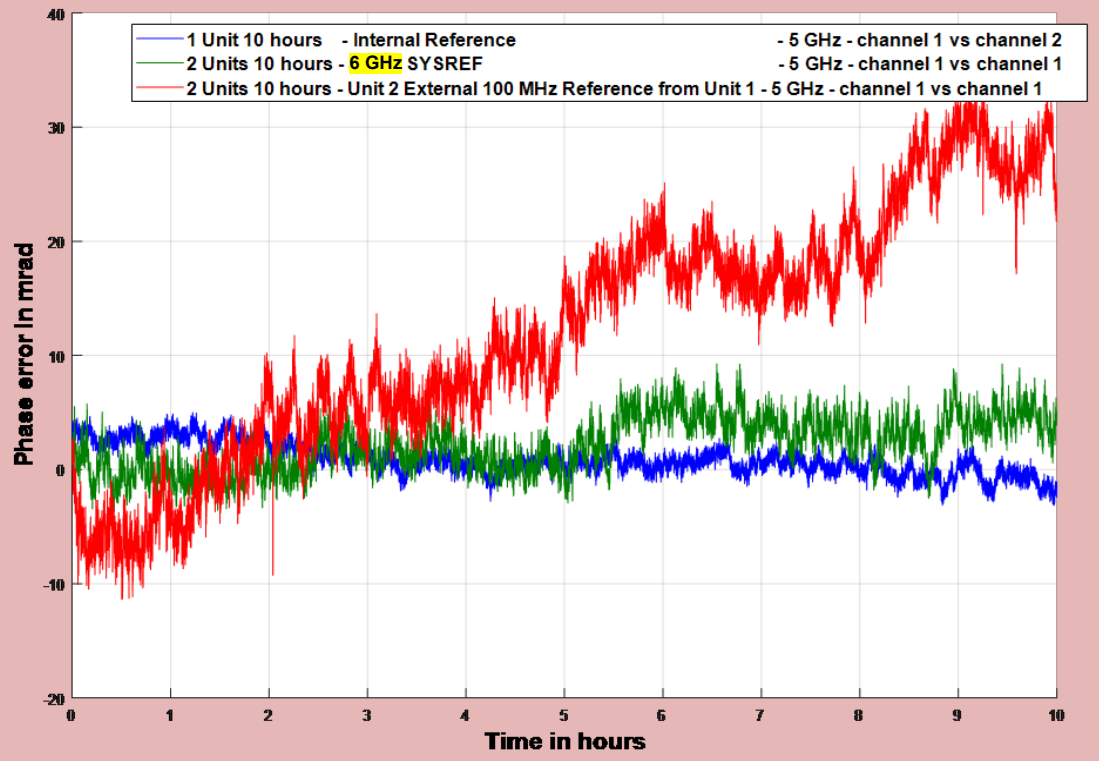
APVSG: Main Operation Modes

- Analog modulations (AM, FM, PM, Pulse Mod): **Option MOD**
- Some digital modulations: for example, xQAM: **Option IVM**
- Compilation of I/Q files / segments; upload to APVSG internal RAM; (segment ID selective) playback
- I/Q file streaming through FCP (Fast Control Port): **Option FCP**
- Compilation of PDW lists; Upload to APVSG; real-time interpretation to I/Q data; playback: **Option PDW**
- PDW list streaming through FCP (Fast Control Port): **Option FCP**

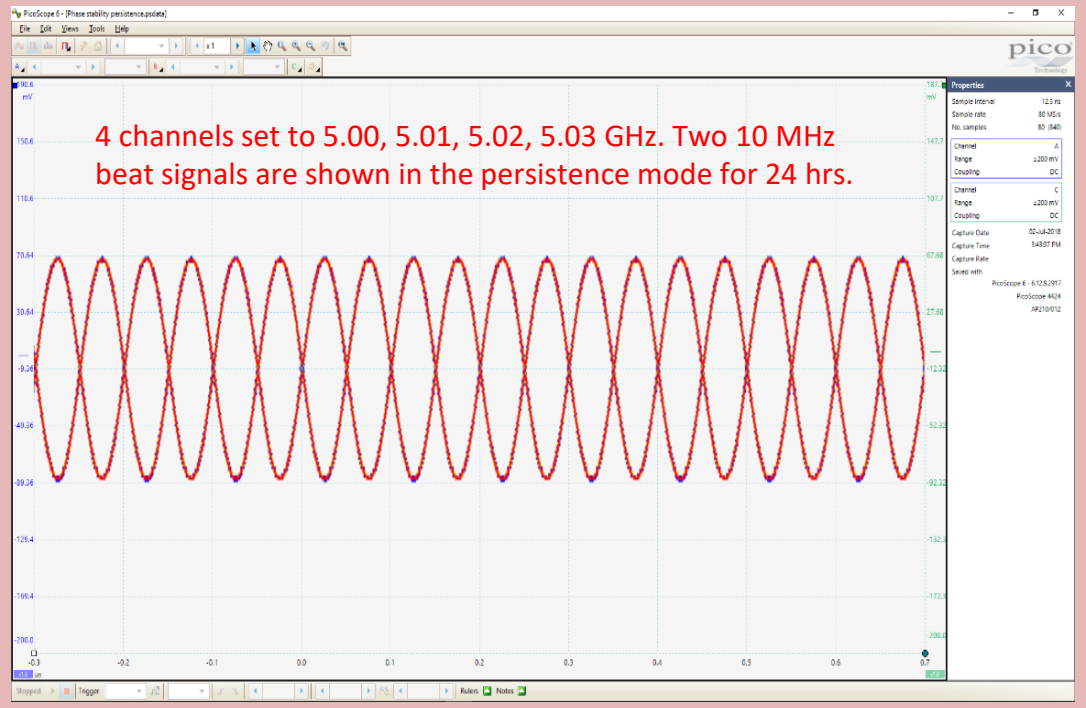
- Ultra-fast switching: **Option UFS**
- Phase-coherent switching: **Option PHS**
- Time base synchronization: **Option SYNC**
- Phase-calibratable mode: **Option PCM**

Phase Coherence

Phase Coherence at 5 GHz



Phase coherence between 2 different frequencies

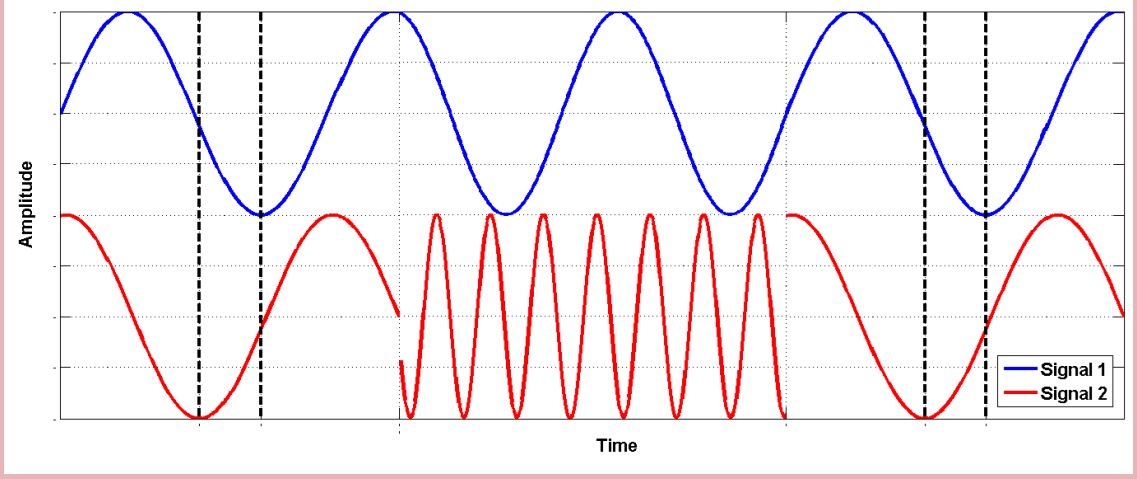


How to Reach Phase Coherence

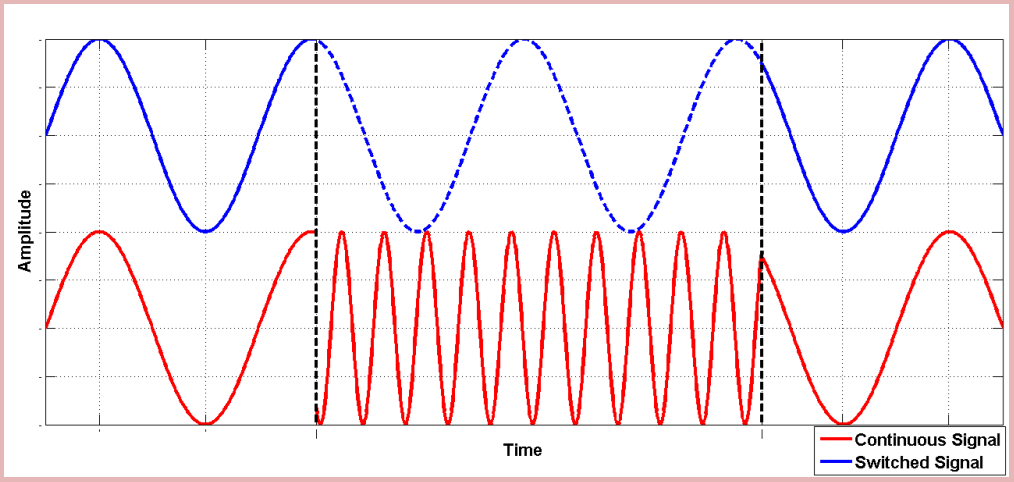
- Each APVSG module has a common highly stable OCXO frequency reference. Frequencies of all channels are digitally synthesized / derived from the common reference frequency with high resolution.
- Same frequency synthesis circuitries of the parallel channels ensures the maximum phase coherence.
- All the channels in the APVSG module are in a similar ambient environment that ensures min. drift difference.
- Each module features a pair of high-frequency clock ports (6 GHz) allowing for excellent synchronization between the multiple APVSG modules.
- Flexible synchronization to different external references: 10 MHz, 100 MHz, and even a reference range of 5 to 250 MHz.

Phase-Coherent Switching

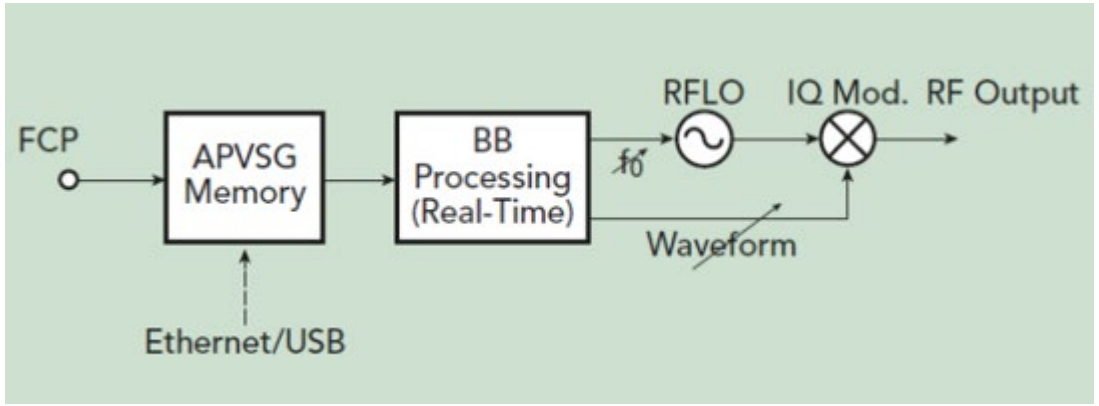
Phase Coherent Switching:
The relative phase between channels 1 and 2 (signal 1 and 2) remains the same after channel 2 temporarily switched to a different frequency.



Phase Memory:
The signal returns to the same absolute phase when returning to the previous frequency and amplitude setting.



Pulse Descriptor Word: Playback and Streaming



Mode 1: PDW List Upload & Playback

A list of PDWs (precompiled file describing pulse sequence parameters) is uploaded into the APVSG internal memory. During the playback, each PDW is translated to the corresponding modulation parameters in real-time for signal generation.

Mode 2: PDW Streaming

PDWs are fed into the APVSG internal memory in real-time through the FCP (Fast Control Port) for immediate playback as described in mode 1.

(AN6008: Pulse Descriptor Word for APVSG)

PDW (Pulse Descriptor Word) Structure

Address Range	Parameter Name	Parameter Group
1	PDW Configuration	PDW Setting
2 – 3	Reserved	
4	PDW Modulation	
5 – 6	Reserved	
7	PDW Marker	
8 – 15	Reserved	
16 – 23	Start Time	PDW Timing
24 – 31	Pulse Width	
32 – 33	Waveform Segment	Waveform Modulation
34 – 47	Reserved	
48	RF Output	Carrier Output
49 – 54	Frequency	
55 – 56	Power	
57 – 58	Fixed Phase	
60 – 69	Reserved	Offset
70 – 89	Reserved	FM/PM
90 – 97	Reserved	AM
98 – 105	Reserved	Chirp
106	Sweep On Pulse	Phase Sweep
107 – 108	Phase Step	
109 – 116	Sweep Dwell Time	
117 – 124	Sweep Step Time	
125 – 255	Reserved	Reserved

PCM: Phase Calibratable Mode

- With option PHS, the APVSG guarantees deterministic and reproducible phase relationships between individual channels and individual devices.
- Deterministic and reproducible, however, means that those phase relationships may still vary with power and frequency settings. Varying RF path configurations (gain and attenuation settings must be adjusted) cause jumps in the phase relationship over power and frequency setting. Thus, phase calibration is only feasible for selected combinations of power and frequency. Covering a broader range of power and frequency would require a very high number of phase calibration points, causing prohibitively long calibration measurement times.
- PCM addresses that shortcoming by using less, and therefore larger, ranges over power and frequency using a common RF path configuration and thus generating stable phase relationships.
- Power setting accuracy and resolution is maintained by scaling IQ modulation data instead of adjusting RF path gain or attenuation.

(AN6011: Phase Calibratable Mode for APVSG)

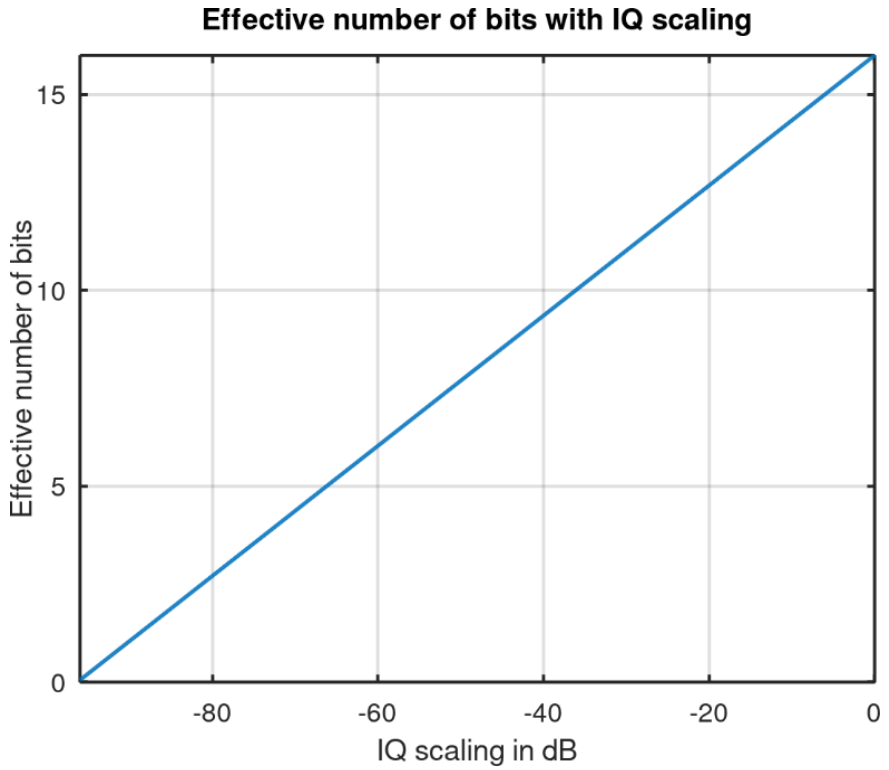
PCM: Effect of PCM

Advantages of PCM

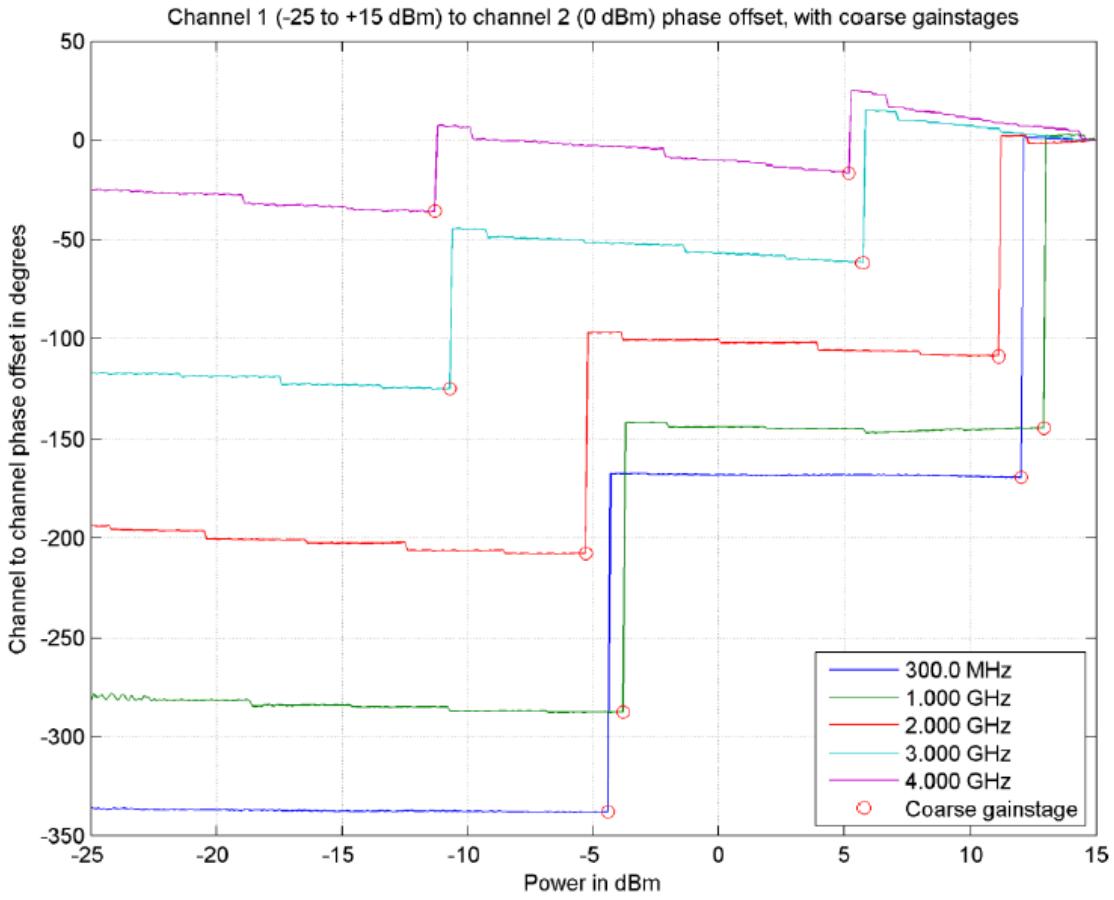
- Static phase relationships over power level.
- Linear phase relationships over frequency.
- Phase calibration over a larger or even the full power and frequency range is possible with only a few calibration points.
- PCM has no impact on switching speed. PCM is fully supported in ultra-fast switching (UFS) mode, e.g., with pulse descriptor word (PDW) playback.

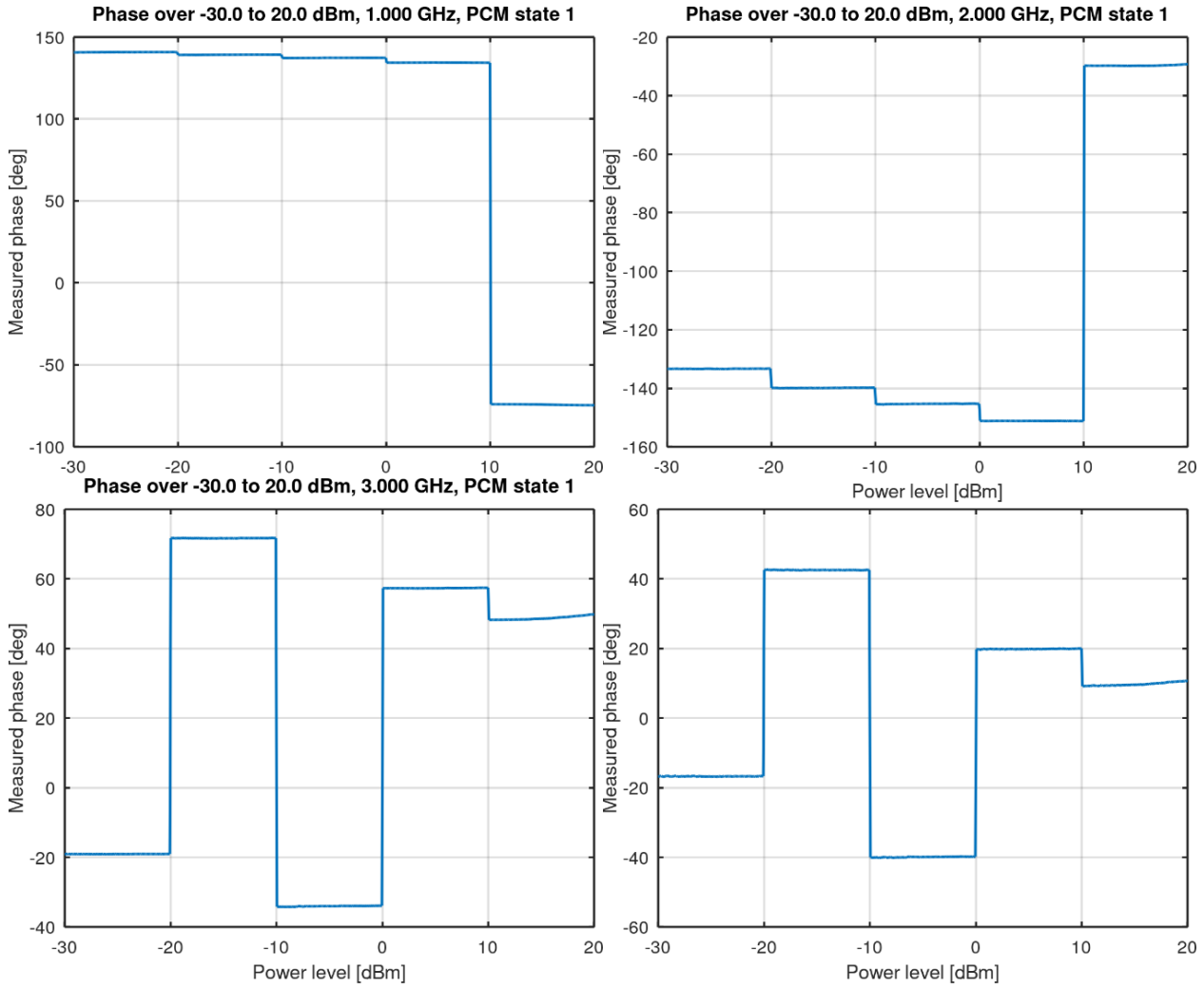
Impact of IQ Scaling

- Effective # of bits decreases with bigger IQ scaling range.

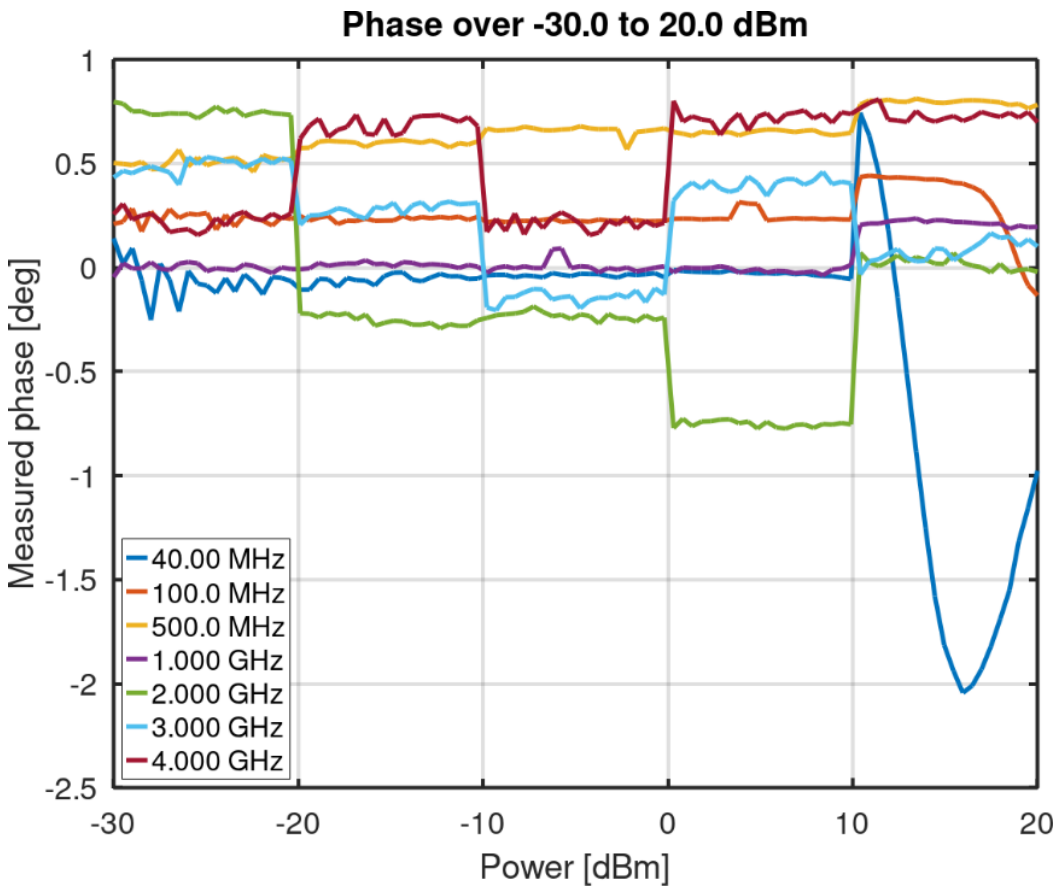


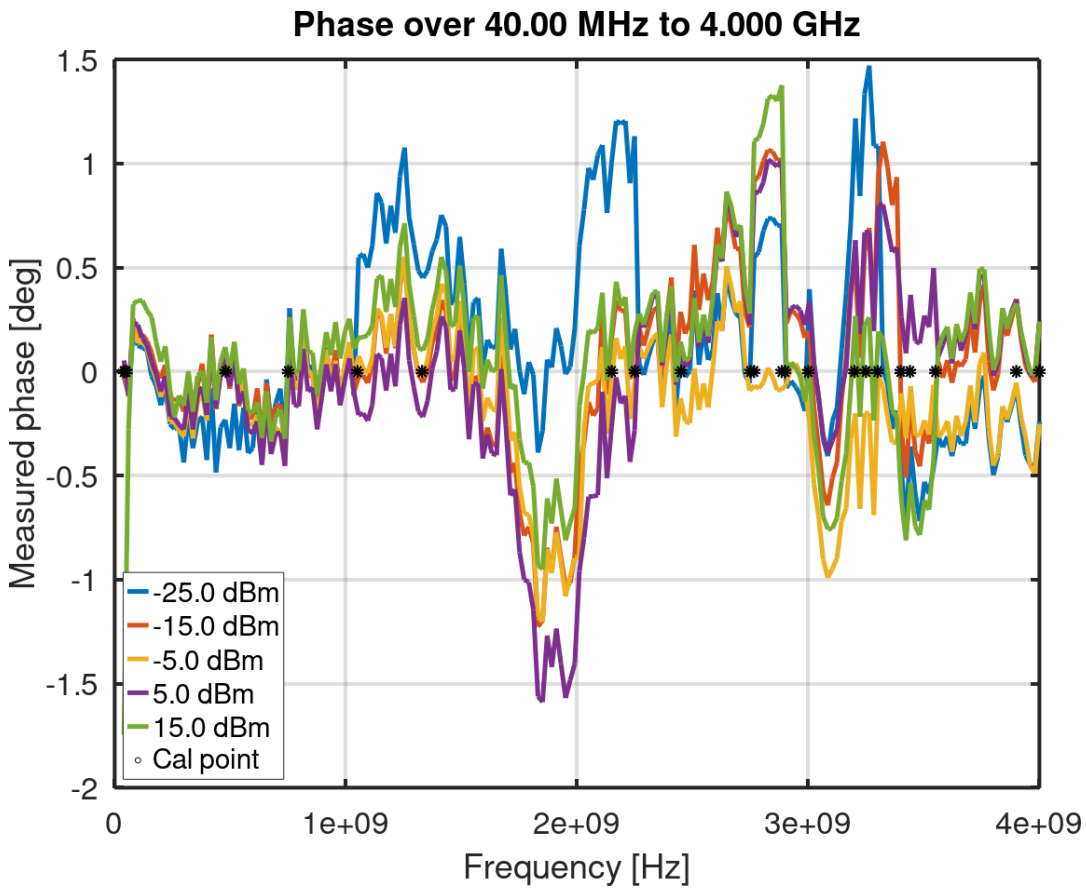
Phase vs. Power and Frequency
Before and After Calibratable Mode

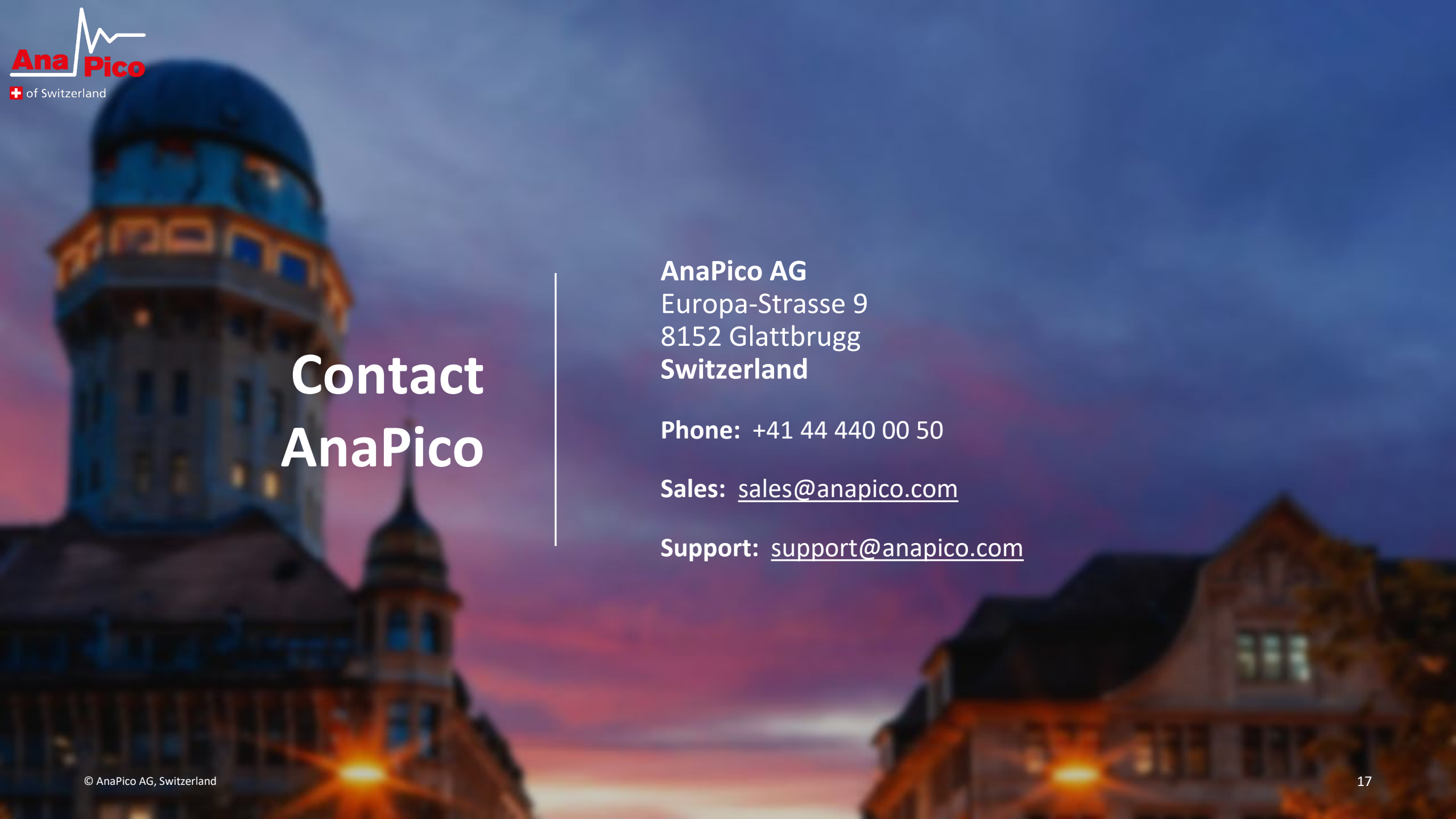




Phase vs. Power and Frequency After RF Phase Calibration







Contact AnaPico

AnaPico AG
Europa-Strasse 9
8152 Glattbrugg
Switzerland

Phone: +41 44 440 00 50

Sales: sales@anapico.com

Support: support@anapico.com