

# **Agilent V2820A Vector Signal Analyzer**

## **Specifications**



**Agilent Technologies**

# Notices

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## Safety Notices

The following safety precautions should be

### CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

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A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

## Specification notes

### Specifications (warranted performance)

Specifications describe the instrument's warranted performance. All units are warranted to meet performance specifications under the following conditions:

- Ambient operating temperature of 18°C to 28°C, unless otherwise noted.
- After specified warm-up time of 30 minutes and self calibration at ambient temperature.

**Note:** All items are specifications unless otherwise noted.

### Typical (mean plus three standard deviations)

“Typical” indicates performance that units will meet under the following conditions:

- Ambient operating temperature of 23°C, unless otherwise noted.
- After specified warm-up time of 30 minutes and self calibration at ambient temperature.
- This performance is not warranted.

### Nominal (mean or expected value)

“Nominal” values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by product warranty.

## Modes of operation

### Standard spectrum analysis modes

- Spectrum analyzer (power envelope amplitude vs. frequency spectrum)
- Zero span (power envelope amplitude vs. time)
- ACPR (adjacent channel power ratio bar chart)
- Channel power list
- Spectrum emissions mask (SEM).

### Optional vector signal analysis modes

- GSM-GPRS-EDGE
- EDGE Evolution
- cdmaOne and cdma2000
- W-CDMA FDD uplink (mobile phone transmitter signals)
- W-CDMA FDD downlink (base station transmitter signals)
- 802.11a, b, g, j, and n WLAN (SISO signals)
- 802.16e-2005 WiMAX (SISO signals)
- Generic FSK and PSK signals.
- HSPA and HSPA+

## Specifications

### FREQUENCY

Frequency parameters	Specification
Frequency range	V2820A-504: 400 MHz to 4.0 GHz <sup>1</sup> V2820A-506: 400 MHz to 6.0 GHz <sup>2</sup>
Frequency setting resolution	0.1 Hz
Frequency accuracy	Same as frequency reference plus synthesizer resolution term <sup>3</sup>
Frequency switching speed <sup>4</sup>	250 $\mu$ s V2820A-UPN: 1.05 ms

### INTERNAL FREQUENCY REFERENCE

Internal frequency reference parameters	Specification
Aging rate	$\leq 1$ ppm per year
Temperature stability	$\leq 0.2$ ppm <sup>5</sup> (Nominal)

### FREQUENCY REFERENCE OUTPUT

Frequency reference parameters	Specification
Impedance	50 $\Omega$ (Nominal), AC coupled
Reference output signal	10 MHz, +7 dBm $\pm$ 3 dB (Nominal)

### EXTERNAL FREQUENCY REFERENCE INPUT

External Frequency Reference Parameters		Specification
Frequency lock range	Hardware lock mode <sup>6</sup>	10 MHz $\pm$ 10 Hz (1 ppm) input frequency lock range
	Variable input frequency mode	1 MHz to 60 MHz <sup>7</sup>
Amplitude		Lock range: -3 dBm to +15 dBm <sup>8</sup>
Impedance		50 $\Omega$ (Nominal)

<sup>1</sup> Over range operation provided: 325 MHz to 4.0 GHz. Performance below 400 MHz is not specified.

<sup>2</sup> Over range operation provided: 325 MHz to 6.5 GHz. Performance below 400 MHz and above 6.0 GHz is not specified.

<sup>3</sup> Synthesizer resolution term:  $\leq 20$   $\mu$ Hz.

<sup>4</sup> From sync out on start tune to within 1 KHz of final value.

<sup>5</sup> Total variation from 0° C to 50° C ambient temperature range.

<sup>6</sup> Factory preset setting.

<sup>7</sup> On 10 Hz boundaries Freq = 1 MHz + n \* 10 Hz. Reference accuracy:  $\leq \pm 1$  ppm. Sine or square wave inputs acceptable. Lock time may be up to 30 seconds.

<sup>8</sup> Over range operation provided: Maximum span is 3.675 GHz. Performance below 400 MHz is not specified.

## SPECTRUM ANALYSIS CONTROLS AND PARAMETERS

Spectrum analysis parameter	Specification
Frequency span	V2820A-504: 200 Hz to 3.6 GHz <sup>9</sup> V2820A-506: 200Hz to 5.6 GHz <sup>10</sup> Zero span mode available
Sweep time settings in zero span mode	1 $\mu$ s to 30 sec <sup>11</sup>
Sweep modes	Continuous, single
IF bandwidth <sup>12</sup> Relative flatness over 20 MHz Relative flatness over 4 MHz 3 dB BW 6 dB BW	$\pm 1.0$ dB (typical) $\pm 0.5$ dB (typical) > 30 MHz (typical) > 38 MHz (typical)
Resolution bandwidths	1 Hz to 3 MHz (ENBW) with 1 Hz resolution for spans > 0 Hz <sup>13</sup>
Resolution bandwidth filters (1 Hz resolution) <sup>14</sup>	Brickwall: 10 Hz to 35 MHz, flat BW <sup>15</sup> Root Raised Cosine $\alpha=0.22$ : 10 Hz to 28 MHz, 3 dB BW Gaussian: 10 Hz to 7 MHz, 3 dB BW Five-pole synchronously tuned: 10 Hz to 2.3 MHz, 3 dB BW Four-pole synchronously tuned: 10 Hz to 1.75 MHz, 3 dB BW
Amplitude Reference level range setting Scale settings	+40 dBm to -170 dBm Manual: 0.1 dB/division to 40 dB/division
Pre-amplifier	On, off 400 MHz to 2.5 GHz (Nominal gain 15 dB) 2.5 GHz to 4.0 GHz (Nominal gain 20 dB) 4.0 GHz to 6.0 GHz (Nominal gain 18 dB)
Display Detection modes Trace hold displays	Normal, maximum, minimum, sample, power average, power average plus noise correction Normal, max hold, min hold, min/max hold

<sup>9</sup> Over range operation provided: Maximum span is 3.675 GHz. Performance below 400 MHz is not specified.

<sup>10</sup> Over range operation provided: Maximum span is 6.175 GHz. Performance below 400 MHz and above 6.0 GHz is not specified.

<sup>11</sup> Maximum sweep time is limited to 32 MSa data points.

<sup>12</sup> Flatness across a given measurement span is the sum of IF flatness and RF flatness.

<sup>13</sup> RBW accuracy < 1% Nominal.

<sup>14</sup> Filter types are settable in zero span, channel power list and ACPR modes.

<sup>15</sup> Filter is raised-cosine type, alpha = 0.091. ENBW and 6 dB BW is 1.1 \* RBW setting

## Specifications

Spectrum analysis parameter	Specification
Averaging Modes	1 to 1,000 traces <sup>16</sup> Log, power, log group, power group, max group, min group, min/max group
Markers  Marker amplitude resolution	Four independent markers, each with a delta marker, normal and peak modes  0.01 dB from front panel 0.001 dB from SCPI remote interface
Channel power list	Single command to execute up to 501 power measurements

### SPECTRUM ANALYSIS AMPLITUDE<sup>17</sup>

Amplitude parameter	Specification	
Maximum safe input power	+35 dBm	
Maximum safe DC voltage	± 50 VDC	
Absolute accuracy <sup>18</sup>	Specification (typical)	
325 MHz to 400 MHz	± 0.2 dB (Nominal)	
400 MHz ≤ Freq ≤ 2,000 MHz	± 0.6 (± 0.2) dB	
2,000 MHz < Freq ≤ 6000 MHz	± 0.8 (± 0.3) dB	
6,000 MHz < Freq ≤ 6,500 MHz	± 5.0 dB (Nominal)	
Reference level accuracy (referenced to 0 dBm)	Reference level setting	Accuracy
	+10 dBm to -75 dBm	± 0.2 dB
	-75 dBm to -100 dBm	± 0.6 dB
Display scale fidelity <sup>19</sup>	± 0.2 dB	
Attenuator accuracy <sup>20</sup>	<u>Frequency &lt; 2.5 GHz</u> ± 0.1 dB for 5 dB through 20 dB attenuator settings ± 0.15 dB for >20 dB attenuator setting <u>Frequency ≥ 2.5 GHz</u> ± 0.1dB for 5 dB through 10 dB attenuator settings ± 0.2 dB for 15 dB through 25 dB attenuator settings ± 0.25 dB for 30 dB attenuator setting	
Amplitude repeatability <sup>21</sup>	± 0.15 dB ± 0.07 dB (typical)	
Amplitude change due to preamp on	± 0.2dB, ± 0.15 dB (typical)	

<sup>16</sup> CDMA and WCDMA measurement personalities limit number of trace averages to 100.

<sup>17</sup> Specifications apply when autocoupled unless otherwise stated.

<sup>18</sup> Input power at 0 dBm, span = 1 MHz and RBW = 100 Hz.

<sup>19</sup> Signal level within 60 dB of top of screen, reference level 0 dBm, no change in instrument state.

<sup>20</sup> Only applies if input attenuator is changed from auto-coupled setting.

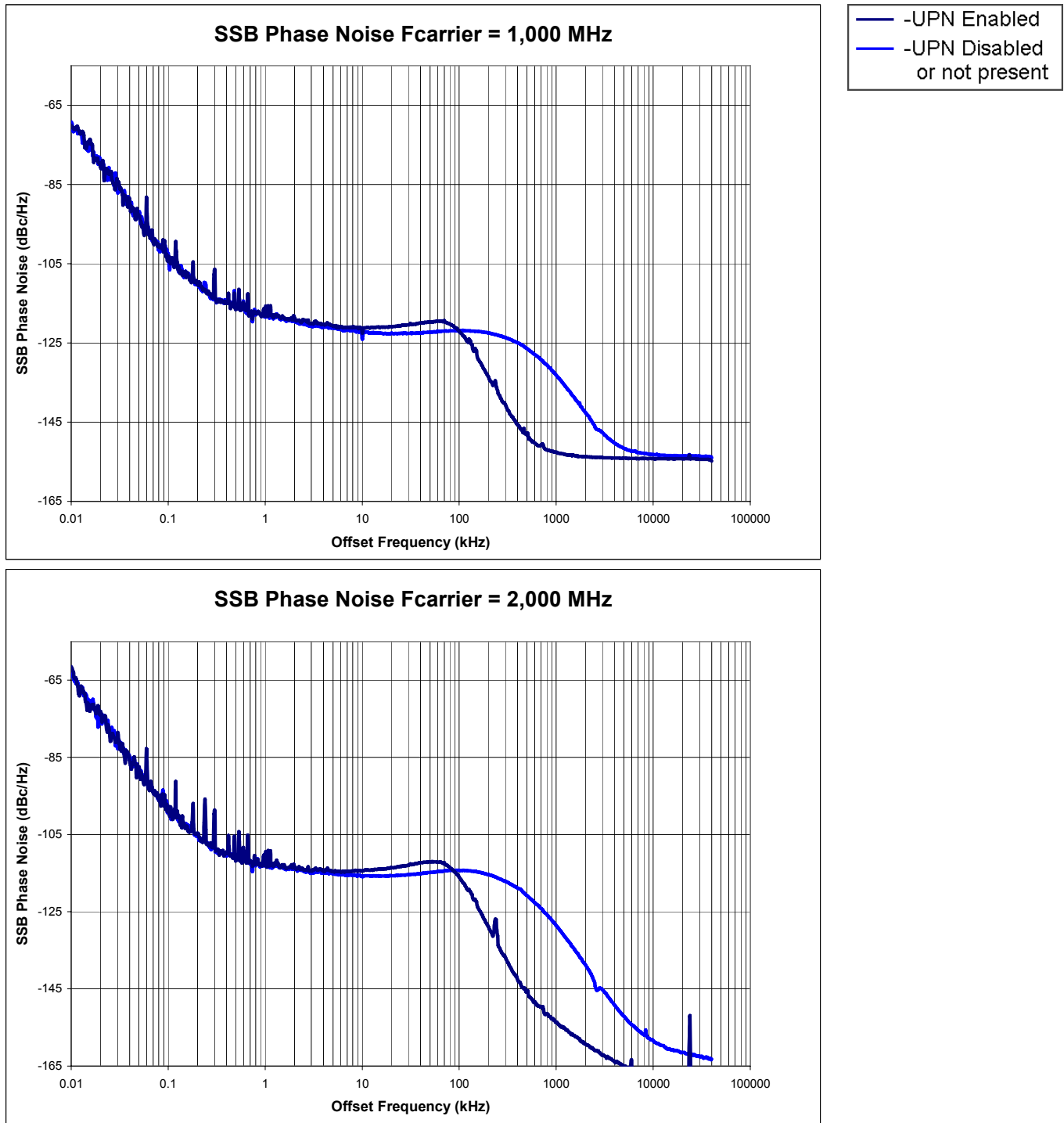
<sup>21</sup> For repetitive CW power readings with read signal removed then reapplied for signals: > 40 dB above noise floor within 5 minutes.

Amplitude parameter	Specification
Displayed average noise level <sup>22</sup>	$\leq -140$ dBm/Hz, pre-amp off ( $F \leq 2500$ MHz) $\leq -138$ dBm/Hz, pre-amp off ( $2500 \text{ MHz} < F \leq 4000$ MHz) $\leq -128$ dBm/Hz, pre-amp off ( $4000 \text{ MHz} < F \leq 6000$ MHz) $\leq -150$ dBm/Hz, pre-amp on ( $F \leq 2500$ MHz) $\leq -148$ dBm/Hz, pre-amp on ( $2500 \text{ MHz} < F \leq 4000$ MHz) $\leq -143$ dBm/Hz, pre-amp on ( $4000 \text{ MHz} < F \leq 6000$ MHz)
VSWR	$\leq 1.4:1$ (Nominal)
Spurious and residual responses	
TOI (referred to the RF input, two 0 dBm input signals and reference level = 0 dBm)	$F < 2325$ MHz = +35 dBm (Nominal) $F \geq 2325$ MHz = +34 dBm (Nominal)
SOI (referred to the RF input, 0 dBm input signals and reference level = 0 dBm)	+50 dBm (Nominal)
Residuals (reference level setting $\leq -40$ dBm) Pre-amp on	$\leq -95$ dBm
LO related spurs	$\leq -65$ dBc

<sup>22</sup> For V2820A-SPI units, 1dB degradation of performance across all frequency bands with preamp on and off.

## Specifications

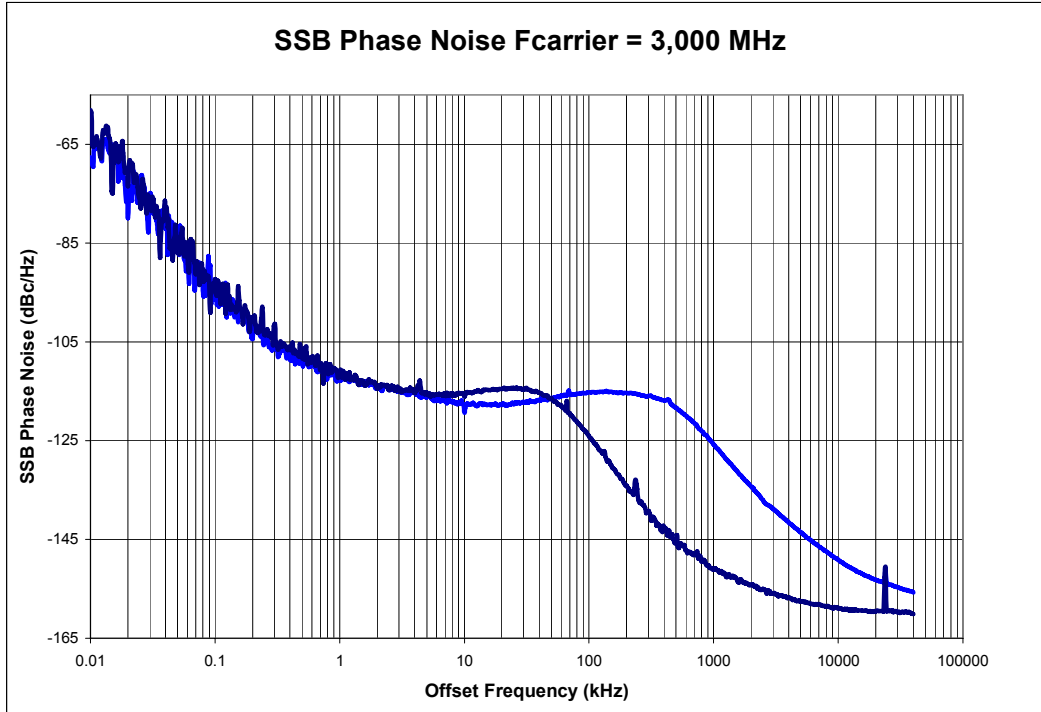
### PHASE NOISE FOR STANDARD PRODUCT vs. V2820A-UPN OPTION



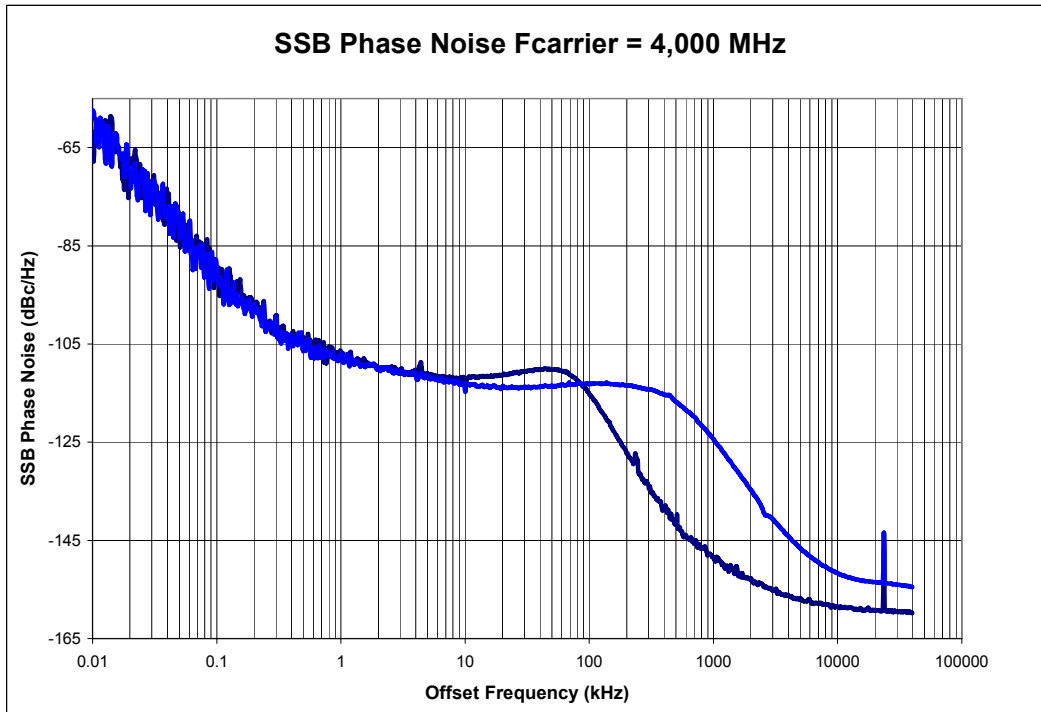
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Agilent V2820A Specifications, March 2010



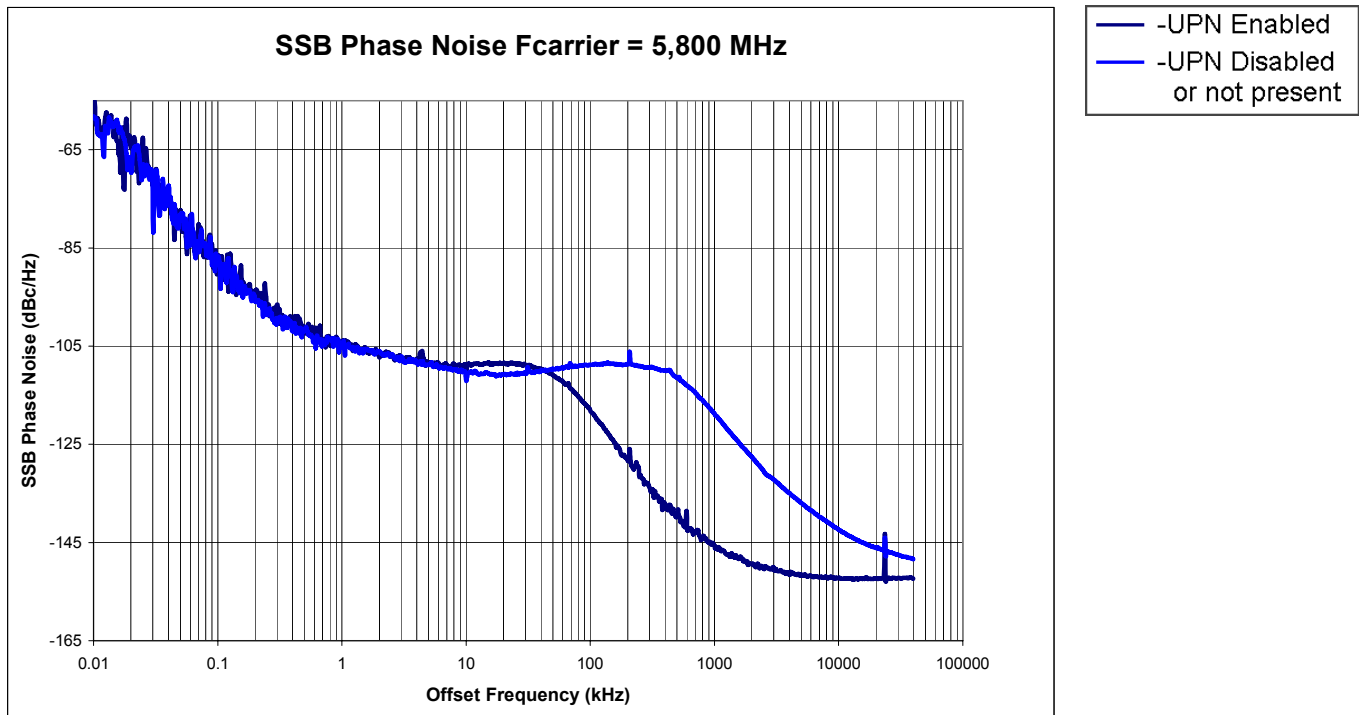


— -UPN Enabled  
 — -UPN Disabled or not present



Specifications are subject to change without notice.

## Specifications



### GENERATOR OUTPUT

Generator output parameter	Specification
Frequency range <sup>23</sup>	400 MHz to 2500 MHz
Sweep span <sup>24</sup>	0 MHz to 2100 MHz
Sweep points	1 to 501
Dwell setting	1 ms to 1 sec in 1-ms increments
Amplitude	Fixed: -18 dBm ± 5.0 dB (typical)

<sup>23</sup> Over range operation provided: 325 MHz to 2.7 GHz. Performance below 400 MHz and above 2.5 GHz is not specified.

<sup>24</sup> Over range operation provided: Maximum span: 2.375 GHz. Performance below 400MHz and above 2.5 GHz is not specified.

MEASUREMENT SPEED NOMINAL VALUES<sup>25 26</sup>

Measurement speed parameter	Nominal value	Remote Front Panel performance <sup>27</sup>
General Purpose mode Spectrum or zero span <sup>28</sup>	16.0 ms	7.29 ms
ACPR/ACLR <sup>29</sup> Center, upper & lower adjacent, upper & lower alternate V2820A-UPN: Center channel only (measurement of adjacent & alternate off)	5.0 ms 13.0 ms 4.0 ms	1.93 ms 6.5 ms 0.9 ms
Channel power list mode <sup>30</sup> Single frequency With any frequency change V2820A-UPN: Maximum reading rate (minimum step width) <sup>31</sup>	600 $\mu$ s per point 720 $\mu$ s per point 1500 $\mu$ s per point 100 $\mu$ s per point	590 $\mu$ s per point 670 $\mu$ s per point 1500 $\mu$ s per point 100 $\mu$ s per point
GSM mode <sup>32</sup> Phase error, channel power, and time mask Phase error and channel power free run trigger (burst measurement 100 averages) Phase error and channel power video trigger (burst measurement 100 averages) ORFS due to modulation or switching	22.4 ms 15.5 ms (6.3 ms/burst) 14 ms (4.7 ms/burst) 17.5 ms	8.4 ms 8.1 ms (6.2 ms/burst) 4.7 ms (4.6 ms/burst) 9.4 ms
EDGE mode <sup>33</sup> EVM, channel power, and time mask EVM and channel power (burst measurement 100 averages) ORFS due to modulation or switching	22.0 ms 18.7 ms (6.4 ms/burst) 20.7 ms	10.3 ms 9.9 ms (6.3 ms/burst) 9.4 ms
EDGE 2.0 EVM, channel power, and time mask EVM and channel power (burst measurement 100 averages) ORFS due to modulation or switching	22.9 ms 14.2 ms (5.0 ms/burst) 19 ms	9.2 ms 9.2 ms (4.9 ms/burst) 9.4 ms

<sup>25</sup> General test conditions: Fast mode on, noise correction off, range check off, randomize start off, background tasks off, display off.

<sup>26</sup> Except where noted, GPIB is used.

<sup>27</sup> Using the V2820A Remote Front Panel software running on a Windows XP, 3.4 GHz, desktop PC.

<sup>28</sup> Instrument preset, all settings auto coupled: 300 kHz  $\leq$  span  $\leq$  300 MHz. In zero span, sweep time  $\leq$  5 ms and 1 MHz BW. Time is trigger to data available.

<sup>29</sup> 100  $\mu$ s sweep time, 3.84 MHz BW, RRC filter.

<sup>30</sup> 101-point list, 400  $\mu$ s acquisition time,  $\geq$  1 MHz BW, brickwall.

<sup>31</sup>  $\leq$  50  $\mu$ s acquisition time,  $\geq$  1 MHz BW, brickwall.

<sup>32</sup> Single burst, no averaging.

<sup>33</sup> Single burst, no averaging.

## Specifications

Measurement speed parameter	Nominal value	Remote Front Panel performance <sup>27</sup>
cdma2000 mode		
Demodulation measurement <sup>34</sup>	46 ms	41 ms
ACPR method 1 <sup>35</sup>	4.6 ms	21.8 ms
V2820A-UPN:	29.5 ms	26.4 ms
ACPR method 2 <sup>36</sup>	223 ms	219.3 ms
V2820A-UPN:	232 ms	228.5 ms
Spectrum emissions mask and occupied bandwidth <sup>37</sup>	37 ms	16 ms
W-CDMA DL mode		
Demodulation measurement <sup>38</sup>	117.5 ms	108.6 ms
ACLR method 1 <sup>39</sup>	5.4 ms	2.3 ms
V2820A-UPN:	10 ms	6.8 ms
ACLR method 2 <sup>40</sup>	208 ms	205 ms
V2820A-UPN:	218 ms	214 ms
Spectrum emissions mask and occupied bandwidth <sup>41</sup>	49 ms	27 ms
W-CDMA UL mode		
Demodulation measurement <sup>42</sup>	69 ms	62 ms
ACLR method 1 <sup>43</sup>	5.1 ms	2.3 ms
V2820A-UPN:	10 ms	6.8 ms
ACLR method 2 <sup>44</sup>	209 ms	204 ms
V2820A-UPN:	218 ms	214 ms
Spectrum emissions mask and occupied bandwidth <sup>45</sup>	56 ms	34 ms

<sup>34</sup> Parameters measured: Rho, code domain power, RMS EVM, peak EVM, peak code domain error, frequency error, IQ offset, and total channel power.

<sup>35</sup> 500  $\mu$ s sweep.

<sup>36</sup> To preset condition accuracy, display off.

<sup>37</sup> Measured with General Purpose SEM measurement, Channel Sweep time = 100  $\mu$ s, Number of Averages = 1, measurement mode = sweep.

<sup>38</sup> Parameters measured: code domain power, RMS EVM, peak EVM, peak code domain error, frequency error, IQ offset, and total channel power.

<sup>39</sup> 100  $\mu$ s sweep.

<sup>40</sup> To preset condition accuracy, display off.

<sup>41</sup> Measured with general-purpose SEM measurement, channel Sweep time = 100  $\mu$ s, number of averages = 1, measurement mode = sweep.

<sup>42</sup> Parameters measured: code domain power, RMS EVM, peak EVM, peak code domain error, frequency error, IQ offset, and total channel power.

<sup>43</sup> 100  $\mu$ s sweep.

<sup>44</sup> 100 averages.

<sup>45</sup> Measured with general-purpose SEM measurement, channel sweep time = 100  $\mu$ s, number of averages = 1, measurement mode = sweep.

Measurement speed parameter	Nominal value	Remote Front Panel performance <sup>27</sup>
HSDPA Demodulation measurement <sup>46</sup>	130.5 ms	121.3 ms
WLAN mode <sup>47</sup>		
802.11a	14.4 ms	21.5 ms
	V2820A-UPN: 20.8 ms	23.6 ms
802.11b	34.6 ms	37 ms
	V2820A-UPN: 34.6 ms	37 ms
802.11j	15.8 ms	21.5 ms
	V2820A-UPN: 22.1 ms	25 ms
802.11n 20MHz signal bandwidth	20.7 ms	21.5 ms
	V2820A-UPN: 23.2 ms	25.4 ms
802.11n 40MHz signal bandwidth	17.2 ms	21.5 ms
	V2820A-UPN: 23.6 ms	28 ms
WiMAX mode <sup>48</sup>		
802.16e 10 MHz signal bandwidth	164.8 ms	99 ms
802.16e 20 MHz signal bandwidth	148.0 ms	80 ms
Maximum display refresh rate for a complete update of a 640x480 pixel VGA screen: Internal display	30 sweeps/sec (33 ms/sweep)	(PC-dependent)
Data transfer over LAN/TCP/IP	Up to 0.4 MBps	Up to 10 MBps <sup>49</sup>
Remote trace data transfer: <sup>50</sup>		
LAN	3.7 ms	0.9 ms
USB	13 ms	n/a
GPIO	24 ms	n/a
Time to switch between measurements: <sup>51</sup>		
Within general purpose mode	5.5 ms	2.0 ms
From digital to general purpose mode	10.7 ms	3.5 ms
From general purpose to digital mode	12.4 ms	3.6 ms
Within GSM or EDGE mode	9.4 ms	3.6 ms
From cdma2000 or WCDMA non-demodulate to demodulate	15.9 ms	4.4 ms
From cdma2000 or WCDMA demodulate to non-demodulate	11.8 ms	6.4 ms

<sup>46</sup> Parameters measured: Code domain power, RMS EVM, peak EVM, peak code domain error, frequency error, IQ offset, and total channel power.

<sup>47</sup> Display off, plots turned off, mean of 100 iterations, no frequency change, time includes GPIO transfer time (802.11b waveform with 504 chips).

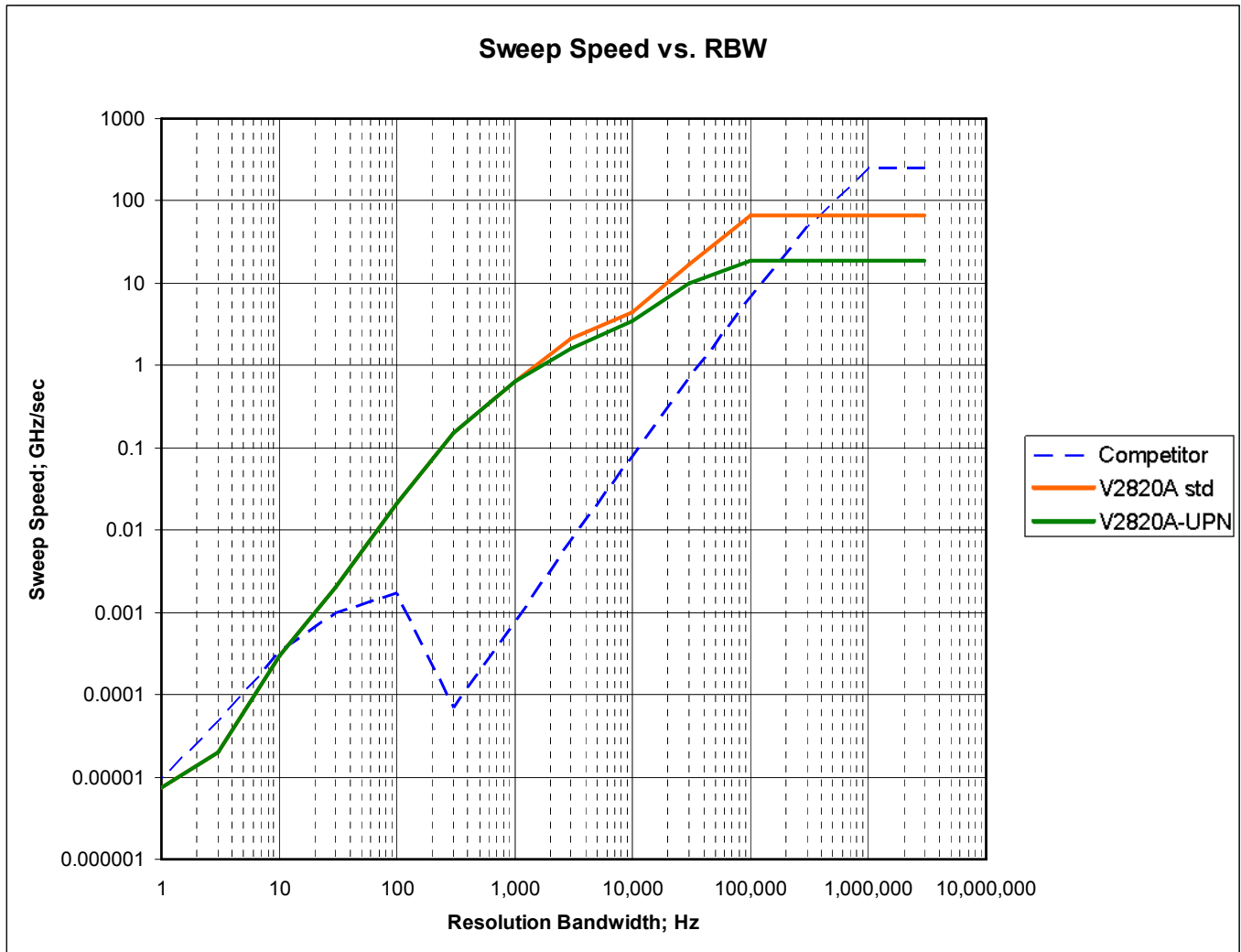
<sup>48</sup> FFT Size: 1024, channel equalization: Channel estimated sequence plus pilots.

<sup>49</sup> Using PC socket connection.

<sup>50</sup> Zero span, sweep time 100  $\mu$ s, binary data transfer, 501 data points.

<sup>51</sup> Display off, MEAS1 ; INIT ; IMM ; \*WAI ; ; MEAS2 ; INIT ; IMM ; \*OPC.

Supplemental speed information



## V2800A-102: GSM/GPRS/EDGE SIGNAL ANALYSIS PERSONALITY

GSM/GPRS power and modulation quality parameter	Specification (carrier $\leq$ 2.5 GHz)		
Channel power Measurement range Accuracy	+33 dBm to -30 dBm (typical) $\pm$ 0.6 dB (typical)		
Phase and frequency error Frequency error measurement range Frequency error accuracy RMS phase error measurement range RMS phase error accuracy Peak phase error measurement range <sup>52</sup> Peak phase error accuracy <sup>53</sup> Phase error floor	$\pm$ 50 kHz (typical) $\pm$ 10 Hz (typical) 0 to 10° (typical) $< \pm$ 1° 0 to 25° (typical) $\pm$ 2° RMS: 0.35°, peak: 1.0°		
Time mask conformance Sampling resolution Accuracy along burst peak Outputs	0.615 $\mu$ s (1/6 bit) $\pm$ 0.25 dB Pass/fail, complete burst with upper and lower mask limit lines		
Output RF spectrum <sup>54</sup>			
Relative accuracy	$\pm$ 0.7dB (typical)		
ORFS due to modulation			
Dynamic range (dBc)	Offset frequency in kHz	Carrier frequency Fc (typical in parenthesis)	
		400 MHz $\leq$ Fc $\leq$ 1 GHz	1 GHz $<$ Fc $<$ 2 GHz
	200	35	35
	250	40	40
	400	68	67
	600	73 (76)	72 (74)
	1200	77 (80)	77 (79)
Dynamic range (dBc) for Mode V2820A-UPN	Offset frequency in kHz	Carrier frequency Fc (typical in parenthesis)	
		400 MHz $\leq$ Fc $\leq$ 1 GHz	1 GHz $<$ Fc $<$ 2 GHz
	200	35	35
	250	40	40
	400	70	69
	600	81 (82)	79 (81)
	1200	82 (84)	82 (83)
1800 <sup>55</sup>	77 (79)	77 (79)	
ORFS due to switching			
Dynamic range (dBc)	Offset frequency in kHz	Carrier frequency Fc (typical)	
		400 MHz $\leq$ Fc $\leq$ 1 GHz	1 GHz $<$ Fc $<$ 2 GHz
	400	67 (68)	66 (67)
	600	73 (74)	70.5 (72)
1200	77 (79)	76 (78)	

<sup>52</sup> Average of peak from each burst.<sup>53</sup> Average of peak from each burst.<sup>54</sup> Nominal carrier power at RF input  $\geq$  -10 dBm. Does not include level uncertainty due to inherent noise.<sup>55</sup> 1800 kHz offset measured using 100 kHz RBW. All other offsets measured using 30 kHz RBW.<sup>56</sup> 1800 kHz offset measured using 100 kHz RBW. All other offsets measured using 30 kHz RBW.

## Specifications

GSM/GPRS power and modulation quality parameter	Specification (carrier ≤ 2.5 GHz)		
	1800	80 (81)	80 (81)
Dynamic range (dBc) for Mode V2820A-UPN	Offset frequency in kHz	Carrier frequency Fc (typical)	
		400 MHz ≤ Fc ≤ 1 GHz	1 GHz < Fc < 2 GHz
	400	69 (70)	69 (70)
	600	78 (80)	77 (79)
	1200	82 (84)	82 (84)
	1800	83 (85)	81 (83)
Displays	Power vs. time with time mask, ORFS due to modulation, ORFS due to switching, phase error vs. time, symbols vs. time		

EDGE power and modulation quality parameter	Specification (carrier ≤ 2.5 GHz)	
Channel power		
Measurement range	+33 dBm to -30 dBm (typical)	
Accuracy	± 0.6 dB (typical)	
Frequency error		
Frequency error measurement offset	± 50 kHz (typical)	
Frequency error accuracy	± 10 Hz (typical)	
EVM		
RMS measurement range	0 to 15% (typical)	
RMS floor	≤ 0.6%	
Origin offset range	-20 dBc maximum (typical)	
RMS accuracy	± 0.5%	
Time mask conformance		
Sampling resolution	0.615 μs (1/6 bit) (typical)	
Accuracy along burst peak <sup>57</sup>	± 0.25 dB (typical)	
Output RF spectrum <sup>58</sup>		
Relative accuracy	± 0.7 dB (typical)	

<sup>57</sup> Pass/fail, complete burst with upper and lower mask limit lines.

<sup>58</sup> Nominal carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.



EDGE power and modulation quality parameter	Specification (carrier ≤ 2.5 GHz)		
ORFS due to modulation			
Dynamic range (dBc)	Offset frequency in kHz	Carrier frequency Fc (typical in parenthesis)	
		400 MHz ≤ Fc ≤ 1 GHz	1 GHz < Fc ≤ 2 GHz
	200	37	37
	250	41	41
	400	68	67
	600	73 (74)	71 (73)
	1200	78 (79)	77 (78)
1800 <sup>59</sup>	75 (77)	75 (77)	
Dynamic range (dBc) for Mode V2820A-UPN	Offset frequency in kHz	Carrier frequency Fc (typical in parenthesis)	
		400 MHz ≤ Fc ≤ 1 GHz	1 GHz < Fc ≤ 2 GHz
	200	37	37
	250	41	41
	400	70	70
	600	80 (81)	79 (80)
	1200	81 (83)	80 (82)
1800 <sup>60</sup>	77 (79)	77 (79)	
ORFS due to switching			
Dynamic range (dBc)	Offset frequency in kHz	Carrier frequency Fc (typical)	
		400 MHz ≤ Fc ≤ 1 GHz	1GHz < Fc ≤ 2 GHz
	400	67 (68)	66 (67)
	600	72 (73)	70 (72)
	1200	77 (78)	76 (77)
1800	80 (81)	80 (81)	
Dynamic range (dBc) for Mode V2820A-UPN	Offset frequency in kHz	Carrier frequency Fc (typical)	
		400 MHz ≤ Fc ≤ 1 GHz	1GHz < Fc ≤ 2 GHz
	400	67 (68)	68 (69)
	600	78 (79)	78 (79)
	1200	80 (82)	79 (81)
1800	80 (82)	81 (83)	
Displays	Power vs. time with time mask, ORFS due to modulation, ORFS due to switching, EVM vs. time, symbols vs. time, constellation		

<sup>59</sup> 1800kHz offset measured using 100 kHz RBW. All other offsets measured using 30 kHz RBW.

<sup>60</sup> 1800kHz offset measured using 100 kHz RBW. All other offsets measured using 30 kHz RBW.

## Specifications

### V2800A-103: EDGE EVOLUTION SIGNAL ANALYSIS

<b>EDGE Evolution power and modulation quality parameter</b>	<b>Specification (carrier ≤ 2.5 GHz)</b>
Channel power Measurement range Accuracy	+33 dBm to -30 dBm (typical) ± 0.6 dB (typical)
Frequency error Frequency error measurement offset Frequency error accuracy	± 50kHz (typical) ± 10Hz (typical)
EVM RMS measurement range RMS floor  Origin offset range RMS accuracy	0 to 15% (typical) ≤ 0.50% - 20 dBc maximum (typical) ± 0.5%
Time mask conformance Sampling resolution Accuracy along burst peak Outputs	0.615 μs (1/6 bit) (typical) ± 0.25 dB (typical) Pass/fail, complete burst with upper and lower mask limit lines
Displays	Power vs. time with time mask, ORFS due to modulation, ORFS due to switching, EVM vs. time, symbols vs. time, constellation

EDGE Evolution power and modulation quality parameter		Specification (carrier $\leq$ 2.5 GHz)	
Output RF spectrum <sup>61</sup>			
Relative accuracy		$\pm 0.7$ dB (typical)	
ORFS due to modulation			
Dynamic range (dBc)	Offset frequency in kHz	Carrier frequency Fc (typical in parenthesis)	
		400 MHz $\leq$ Fc $\leq$ 1 GHz	1 GHz < Fc $\leq$ 2 GHz
		200	36
		250	39
		400	68 (69)
		600	74 (75)
		1200	77.5 (78.5)
1800 <sup>62</sup>	74 (75)	72 (75)	
Dynamic range (dBc) for V2820A-UPN	Offset frequency in kHz	Carrier frequency Fc (typical in parenthesis)	
		400 MHz $\leq$ Fc $\leq$ 1 GHz	1 GHz < Fc $\leq$ 2 GHz
		200	36
		250	39
		400	69
		600	77 (78)
		1200	79 (80)
1800 <sup>63</sup>	75 (76)	76 (77)	
ORFS due to switching			
Dynamic range (dBc)	Offset frequency in kHz	Carrier frequency Fc (typical)	
		400 MHz $\leq$ Fc $\leq$ 1 GHz	1 GHz < Fc $\leq$ 2 GHz
		400	67 (68)
		600	74 (75)
		1200	78 (79)
1800	79 (82)	77 (80)	
Dynamic range (dBc) for V2820A-UPN	Offset frequency in kHz	Carrier frequency Fc (typical)	
		400 MHz $\leq$ Fc $\leq$ 1 GHz	1 GHz < Fc $\leq$ 2 GHz
		400	70
		600	78 (79)
		1200	80 (81)
1800	80 (81)	80.5 (81.5)	

<sup>61</sup> Nominal carrier power at RF input  $\geq$  -10 dBm. QAM32 R325 Normal. Does not include level uncertainty due to inherent noise.

<sup>62</sup> 1800kHz offset measured using 100 kHz RBW. All other offsets measured using 30 kHz RBW.

<sup>63</sup> 1800kHz offset measured using 100 kHz RBW. All other offsets measured using 30 kHz RBW.

## Specifications

### V2800A-104: CDMA2000 REVERSE LINK SIGNAL ANALYSIS PERSONALITY

cdma2000 power and modulation quality parameter	Specification (carrier ≤ 2.5 GHz)
Channel power Measurement range Accuracy (1.2288 MHz BW)	+33 dBm to -70 dBm (typical) ± 0.6 dB (typical)
Frequency error Frequency error measurement range Frequency error accuracy	± 3 kHz (typical) ± 10 Hz (typical)
Rho ( $\rho$ ) Range Ceiling Accuracy	0.7 $\rho$ to 1.0 $\rho$ (typical) > 0.9995 $\rho$ ± 0.005 $\rho$ (for $\rho$ values > 0.9)
Code domain power Relative accuracy, for code channels ≥ -20dB of total power	± 0.3 dB (typical)
Adjacent channel power <sup>64</sup> Dynamic range  V2820A-UPN:	74 dBc at 885 kHz offset (typical) 86 dBc at 1980 kHz offset (typical)  79 dBc at 885 kHz offset (typical) 88.5 dBc at 1980 kHz offset (typical)
Relative accuracy	± 0.5 dB (typical)
Occupied bandwidth Frequency accuracy	± 5 kHz (typical)
Spectrum emissions mask <sup>65</sup> Accuracy relative to carrier power	< 0.5 dB
Displays	Code domain power, adjacent channel power with limits, occupied bandwidth with limit lines, conducted spurious emissions with limits

<sup>64</sup> Carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.

<sup>65</sup> Carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.

## V2800A-106: WCDMA UPLINK SIGNAL ANALYSIS PERSONALITY

W-CDMA power and modulation quality parameter	Specification (carrier = 1800 MHz to 2200 MHz)
Channel power Measurement range Accuracy (3.84 MHz BW)	+33 dBm to -60 dBm (typical) ± 0.6 dB (typical)
Frequency error Frequency error measurement range Frequency error accuracy	± 3 kHz (typical) ± 10 Hz (typical)
RMS EVM Range Floor Accuracy	0% to 25% (typical) 1.8% (typical) ± 2%
Code domain power Relative accuracy, for code channels ≥ -20 dB of total power.	± 0.3 dB
Adjacent channel power <sup>66</sup> Dynamic range  V2820A-UPN:	67 dBc at 5 MHz offset (typical) 69 dBc at 10 MHz offset (typical)  68 dBc at 5 MHz offset (typical) 70 dBc at 10 MHz offset (typical)
Relative accuracy	± 0.5 dB (typical)
Occupied bandwidth Frequency accuracy	± 20 kHz (Nominal)
Spectrum emissions mask <sup>67</sup> Accuracy relative to carrier power	< 1.5 dB (Nominal)
Displays	Code domain power, adjacent channel power with limits, occupied bandwidth with limit lines, spectrum emissions with limits

<sup>66</sup> Carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.

<sup>67</sup> Carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.

## Specifications

### V2800A-105: WCDMA DOWNLINK SIGNAL ANALYSIS PERSONALITY

W-CDMA power and modulation quality parameter	Specification (carrier frequency = 1800 MHz to 2200 Mhz)
Channel power Measurement range Accuracy (3.84 MHz BW)	+33 dBm to -60 dBm (typical) ± 0.6 dB (typical)
Frequency error Frequency error measurement range Frequency error accuracy	± 3 kHz (typical) ± 10 Hz (typical)
RMS EVM Range Floor Accuracy Symbol EVM <sup>68</sup>	0% to 25% (typical) 1.8% (typical) ± 2% 0.5%
Code domain power Relative accuracy, for code channels ≥ -20 dB of total power.	± 0.3 dB
Adjacent channel power <sup>69</sup> Dynamic range  V2820A-UPN:	67 dBc at 5 MHz offset (typical) 69 dBc at 10 MHz offset (typical) 68 dBc at 5 MHz offset (typical) 70 dBc at 10 MHz offset (typical)
Relative accuracy	± 0.5 dB (typical)
Occupied bandwidth Frequency accuracy	± 20 kHz (Nominal)
Spectrum emissions mask <sup>70</sup> Accuracy relative to carrier power	< 1.5 dB (Nominal)
Displays	Code domain power, adjacent channel power with limits, occupied bandwidth with limit lines, spectrum emissions with limits

<sup>68</sup> Valid for CPICH only signal.

<sup>69</sup> Carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.

<sup>70</sup> Carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.

V2800A-107: WCDMA HSPA DOWNLINK SIGNAL ANALYSIS PERSONALITY , and  
 V2800A-108: WCDMA HSPA UPLINK SIGNAL ANALYSIS PERSONALITY

<b>HSPA power and modulation quality parameter</b>	<b>Specification (carrier frequency = 1800 MHz to 2200 MHz)</b>
Channel power Measurement range Accuracy (3.84 MHz BW)	+33 dBm to -60 dBm (typical) ± 0.6 dB (typical)
Frequency error Frequency error measurement range Frequency error accuracy	± 3 kHz (typical) ± 10 Hz (typical)
RMS EVM Range Floor <sup>71</sup> QPSK 16QAM 64QAM  Accuracy	0% to 25% (typical) 2.25% (typical) <sup>72</sup> 1.25% (Nominal) 1.30% (Nominal) 1.35% (Nominal)  ± 2%
Code domain power Relative accuracy, for code channels ≥ -20 dB of total power.	± 0.3 dB
Adjacent channel power <sup>73</sup> Dynamic range	-66 dBc @ 5 MHz offset (typical) -68 dBc @ 10 MHz offset (typical)
Relative accuracy	± 0.5 dB (typical)
Occupied bandwidth Frequency accuracy	± 20 kHz (Nominal)
Spectrum emissions mask <sup>74</sup> Accuracy relative to carrier power	< 1.5 dB (Nominal)
Displays	Code domain power, adjacent channel power with limits, occupied bandwidth with limit lines, spectrum emissions with limits

<sup>71</sup> Test model 5 with two HS-PDSCH channels (HS channels are: QPSK or 16 QAM or 64 QAM).

<sup>72</sup> Test model 5 with two HS-PDSCH channels (HS channels using 16 QAM).

<sup>73</sup> Carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.

<sup>74</sup> Carrier power at RF input ≥ -10 dBm. Does not include level uncertainty due to inherent noise.

## Specifications

### V2800A-110: WIRELESS LAN (WLAN) SIGNAL ANALYSIS PERSONALITY

WLAN power and modulation quality parameter	Specification	
Channel power Measurement range Carrier frequency 2.4 GHz Carrier frequency 4.9 and 5.8 GHz  Accuracy OFDM 20 MHz signal bandwidth OFDM 40 MHz signal bandwidth DSSS/CCK	+33 dBm to -60 dBm (typical) +15 dBm to -60 dBm (typical)  ± 0.85 dB (typical) ± 0.85 dB (typical) ± 0.85 dB (typical)	
Frequency error Measurement range OFDM DSSS/CCK  Accuracy	± 312 kHz ± 100 kHz  ± 10 Hz (typical)	
RMS EVM floor <sup>75</sup> Nominal	Standard phase noise	Model 2820A-UPN
802.11a	-42.5 dB at 4.9 to 5.8GHz	-44 dB at 4.9 to 5.8GHz
802.11b	-49 dB at 2.4 GHz	-50.5 dB at 2.4 GHz
802.11g	-47 dB at 2.4 GHz	-50.5 dB at 2.4 GHz
802.11j	-44 dB at 4.9 GHz	-45 dB at 4.9 GHz
802.11n 20 MHz signal bandwidth <sup>76</sup>	-46 dB at 2.4 GHz -42 dB at 5.1 to 5.8GHz	-48 dB at 2.4 GHz -44 dB at 5.1 to 5.8GHz
802.11n 40 MHz signal bandwidth <sup>77</sup>	-40 dB at 5.1 to 5.8GHz	-42 dB at 5.1 to 5.8GHz
Channel flatness mask margin OFDM 20 MHz signal bandwidth OFDM 40 MHz signal bandwidth	1.4 dB (typical) at 2.4 GHz and 5.8 GHz 1.0 dB (typical) at 5.8 GHz	

<sup>75</sup> Applies when input signal is above -20 dBm, with expected channel power set equal to input power.

<sup>76</sup> Measuring 802.11n SISO signals when configured as the master in a MIMO system configuration can degrade the EVM floor up to 3 dB.

<sup>77</sup> Measuring 802.11n SISO signals when configured as the master in a MIMO system configuration can degrade the EVM floor up to 3 dB.



## V2800A-111: WiMAX SIGNAL ANALYSIS PERSONALITY

WiMAX power and modulation quality parameter	Specification
Channel Power Measurement Range Carrier Frequency < 3.6 GHz  Accuracy 10 MHz signal bandwidth 20 MHz signal bandwidth	+33 dBm to -60 dBm (typical)  ± 0.85 dB (typical) ± 0.85 dB (typical)
Frequency Error Measurement Range 10MHz BW signal bandwidth <sup>78</sup> 20MHz BW signal bandwidth <sup>79</sup>  Accuracy	± 60 kHz ± 120 kHz  ± 10 Hz (Nominal)
RCE Floor <sup>80</sup> 10 MHz signal bandwidth <sup>81</sup>  20 MHz signal bandwidth <sup>82</sup>	Typical (Nominal) -47 dB (-48 dB) at 700 MHz -45.5 dB (-47 dB) at 2.5 GHz -44 dB (-46 dB) at 3.5 GHz  -44 dB (-46 dB) at 700 MHz -43 dB (-45 dB) at 2.5 GHz -42 dB (-44 dB) at 3.5 GHz
Channel Flatness Mask Margin 10 MHz signal bandwidth 20 MHz signal bandwidth	1.8 dB (Nominal) 1.7 dB (Nominal)
Spectrum emissions mask <sup>83</sup> Accuracy relative to carrier power	< 2.0 dB sweep mode (Nominal) < 1.0 dB step mode (Nominal)

<sup>78</sup> FFT Size: 1024, channel equalization: Channel estimated sequence plus pilots.

<sup>79</sup> FFT Size: 1024, channel equalization: Channel estimated sequence plus pilots.

<sup>80</sup> Applies when input signal is above -20 dBm, with Expected Channel Power set equal to input power.

<sup>81</sup> FFT Size: 1024, channel equalization: Channel estimated sequence plus pilots.

<sup>82</sup> FFT Size: 1024, channel equalization: Channel estimated sequence plus pilots.

<sup>83</sup> Carrier power at RF input ≥ -20 dBm. Does not include level uncertainty due to inherent noise.

## Specifications

### V2800A-101: FLEXIBLE DIGITAL MODULATION GENERATION PERSONALITY

FSK parameters		Specification
Modulation Type	FSK2	
Filters	Filter Types	Rectangular, RC, RRC, Gaussian, NRZ Gauss
Filter factor	RC, RRC Gaussian, NRZ Gauss	Ratio is 0.2 to 1.0 Ratio is 0.2 to 3.0
Symbol rate	Symbol rate resolution	1 symbols/sec (Sps)
	Minimum symbol rate	10 KSps
	Maximum symbol rate	Gaussian, NRZ Gauss <ul style="list-style-type: none"> <li>▪ 3.125 MSps (factor &lt; 0.5)</li> <li>▪ 2.5 MSps (0.5 ≤ factor &lt; 1.0)</li> <li>▪ 1.25 MSps (factor ≥ 1.0)</li> </ul> RC, RRC, rectangular <ul style="list-style-type: none"> <li>▪ 1.25 MSps</li> </ul>
Frequency separation	Range	Gaussian, NRZ Gauss, rectangular <ul style="list-style-type: none"> <li>▪ 2 X symbol rate</li> </ul> RC, RRC <ul style="list-style-type: none"> <li>▪ 1 X symbol rate</li> </ul>
PSK parameters		Specification
Modulation types	BPSK QPSK $\pi/4$ QPSK $3\pi/4$ QPSK 8PSK	
Filters	Filter types	NRZ, RC, RRC, Gaussian, NRZ Gauss, Wideband
Filter factor	RC, RRC Gaussian, NRZ Gauss	Ratio is 0.2 to 1.0 Ratio is 0.3 to 3.0
Symbol rate	Symbol rate resolution	1 symbols/sec (Sps)
	Minimum symbol rate	10 KSps
	Maximum symbol rate	Gaussian, NRZ Gauss <ul style="list-style-type: none"> <li>▪ 3.125 MSps (factor &lt; 0.5)</li> <li>▪ 2.5 MSps (0.5 ≤ factor &lt; 1.0)</li> <li>▪ 1.25 MSps (factor ≥ 1.0)</li> </ul> NRZ, wideband <ul style="list-style-type: none"> <li>▪ 1.25 MSps</li> </ul> RC, RRC <ul style="list-style-type: none"> <li>▪ 6.25 MSps</li> </ul>
EVM Nominal Values		
Modulation	Filter Type	RMS EVM; %
All PSK	NRZ, Wideband	< 0.25%
FSK	NRZ	< 0.3%

Specifications are subject to change without notice.

## TRIGGER AND SYNCHRONIZATION INPUTS AND OUTPUTS

Trigger and synchronization input and output parameters	Events
Trigger sources <sup>84</sup>	Free run External Video Bus External arm using video trigger Bus arm using external or video trigger Latched External
Trigger delay range	-30 sec to +30 sec
Trigger modes	On measurement On acquire
External trigger	Selectable on rising or falling edge of external input Input level TTL Minimum input pulse width required 50 ns (Nominal)
Video trigger modes	Selectable on rising or falling signal edge Video level Prequalification mode level and time settings
Sync output modes	Generate a sync pulse: Off Begin measurement Start tune Ready acquire Start acquire End acquire End measurement
Sync output polarity select	Sync out is on the rising or falling edge
Sync output	TTL level Minimum pulse width 200 ns (Nominal)
Even second clock input	External even second clock (TTL)-
Even second clock output	External even second clock (TTL)-

<sup>84</sup> Bus trigger and bus arm available only in channel power list mode.

## Specifications

### GENERAL SPECIFICATIONS

General specifications											
IEC	This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 61010-1 Second Edition.										
EMC compliance	<ul style="list-style-type: none"> <li>▪ Complies with European EMC Directive 2004/108/EC</li> <li>▪ IEC/EN 61326-1 or IEC/EN 61326-2-1</li> <li>▪ CISPR Pub 11 Group 1, class A</li> <li>▪ AS/NZS CISPR 11</li> <li>▪ ICES/NMB-001: This ISM device complies with Canadian ICES-001. (Cet appareil ISM est conforme a la norme NMB du Canada.)</li> </ul>										
Safety compliance	<ul style="list-style-type: none"> <li>▪ Complies with European Low Voltage Directive 2006/95/EC</li> <li>▪ IEC/EN 61010-1, 2nd Edition</li> <li>▪ Canada: CSA 22.2 N0. 61010-1-04</li> <li>▪ USA: UL Std No. 61010-1 (Second Edition)</li> <li>▪ This instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermverordnung - 3.GSGV Deutschland): <table border="1" data-bbox="548 743 1122 877"> <thead> <tr> <th>Acoustic noise emission</th> <th>Geraeuschemission</th> </tr> </thead> <tbody> <tr> <td>LpA &lt; 70 dB</td> <td>LpA &lt; 70 dB</td> </tr> <tr> <td>Operator position</td> <td>Am Arbeitsplatz</td> </tr> <tr> <td>Normal position</td> <td>Normaler Betrieb</td> </tr> <tr> <td>Per ISO 7779</td> <td>Nach DIN 45635 t.19</td> </tr> </tbody> </table> </li> </ul>	Acoustic noise emission	Geraeuschemission	LpA < 70 dB	LpA < 70 dB	Operator position	Am Arbeitsplatz	Normal position	Normaler Betrieb	Per ISO 7779	Nach DIN 45635 t.19
Acoustic noise emission	Geraeuschemission										
LpA < 70 dB	LpA < 70 dB										
Operator position	Am Arbeitsplatz										
Normal position	Normaler Betrieb										
Per ISO 7779	Nach DIN 45635 t.19										
Power requirements	100 VAC to 240 VAC; 50/60 Hz (automatically detected); 130 VA max.										
Calibration	Annual calibration cycle in system.										
Environment (for indoor use only)	<ul style="list-style-type: none"> <li>▪ 18°C to 28°C specified operating, unless otherwise noted</li> <li>▪ 0°C to 50°C operating range (+23°C is optimal)</li> <li>▪ -25°C to 65°C storage (AC power off)</li> <li>▪ Altitude: 2000 meters above sea level maximum specified operating</li> <li>▪ Cooling forced air top, bottom and side intakes, and rear exhaust. For proper cooling in a rack, use Agilent Technologies Inc. V2820A-1CM Rack Mount Kit.</li> </ul>										
Digital inputs/outputs	4 bits, TTL-compatible										
Interfaces	<ul style="list-style-type: none"> <li>▪ IEEE-488.1 compliant; supports IEEE-488.2 common commands and status model topology</li> <li>▪ LAN: 10/100 BT Ethernet, RJ45, LXI Class C, no auto MDIX</li> <li>▪ IVI-COM</li> <li>▪ USB: <ul style="list-style-type: none"> <li>○ B-style connector ("FROM HOST") is USB 2.0 compliant</li> <li>○ All A-style connectors are USB 1.1 compliant</li> </ul> </li> <li>▪ RF in / TG out: Type N connector</li> </ul>										
Mechanical vibration and shock (type tested)	<ul style="list-style-type: none"> <li>▪ Random Vibration: MIL-PRF-28800F CL3, 3 axes, 5-500 Hz, 2.09g RMS</li> <li>▪ Sine-Sweep for resonances: 3 axes, 5-500 Hz, 0.5g</li> <li>▪ Bench Handling: MIL-STD-810F, 4.5.7 Procedure VI</li> </ul>										
General mechanical information	<ul style="list-style-type: none"> <li>▪ Height: 3U (133 mm) (5.25 in.)</li> <li>▪ Width: Half-rack (213 mm) (8.4 in.)</li> <li>▪ Depth: 464 mm (18.25 in.)</li> <li>▪ Weight: 7.5 kg (16.5 lb)</li> </ul>										
Warranty	1 year										
Accessories supplied	<ul style="list-style-type: none"> <li>▪ AC power cable</li> <li>▪ Printed Quick Start Guide</li> <li>▪ CD-ROM containing V2820A VSA system help, utility programs, and PDF files (also available on the Agilent Technologies Inc. website at <a href="http://www.agilent.com">www.agilent.com</a>).</li> </ul>										

Specifications are subject to change without notice.