



Agilent X-Series Signal Analyzer

**This manual provides documentation for the
following X-Series Analyzer:**

EXA Signal Analyzer N9010A

**N9010A EXA
Specifications Guide
(Comprehensive Reference Data)**



Agilent Technologies

Notices

© Agilent Technologies, Inc. 2007 - 2013

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number

N9010-90025
Supersedes: August 2013

Print Date

December 2013

Printed in USA

Agilent Technologies, Inc.
1400 Fountaingrove Parkway
Santa Rosa, CA 95403

Warranty

The material contained in this document is provided “as is,” and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or subcontract, Software is delivered and

licensed as “Commercial computer software” as defined in DFAR 252.227-7014 (June 1995), or as a “commercial item” as defined in FAR 2.101(a) or as “Restricted computer software” as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies’ standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

Safety Notices

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.

WARNING

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.

Warranty

This Agilent technologies instrument product is warranted against defects in material and workmanship for a period of three years from the date of shipment. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about this analyzer, including firmware upgrades, application information, and product information, see the following URLs:

<http://www.agilent.com/find/exa>

To receive the latest updates by email, subscribe to Agilent Email Updates:

<http://www.agilent.com/find/emailupdates>

Information on preventing analyzer damage can be found at:

<http://www.agilent.com/find/tips>

1. Agilent EXA Signal Analyzer

Definitions and Requirements	18
Definitions	18
Conditions Required to Meet Specifications	18
Certification	18
Frequency and Time	19
Frequency Range	19
Band	19
Standard Frequency Reference	20
Precision Frequency Reference	21
Frequency Readout Accuracy	22
Frequency Counter	23
Frequency Span	23
Sweep Time and Trigger	24
Triggers	25
Gated Sweep	26
Number of Frequency Sweep Points (buckets)	26
Nominal Measurement Time vs. Span [Plot]	27
Resolution Bandwidth (RBW)	28
Analysis Bandwidth	29
Preselector Bandwidth	29
Video Bandwidth (VBW)	30
Amplitude Accuracy and Range	31
Measurement Range	31
Maximum Safe Input Level	31
Display Range	31
Marker Readout	32
Frequency Response	33
IF Frequency Response	34
IF Phase Linearity	35
Absolute Amplitude Accuracy	36
Input Attenuation Switching Uncertainty	37
RF Input VSWR	38
Resolution Bandwidth Switching Uncertainty	38
Reference Level	38
Display Scale Fidelity	39
Available Detectors	40
Dynamic Range	41
Gain Compression	41
Displayed Average Noise Level	43
Displayed Average Noise Level (DANL)	43
Spurious Responses	45
Second Harmonic Distortion	46
Third Order Intermodulation	47
Nominal Dynamic Range vs. Offset Frequency vs. RBW for Freq Option ≤ 526 [Plot] (SN prefix \geq MY/SG/US5340, ship standard with N9010A-EP3)	49
Nominal Dynamic Range vs. Offset Frequency vs. RBW for Freq Option ≤ 526 [Plot] (SN prefix $<$ MY/SG/US5340)	49
Nominal Dynamic Range at 1 GHz for Freq Option ≤ 526 [Plot]	50

Contents

Nominal Dynamic Range Bands 1-4 for Freq Option ≤ 526 [Plot]	50
Phase Noise	51
Nominal Phase Noise of Different LO Optimizations for Freq Option ≤ 526 [Plot] (SN prefix \geq MY/SG/US5340, Ship standard with N9010A-EP3)	53
Nominal Phase Noise of Different LO Optimizations for Freq Option ≤ 526 [Plot] (SN prefix $<$ MY/SG/US5340)	53
Nominal Phase Noise of Different LO Optimizations for Freq Option > 526 [Plot]	54
Nominal Phase Noise of Different Center Frequencies for Freq Option ≤ 526 [Plot] (SN prefix \geq MY/SG/US5340, Ship standard with N9010A-EP3)	55
Nominal Phase Noise of Different Center Frequencies for Freq Option ≤ 526 [Plot] (SN prefix $<$ MY/SG/US5340)	55
Nominal Phase Noise of Different Center Frequencies for Freq Option >526 [Plot]	56
Power Suite Measurements	57
Channel Power	57
Occupied Bandwidth	57
Adjacent Channel Power (ACP)	58
Fast ACPR Test [Plot]	61
Power Statistics CCDF	61
Burst Power	62
TOI (Third Order Intermodulation)	62
Harmonic Distortion	62
Spurious Emissions	62
Spectrum Emission Mask	63
Options	64
General	66
Inputs/Outputs	71
Front Panel	71
Rear Panel	72
Regulatory Information	75
Declaration of Conformity	76
2. I/Q Analyzer	
Specifications Affected by I/Q Analyzer	78
Frequency	79
Clipping-to-Noise Dynamic Range	80
Data Acquisition	81
Time Record Length (IQ pairs)	81
ADC Resolution	81
3. VXA Vector Signal and WLAN Modulation Analysis Application	
Vector Signal Analysis Performance (N9064A-1FP/1TP)	84
Frequency	84
Range	84
Center Frequency Tuning Resolution	84
Frequency Span, Maximum	84
FFT Spectrum	84
Frequency Points per Span	84
FFT Window Type	84

Input	85
Range	85
ADC overload	85
Amplitude Accuracy	86
Absolute Amplitude Accuracy	86
Amplitude Linearity	86
IF Flatness	86
Sensitivity	86
Dynamic Range	87
Third Order Intermodulation distortion	87
Noise Density at 1 GHz	87
Residual Responses	87
Image Responses	87
LO Related Spurious	87
Other Spurious	87
Analog Modulation Analysis (N9064A-1FP/1TP)	88
AM Demodulation	88
PM Demodulation	88
FM Demodulation	89
Flexible Digital Modulation Analysis (N9064A-2FP/2TP)	90
Accuracy	90
Residual EVM for Video Modulation Formats	91
WLAN Modulation Analysis (N9064A-3FP/3TP)	92
IEEE 802.11a/g OFDM	92
IEEE 802.11b/g DSSS	92
4. Option B25 - 25 MHz Analysis Bandwidth	
Specifications Affected by Analysis Bandwidth	94
Other Analysis Bandwidth Specifications	95
IF Spurious Response	95
IF Frequency Response	96
IF Phase Linearity	97
Data Acquisition	98
Time Record Length (IQ pairs)	98
ADC Resolution	98
5. Option B40 - 40 MHz Analysis Bandwidth	
Specifications Affected by Analysis Bandwidth	100
Other Analysis Bandwidth Specifications	101
IF Frequency Response	102
IF Phase Linearity	103
EVM	104
Data Acquisition	105
Time Record Length	105
ADC Resolution	105
Capture Time [Plot]	105
6. Option CR3 - Connector Rear, 2nd IF Output	

Specifications Affected by Connector Rear, 2nd IF Output	108
Other Connector Rear, 2nd IF Output Specifications	109
Aux IF Out Port	109
Second IF Out	109
7. Option CRP - Connector Rear, Arbitrary IF Output	
Specifications Affected by Connector Rear, Arbitrary IF Output	112
Other Connector Rear, Arbitrary IF Output Specifications	113
Aux IF Out Port	113
Arbitrary IF Out	113
8. Option EA3 - Electronic Attenuator, 3.6 GHz	
Specifications Affected by Electronic Attenuator	116
Other Electronic Attenuator Specifications	117
Range (Frequency and Attenuation)	117
Distortions and Noise	118
Frequency Response	119
Absolute Amplitude Accuracy	119
Electronic Attenuator Switching Uncertainty	120
9. Option EMC - Precompliance EMI Features	
Frequency	122
Frequency Range	122
EMI Resolution Bandwidths	122
Amplitude	124
EMI Average Detector	124
Quasi-Peak Detector	124
RMS Average Detector	124
10. Option ESC - External Source Control	
General Specifications	126
Frequency Range	126
Dynamic Range	127
Power Sweep Range	128
Measurement Time	128
Supported External Sources	129
11. Option EXM - External Mixing	
Specifications Affected by External mixing	132
Other External Mixing Specifications	133
Connection Port EXT MIXER	133
Mixer Bias	133
IF Input	133
LO Output	134
12. Option MPB - Microwave Preselector Bypass	
Specifications Affected by Microwave Preselector Bypass	136

Other Microwave Preselector Bypass Specifications	137
Additional Spurious Responses	138
13. Option P03, P07, P13, P26, P32 and P44 - Preamplifier	
Specifications Affected by Preamp	140
Other Preamp Specifications	141
Gain	141
Noise figure	141
1 dB Gain Compression Point	142
Displayed Average Noise Level (DANL)Preamp On	143
Frequency Response – Preamp On	144
RF Input VSWR	145
Nominal VSWR – Preamp On, Freq Option \leq 526 [Plot]	146
Third Order Intermodulation Distortion	146
Nominal Dynamic Range at 1 GHz, Preamp On, Freq Option \leq 526 [Plot]	147
14. Option PFR - Precision Frequency Reference	
Specifications Affected by Precision Frequency Reference	150
15. Option YAS - Y-Axis Screen Video Output	
Specifications Affected by Y-Axis Screen Video Output	152
Other Y-Axis Screen Video Output Specifications	153
General Port Specifications	153
Screen Video	153
Delay	154
Continuity and Compatibility	155
16. Analog Demodulation Measurement Application	
Pre-Demodulation	158
Carrier Frequency	158
Demodulation Bandwidth	158
Capture Memory	158
Post-Demodulation	159
Maximum Audio Frequency Span	159
Filters	159
Frequency Modulation - Level and Carrier Metrics	160
FM Deviation Accuracy	160
FM Rate Accuracy	160
Carrier Frequency Error	160
Carrier Power	160
Frequency Modulation - Distortion	161
Residual	161
Absolute Accuracy	161
AM Rejection	161
Residual FM	161
Measurement Range	161
Amplitude Modulation - Level and Carrier Metrics	162
AM Depth Accuracy	162

AM Rate Accuracy	162
Carrier Power	162
Amplitude Modulation - Distortion	163
Absolute Accuracy	163
FM Rejection	163
Residual AM	163
Measurement Range	163
Phase Modulation - Level and Carrier Metrics	164
PM Deviation Accuracy	164
PM Rate Accuracy	164
Carrier Frequency Error	164
Carrier Power	164
Phase Modulation - Distortion	165
Residual	165
Absolute Accuracy	165
AM Rejection	165
Measurement Range	165
FM Stereo/Radio Data System (RDS) Measurements	166
FM Stereo Modulation Analysis Measurements	166
17. Noise Figure Measurement Application	
General Specifications	170
Noise Figure	170
Gain	171
Noise Figure Uncertainty Calculator	172
Nominal Instrument Noise Figure, Freq Option ≤ 526	173
Nominal Instrument Input VSWR, DC Coupled, Freq Option ≤ 526	174
18. Phase Noise Measurement Application	
General Specifications	176
Maximum Carrier Frequency	176
Measurement Characteristics	176
Measurement Accuracy	177
Offset Frequency	177
Amplitude Repeatability	178
Nominal Phase Noise at Different Center Frequencies	178
19. 1xEV-DO Measurement Application	
Measurements	180
Channel Power	180
Power Statistics CCDF	180
Occupied Bandwidth	180
Power vs. Time	181
Spectrum Emission Mask and Adjacent Channel Power	182
Spurious Emissions	183
QPSK EVM	183
Code Domain	184
Modulation Accuracy (Composite Rho)	184

In-Band Frequency Range	185
In-Band Frequency Range.....	185
Alternative Frequency Ranges	185
20. 802.16 OFDMA Measurement Application	
Measurements	188
Channel Power	188
Power Statistics CCDF	188
Occupied Bandwidth.....	188
Adjacent Channel Power.....	189
Spectrum Emission Mask	190
Spurious Emissions	190
Modulation Analysis.....	191
In-Band Frequency Range for Warranted Specifications	192
21. Bluetooth Measurement Application	
Basic Rate Measurements	194
Output Power.....	194
Modulation Characteristics	195
Initial Carrier Frequency Tolerance	196
Carrier Frequency Drift.....	197
Adjacent Channel Power.....	197
Low Energy Measurements	198
Output Power.....	198
Modulation Characteristics	199
Initial Carrier Frequency Tolerance	200
Carrier Frequency Drift.....	201
LE In-band Emission.....	201
Enhanced Data Rate (EDR) Measurements	202
EDR Relative Transmit Power	202
EDR Modulation Accuracy.....	203
EDR Carrier Frequency Stability	204
EDR In-band Spurious Emissions.....	205
In-Band Frequency Range	206
Bluetooth Basic Rate and Enhanced Data Rate (EDR) System	206
Bluetooth Low Energy System	206
22. cdma2000 Measurement Application	
Measurements	208
Channel Power	208
Adjacent Channel Power.....	209
Power Statistics CCDF	209
Occupied Bandwidth.....	210
Spectrum Emission Mask	210
Spurious Emissions	211
Code Domain.....	211
QPSK EVM.....	212
Modulation Accuracy (Composite Rho).....	213

In-Band Frequency Range	215
23. CMMB Measurement Application	
Measurements	218
Channel Power	218
Channel Power with Shoulder Attenuation View	218
Power Statistics CCDF	218
Adjacent Channel Power	219
Spectrum Emission Mask	220
Modulation Analysis Settings	221
Modulation Analysis Measurement	222
CMMB Modulation Analysis Specification	224
24. Digital Cable TV Measurement Application	
Measurements	226
Channel Power	226
Power Statistics CCDF	226
Adjacent Channel Power	226
Spectrum Emission Mask	227
DVB-C 64QAM EVM	228
25. DTMB Measurement Application	
Measurements	230
Channel Power	230
Channel Power with Shoulder Attenuation View	230
Power Statistics CCDF	231
Adjacent Channel Power	231
Spectrum Emission Mask	232
16QAM EVM	233
26. DVB-T/H with T2 Measurement Application	
Measurements	236
Channel Power	236
Channel Power with Shoulder Attenuation View	236
Power Statistics CCDF	237
Adjacent Channel Power	237
Spectrum Emission Mask	238
Spurious Emission	239
DVB-T 64QAM EVM	240
DVB-T2 256QAM EVM	241
27. GSM/EDGE Measurement Application	
Measurements	244
EDGE Error Vector Magnitude (EVM)	244
Power vs. Time	245
EDGE Power vs. Time	245
Power Ramp Relative Accuracy	245

Phase and Frequency Error	245
Output RF Spectrum (ORFS)	246
Frequency Ranges	250
In-Band Frequency Ranges	250
28. iDEN/WiDEN/MotoTalk Measurement Application	
Frequency and Time	252
Amplitude Accuracy and Range	253
Dynamic Range	253
Application Specifications	254
Measurements	254
Parameter Setups	254
iDEN Power	254
iDEN Signal Demod	255
MotoTalk Signal Demod	255
29. ISDB-T Measurement Application	
Measurements	258
Channel Power	258
Channel Power with Shoulder Attenuation View	258
Power Statistics CCDF	258
Adjacent Channel Power	259
Spectrum Emission Mask	260
Modulation Analysis Settings	261
Modulation Analysis Measurements	262
ISDB-T Modulation Analysis	264
ISDB-Tmm Modulation Analysis	265
30. LTE Measurement Application	
Supported Air Interface Features	268
Measurements	269
Channel Power	269
Transmit On/Off Power	269
Adjacent Channel Power	270
Occupied Bandwidth	271
Spectrum Emission Mask	271
Spurious Emissions	271
Modulation Analysis	272
In-Band Frequency Range	274
Operating Band, FDD	274
Operating Band, TDD	274
31. Multi-Standard Radio Measurement Application	
Measurements	276
Channel Power	276
Power Statistics CCDF	276
Occupied Bandwidth	276
Spurious Emissions	277

Conformance EVM	278
In-Band Frequency Range	279
32. TD-SCDMA Measurement Application	
Measurements	282
Power vs. Time	282
Transmit Power	282
Adjacent Channel Power	283
Single Carrier	283
Power Statistics CCDF	284
Occupied Bandwidth	284
Spectrum Emission Mask	284
Spurious Emissions	285
Code Domain	285
Modulation Accuracy (Composite EVM)	287
In-Band Frequency Range	289
33. W-CDMA Measurement Application	
Measurements	292
Channel Power	292
Adjacent Channel Power	293
Power Statistics CCDF	295
Occupied Bandwidth	295
Spectrum Emission Mask	295
Spurious Emissions	296
Code Domain	297
QPSK EVM	298
Modulation Accuracy (Composite EVM)	299
Power Control	300
In-Band Frequency Range	301
34. Single Acquisition Combined Fixed WiMAX Measurement Application	
Measurements	304
Transmit Power	304
Tx Output Spectrum	304
64QAM EVM	305
In-Band Frequency Range for Warranted Specifications	306
35. WLAN Measurement Application	
Measurements	308
Channel Power	308
Power Statistics CCDF	310
Occupied Bandwidth	310
Power vs. Time	311
Spectrum Emission Mask	311
Spurious Emission	317
CCK 11Mbps	320
List Sequence Measurements	321

Transmit Power	321
Transmit Output Spectrum	323
64QAM EVM	328
CCK 11Mbps	331
In-Band Frequency Range for Warranted Specifications	332

This chapter contains the specifications for the core signal analyzer. The specifications and characteristics for the measurement applications and options are covered in the chapters that follow.

Definitions and Requirements

This book contains signal analyzer specifications and supplemental information. The distinction among specifications, typical performance, and nominal values are described as follows.

Definitions

- Specifications describe the performance of parameters covered by the product warranty (temperature = 0 to 55°C¹ also referred to as "Full temperature range" or "Full range", unless otherwise noted).
- 95th percentile values indicate the breadth of the population ($\approx 2\sigma$) of performance tolerances expected to be met in 95% of the cases with a 95% confidence, for any ambient temperature in the range of 20 to 30°C. In addition to the statistical observations of a sample of instruments, these values include the effects of the uncertainties of external calibration references. These values are not warranted. These values are updated occasionally if a significant change in the statistically observed behavior of production instruments is observed.
- Typical describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30°C. Typical performance does not include measurement uncertainty.
- Nominal values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

Conditions Required to Meet Specifications

The following conditions must be met for the analyzer to meet its specifications.

- The analyzer is within its calibration cycle. See the General section of this chapter.
- Under auto couple control, except that Auto Sweep Time Rules = Accy.
- For signal frequencies < 10 MHz, DC coupling applied.
- Any analyzer that has been stored at a temperature range inside the allowed storage range but outside the allowed operating range must be stored at an ambient temperature within the allowed operating range for at least two hours before being turned on.
- The analyzer has been turned on at least 30 minutes with Auto Align set to Normal, or if Auto Align is set to Off or Partial, alignments must have been run recently enough to prevent an Alert message. If the Alert condition is changed from "Time and Temperature" to one of the disabled duration choices, the analyzer may fail to meet specifications without informing the user.

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

1. For earlier instruments (S/N prefix <MY/SG/US5052), the operating temperature ranges from 5 to 50°C

Frequency and Time

Description	Specifications		Supplemental Information
Frequency Range			
Maximum Frequency			
<i>Option 503</i>	3.6 GHz		
<i>Option 507</i>	7 GHz		
<i>Option 513</i>	13.6 GHz		
<i>Option 526</i>	26.5 GHz		
<i>Option 532</i>	32 GHz		
<i>Option 544</i>	44 GHz		
<i>Preamp Option P03</i>	3.6 GHz		
<i>Preamp Option P07</i>	7 GHz		
<i>Preamp Option P32</i>	32 GHz		
<i>Preamp Option P13</i>	13.6 GHz		
<i>Preamp Option P26</i>	26.5 GHz		
<i>Preamp Option P44</i>	44 GHz		
Minimum Frequency			
Preamp	AC Coupled^a	DC Coupled	
Off	10 MHz	10 Hz	
On	10 MHz	100 kHz	
Band	Harmonic Mixing Mode	LO Multiple (N^b)	Band Overlaps ^c
0 (10 Hz to 3.6 GHz)	1–	1	<i>Options 503, 507, 513, 526, 532, 544</i>
1 (3.5 GHz to 7 GHz)	1–	1	<i>Option 507</i>
1 (3.5 GHz to 8.4 GHz)	1–	1	<i>Options 513, 526, 532, 544</i>
2 (8.3 GHz to 13.6 GHz)	1–	2	<i>Options 513, 526, 532, 544</i>
3 (13.5 to 17.1 GHz)	2–	2	<i>Options 526, 532, 544</i>
4 (17.0 to 26.5 GHz)	2–	4	<i>Options 526, 532, 544</i>
5 (26.4 GHz to 32 GHz)	2–	4	<i>Option 532</i>
5 (26.4 GHz to 34.5 GHz)	2–	4	<i>Option 544</i>
6 (34.4 GHz to 44 GHz)	4–	8	<i>Option 544</i>

a. AC Coupled only applicable to Freq *Options 503, 507, 513, and 526*.

b. N is the LO multiplication factor. For negative mixing modes (as indicated by the “–” in the “Harmonic Mixing Mode” column), the desired 1st LO harmonic is higher than the tuned frequency by the 1st IF (5.1225 GHz for band 0, 322.5 MHz for all other bands).

Agilent EXA Signal Analyzer
Frequency and Time

- c. In the band overlap regions, for example, 3.5 to 3.6 GHz, the analyzer may use either band for measurements, in this example Band 0 or Band 1. The analyzer gives preference to the band with the better overall specifications (which is the lower numbered band for all frequencies below 26 GHz), but will choose the other band if doing so is necessary to achieve a sweep having minimum band crossings. For example, with CF = 3.58 GHz, with a span of 40 MHz or less, the analyzer uses Band 0, because the stop frequency is 3.6 GHz or less, allowing a span without band crossings in the preferred band. If the span is between 40 and 160 MHz, the analyzer uses Band 1, because the start frequency is above 3.5 GHz, allowing the sweep to be done without a band crossing in Band 1, though the stop frequency is above 3.6 GHz, preventing a Band 0 sweep without band crossing. With a span greater than 160 MHz, a band crossing will be required: the analyzer sweeps up to 3.6 GHz in Band 0; then executes a band crossing and continues the sweep in Band 1.

Specifications are given separately for each band in the band overlap regions. One of these specifications is for the preferred band, and one for the alternate band. Continuing with the example from the previous paragraph (3.58 GHz), the preferred band is band 0 (indicated as frequencies under 3.6 GHz) and the alternate band is band 1 (3.5 to 8.4 GHz). The specifications for the preferred band are warranted. The specifications for the alternate band are not warranted in the band overlap region, but performance is nominally the same as those warranted specifications in the rest of the band. Again, in this example, consider a signal at 3.58 GHz. If the sweep has been configured so that the signal at 3.58 GHz is measured in Band 1, the analysis behavior is nominally as stated in the Band 1 specification line (3.5 to 8.4 GHz) but is not warranted. If warranted performance is necessary for this signal, the sweep should be reconfigured so that analysis occurs in Band 0. Another way to express this situation in this example Band 0/Band 1 crossing is this: The specifications given in the “Specifications” column which are described as “3.5 to 7.0 GHz” represent nominal performance from 3.5 to 3.6 GHz, and warranted performance from 3.6 to 7.0 GHz.

Description	Specifications	Supplemental Information
Standard Frequency Reference		
Accuracy	$\pm[(\text{time since last adjustment} \times \text{aging rate}) + \text{temperature stability} + \text{calibration accuracy}^a]$	
Temperature Stability		
20 to 30°C	$\pm 2 \times 10^{-6}$	
Full temperature range	$\pm 2 \times 10^{-6}$	
Aging Rate	$\pm 1 \times 10^{-6}/\text{year}^b$	
Achievable Initial Calibration Accuracy	$\pm 1.4 \times 10^{-6}$	
Stability	$\pm 2 \times 10^{-8}$	
Residual FM (Center Frequency = 1 GHz 10 Hz RBW, 10 Hz VBW)		$\leq 10 \text{ Hz} \times N^c \text{ p-p in } 20 \text{ ms (nominal)}$

- a. Calibration accuracy depends on how accurately the frequency standard was adjusted to 10 MHz. If the adjustment procedure is followed, the calibration accuracy is given by the specification “Achievable Initial Calibration Accuracy.”
- b. For periods of one year or more.
- c. N is the LO multiplication factor.

Description	Specifications	Supplemental Information
Precision Frequency Reference		
<i>(Option PFR)</i>		
Accuracy	$\pm[(\text{time since last adjustment} \times \text{aging rate}) + \text{temperature stability} + \text{calibration accuracy}]^{\text{a}}]^{\text{b}}$	
Temperature Stability		Nominally linear ^c
20 to 30°C	$\pm 1.5 \times 10^{-8}$	
Full temperature range	$\pm 5 \times 10^{-8}$	
Aging Rate		$\pm 5 \times 10^{-10}/\text{day}$ (nominal)
Total Aging		
1 Year	$\pm 1 \times 10^{-7}$	
2 Years	$\pm 1.5 \times 10^{-7}$	
Settability	$\pm 2 \times 10^{-9}$	
Warm-up and Retrace ^d		Nominal
300 s after turn on		$\pm 1 \times 10^{-7}$ of final frequency
900 s after turn on		$\pm 1 \times 10^{-8}$ of final frequency
Achievable Initial Calibration Accuracy ^e	$\pm 4 \times 10^{-8}$	
Standby power to reference oscillator		Not supplied
Residual FM (Center Frequency = 1 GHz 10 Hz RBW, 10 Hz VBW)		$\leq 0.25 \text{ Hz} \times N^{\text{f}}$ p-p in 20 ms (nominal)

- a. Calibration accuracy depends on how accurately the frequency standard was adjusted to 10 MHz. If the adjustment procedure is followed, the calibration accuracy is given by the specification “Achievable Initial Calibration Accuracy.”
- b. The specification applies after the analyzer has been powered on for four hours.
- c. Narrow temperature range performance is nominally linear with temperature. For example, for $25 \pm 3^\circ \text{C}$, the stability would be only three-fifths as large as the warranted $25 \pm 5^\circ \text{C}$, thus $\pm 0.9 \times 10^{-8}$.
- d. Standby mode does not apply power to the oscillator. Therefore warm-up applies every time the power is turned on. The warm-up reference is one hour after turning the power on. Retracing also occurs every time warm-up occurs. The effect of retracing is included within the “Achievable Initial Calibration Accuracy” term of the Accuracy equation.
- e. The achievable calibration accuracy at the beginning of the calibration cycle includes these effects:
 - 1) Temperature difference between the calibration environment and the use environment
 - 2) Orientation relative to the gravitation field changing between the calibration environment and the use environment
 - 3) Retrace effects in both the calibration environment and the use environment due to turning the instrument power off.
 - 4) Settability
- f. N is the LO multiplication factor.

Description	Specifications	Supplemental Information
Frequency Readout Accuracy Example for EMC ^d	$\pm(\text{marker freq} \times \text{freq ref accy.} + 0.25\% \times \text{span} + 5\% \times \text{RBW}^a + 2 \text{ Hz} + 0.5 \times \text{horizontal resolution}^b)$	Single detector only ^c $\pm 0.0032\%$ (nominal)

- a. The warranted performance is only the sum of all errors under autocoupled conditions. Under non-autocoupled conditions, the frequency readout accuracy will nominally meet the specification equation, except for conditions in which the RBW term dominates, as explained in examples below. The nominal RBW contribution to frequency readout accuracy is 2% of RBW for RBWs from 1 Hz to 390 kHz, 4% of RBW from 430 kHz through 3 MHz (the widest autocoupled RBW), and 30% of RBW for the (manually selected) 4, 5, 6 and 8 MHz RBWs.
First example: a 120 MHz span, with autocoupled RBW. The autocoupled ratio of span to RBW is 106:1, so the RBW selected is 1.1 MHz. The $5\% \times \text{RBW}$ term contributes only 55 kHz to the total frequency readout accuracy, compared to 300 kHz for the $0.25\% \times \text{span}$ term, for a total of 355 kHz. In this example, if an instrument had an unusually high RBW centering error of 7% of RBW (77 kHz) and a span error of 0.20% of span (240 kHz), the total actual error (317 kHz) would still meet the computed specification (355 kHz).
Second example: a 20 MHz span, with a 4 MHz RBW. The specification equation does not apply because the Span: RBW ratio is not autocoupled. If the equation did apply, it would allow 50 kHz of error (0.25%) due to the span and 200 kHz error (5%) due to the RBW. For this non-autocoupled RBW, the RBW error is nominally 30%, or 1200 kHz.
- b. Horizontal resolution is due to the marker reading out one of the sweep points. The points are spaced by $\text{span}/(\text{Npts} - 1)$, where Npts is the number of sweep points. For example, with the factory preset value of 1001 sweep points, the horizontal resolution is $\text{span}/1000$. However, there is an exception: When both the detector mode is “normal” and the $\text{span} > 0.25 \times (\text{Npts} - 1) \times \text{RBW}$, peaks can occur only in even-numbered points, so the effective horizontal resolution becomes doubled, or $\text{span}/500$ for the factory preset case. When the RBW is autocoupled and there are 1001 sweep points, that exception occurs only for spans > 750 MHz.
- c. Specifications apply to traces in most cases, but there are exceptions. Specifications always apply to the peak detector. Specifications apply when only one detector is in use and all active traces are set to Clear Write. Specifications also apply when only one detector is in use in all active traces and the "Restart" key has been pressed since any change from the use of multiple detectors to a single detector. In other cases, such as when multiple simultaneous detectors are in use, additional errors of 0.5, 1.0 or 1.5 sweep points will occur in some detectors, depending on the combination of detectors in use.
- d. In most cases, the frequency readout accuracy of the analyzer can be exceptionally good. As an example, Agilent has characterized the accuracy of a span commonly used for Electro-Magnetic Compatibility (EMC) testing using a source frequency locked to the analyzer. Ideally, this sweep would include EMC bands C and D and thus sweep from 30 to 1000 MHz. Ideally, the analysis bandwidth would be 120 kHz at -6 dB, and the spacing of the points would be half of this (60 kHz). With a start frequency of 30 MHz and a stop frequency of 1000.2 MHz and a total of 16168 points, the spacing of points is ideal. The detector used was the Peak detector. The accuracy of frequency readout of all the points tested in this span was with $\pm 0.0032\%$ of the span. A perfect analyzer with this many points would have an accuracy of $\pm 0.0031\%$ of span. Thus, even with this large number of display points, the errors in excess of the bucket quantization limitation were negligible.

Description	Specifications	Supplemental Information
Frequency Counter^a		See note ^b
Count Accuracy	$\pm(\text{marker freq} \times \text{freq ref accy.} + 0.100 \text{ Hz})$	
Delta Count Accuracy	$\pm(\text{delta freq.} \times \text{freq ref accy.} + 0.141 \text{ Hz})$	
Resolution	0.001 Hz	

- a. Instrument conditions: RBW = 1 kHz, gate time = auto (100 ms), S/N \geq 50 dB, frequency = 1 GHz
b. If the signal being measured is locked to the same frequency reference as the analyzer, the specified count accuracy is ± 0.100 Hz under the test conditions of footnote a. This error is a noisiness of the result. It will increase with noisy sources, wider RBWs, lower S/N ratios, and source frequencies > 1 GHz.

Description	Specifications	Supplemental Information
Frequency Span		
Range		
Option 503	0 Hz, 10 Hz to 3.6 GHz	
Option 507	0 Hz, 10 Hz to 7 GHz	
Option 513	0 Hz, 10 Hz to 13.6 GHz	
Option 526	0 Hz, 10 Hz to 26.5 GHz	
Option 532	0 Hz, 10 Hz to 32 GHz	
Option 544	0 Hz, 10 Hz to 44 GHz	
Resolution	2 Hz	
Span Accuracy		
Swept	$\pm(0.25\% \times \text{span} + \text{horizontal resolution}^{\text{a}})$	
FFT	$\pm(0.1\% \times \text{span} + \text{horizontal resolution}^{\text{a}})$	

- a. Horizontal resolution is due to the marker reading out one of the sweep points. The points are spaced by $\text{span}/(\text{Npts} - 1)$, where Npts is the number of sweep points. For example, with the factory preset value of 1001 sweep points, the horizontal resolution is $\text{span}/1000$. However, there is an exception: When both the detector mode is “normal” and the $\text{span} > 0.25 \times (\text{Npts} - 1) \times \text{RBW}$, peaks can occur only in even-numbered points, so the effective horizontal resolution becomes doubled, or $\text{span}/500$ for the factory preset case. When the RBW is auto coupled and there are 1001 sweep points, that exception occurs only for spans > 750 MHz.

Agilent EXA Signal Analyzer
Frequency and Time

Description	Specifications	Supplemental Information
Sweep Time and Trigger		
Sweep Time Range		
Span = 0 Hz	1 μ s to 6000 s	
Span \geq 10 Hz	1 ms to 4000 s	
Sweep Time Accuracy		
Span \geq 10 Hz, swept		$\pm 0.01\%$ (nominal)
Span \geq 10 Hz, FFT		$\pm 40\%$ (nominal)
Span = 0 Hz		$\pm 0.01\%$ (nominal)
Sweep Trigger	Free Run, Line, Video, External 1, External 2, RF Burst, Periodic Timer	
Delayed Trigger ^a		
Range		
Span \geq 10 Hz, swept	0 to 500 ms	
Span = 0 Hz or FFT	-150 ms to +500 ms	
Resolution	0.1 μ s	

a. Delayed trigger is available with line, video, RF burst and external triggers.

Description	Specifications	Supplemental Information
<p>Triggers</p> <p><u>Video</u></p> <p>Minimum settable level Maximum usable level</p> <p>Detector and Sweep Type relationships</p> <p>Sweep Type = Swept</p> <p> Detector = Normal, Peak, Sample or Negative Peak</p> <p> Detector = Average</p> <p>Sweep Type = FFT</p> <p><u>RF Burst</u></p> <p>Level Range Level Accuracy</p> <p>Bandwidth (–10 dB) Frequency Limitations</p> <p><u>External Triggers</u></p> <p><u>TV Triggers</u></p> <p>Amplitude Requirements</p> <p>Compatible Standards</p>	<p>–170 dBm</p> <p>NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M, PAL-N, PAL-N Combination, PAL-B/-D/-G/-H/-I. PAL-60, SECAM-L</p>	<p>Additional information on some of the triggers and gate sources</p> <p>Independent of Display Scaling and Reference Level</p> <p>Useful range limited by noise</p> <p>Highest allowed mixer level^a + 2 dB (nominal)</p> <p>Triggers on the signal before detection, which is similar to the displayed signal</p> <p>Triggers on the signal before detection, but with a single-pole filter added to give similar smoothing to that of the average detector</p> <p>Triggers on the signal envelope in a bandwidth wider than the FFT width</p> <p>–50 to –10 dBm plus attenuation (nominal)^b</p> <p>±2 dB + Absolute Amplitude Accuracy (nominal)</p> <p>16 MHz (nominal)</p> <p>If the start or center frequency is too close to zero, LO feedthrough can degrade or prevent triggering. How close is too close depends on the bandwidth listed above.</p> <p>See “Trigger Inputs” on page 72</p> <p>Triggers on the leading edge of the selected sync pulse of standardized TV signals.</p> <p>–65 dBm minimum video carrier power at the input mixer, nominal</p>

Agilent EXA Signal Analyzer
Frequency and Time

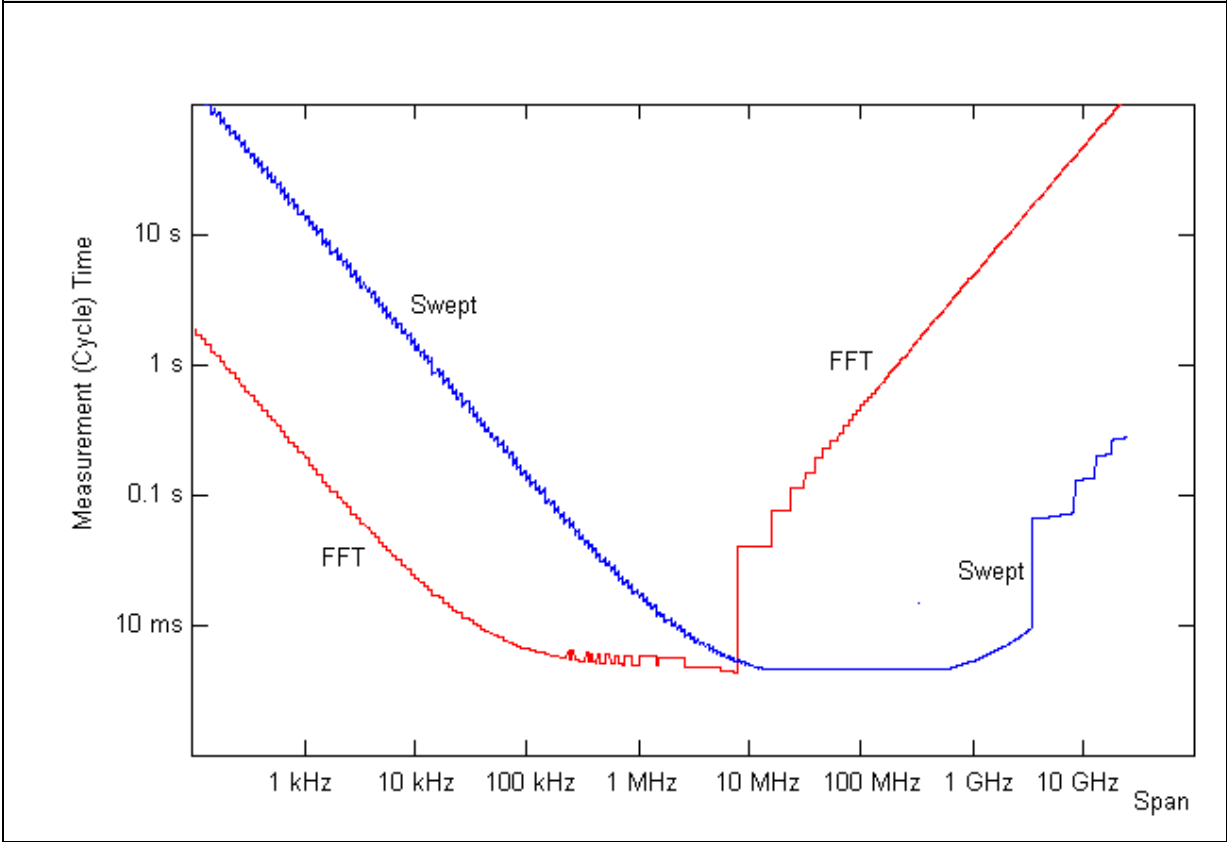
Description	Specifications	Supplemental Information
Field Selection	Entire Frame, Field One, Field Two	
Line Selection	1 to 525, or 1 to 625, standard dependent	

- a. The highest allowed mixer level depends on the IF Gain. It is nominally –10 dBm for Preamp Off and IF Gain = Low.
- b. Noise will limit trigger level range at high frequencies, such as above 15 GHz.

Description	Specifications	Supplemental Information
Gated Sweep		
Gate Methods	Gated LO Gated Video Gated FFT	
Span Range	Any span	
Gate Delay Range	0 to 100.0 s	
Gate Delay Settability	4 digits, ≥100 ns	
Gate Delay Jitter		33.3 ns p-p (nominal)
Gate Length Range (Except Method = FFT)	100 ns to 5.0 s	Gate length for the FFT method is fixed at 1.83/RBW, with nominally 2% tolerance.
Gated Frequency and Amplitude Errors		Nominally no additional error for gated measurements when the Gate Delay is greater than the MIN FAST setting
Gate Sources	External 1 External 2 Line RF Burst Periodic	Pos or neg edge triggered

Description	Specifications	Supplemental Information
Number of Frequency Sweep Points (buckets)		
Factory preset	1001	
Range	1 to 40,001	Zero and non-zero spans

Nominal Measurement Time vs. Span [Plot]



Description	Specifications	Supplemental Information																																							
<p>Resolution Bandwidth (RBW) Range (–3.01 dB bandwidth)</p> <p>Power bandwidth accuracy^a</p> <table border="0"> <tr> <td>RBW Range</td> <td>CF Range</td> <td></td> </tr> <tr> <td>1 Hz to 750 kHz</td> <td>All</td> <td>±1.0% (0.044 dB)</td> </tr> <tr> <td>820 kHz to 1.2 MHz</td> <td><3.6 GHz</td> <td>±2.0% (0.088 dB)</td> </tr> <tr> <td>1.3 to 2.0 MHz</td> <td><3.6 GHz</td> <td></td> </tr> <tr> <td>2.2 to 3 MHz</td> <td><3.6 GHz</td> <td></td> </tr> <tr> <td>4 to 8 MHz</td> <td><3.6 GHz</td> <td></td> </tr> </table> <p>Noise BW to RBW ratio^b</p> <p>Accuracy (–3.01 dB bandwidth)^c</p> <table border="0"> <tr> <td>1 Hz to 1.3 MHz RBW</td> <td></td> <td>±2% (nominal)</td> </tr> <tr> <td>1.5 MHz to 3 MHz RBW</td> <td></td> <td></td> </tr> <tr> <td>CF ≤ 3.6 GHz</td> <td></td> <td>±7% (nominal)</td> </tr> <tr> <td>CF > 3.6 GHz</td> <td></td> <td>±8% (nominal)</td> </tr> <tr> <td>4 MHz to 8 MHz RBW</td> <td></td> <td></td> </tr> <tr> <td>CF ≤ 3.6 GHz</td> <td></td> <td>±15% (nominal)</td> </tr> <tr> <td>CF > 3.6 GHz</td> <td></td> <td>±20% (nominal)</td> </tr> </table> <p>Selectivity (–60 dB/–3 dB)</p>	RBW Range	CF Range		1 Hz to 750 kHz	All	±1.0% (0.044 dB)	820 kHz to 1.2 MHz	<3.6 GHz	±2.0% (0.088 dB)	1.3 to 2.0 MHz	<3.6 GHz		2.2 to 3 MHz	<3.6 GHz		4 to 8 MHz	<3.6 GHz		1 Hz to 1.3 MHz RBW		±2% (nominal)	1.5 MHz to 3 MHz RBW			CF ≤ 3.6 GHz		±7% (nominal)	CF > 3.6 GHz		±8% (nominal)	4 MHz to 8 MHz RBW			CF ≤ 3.6 GHz		±15% (nominal)	CF > 3.6 GHz		±20% (nominal)	<p>1 Hz to 8 MHz Bandwidths above 3 MHz are 4, 5, 6, and 8 MHz. Bandwidths 1 Hz to 3 MHz are spaced at 10% spacing using the E24 series (24 per decade): 1.0, 1.1, 1.2, 1.3, 1.5, 1.6, 1.8, 2.0, 2.2, 2.4, 2.7, 3.0, 3.3, 3.6, 3.9, 4.3, 4.7, 5.1, 5.6, 6.2, 6.8, 7.5, 8.2, 9.1 in each decade.</p>	<p>±0.07 dB (nominal) ±0.15 dB (nominal) ±0.25 dB (nominal)</p> <p>1.056 ±2% (nominal)</p>
RBW Range	CF Range																																								
1 Hz to 750 kHz	All	±1.0% (0.044 dB)																																							
820 kHz to 1.2 MHz	<3.6 GHz	±2.0% (0.088 dB)																																							
1.3 to 2.0 MHz	<3.6 GHz																																								
2.2 to 3 MHz	<3.6 GHz																																								
4 to 8 MHz	<3.6 GHz																																								
1 Hz to 1.3 MHz RBW		±2% (nominal)																																							
1.5 MHz to 3 MHz RBW																																									
CF ≤ 3.6 GHz		±7% (nominal)																																							
CF > 3.6 GHz		±8% (nominal)																																							
4 MHz to 8 MHz RBW																																									
CF ≤ 3.6 GHz		±15% (nominal)																																							
CF > 3.6 GHz		±20% (nominal)																																							

- a. The noise marker, band power marker, channel power and ACP all compute their results using the power bandwidth of the RBW used for the measurement. Power bandwidth accuracy is the power uncertainty in the results of these measurements due only to bandwidth-related errors. (The analyzer knows this power bandwidth for each RBW with greater accuracy than the RBW width itself, and can therefore achieve lower errors.) The warranted specifications shown apply to the Gaussian RBW filters used in swept and zero span analysis. There are four different kinds of filters used in the spectrum analyzer: Swept Gaussian, Swept Flattop, FFT Gaussian and FFT Flattop. While the warranted performance only applies to the swept Gaussian filters, because only they are kept under statistical process control, the other filters nominally have the same performance.
- b. The ratio of the noise bandwidth (also known as the power bandwidth) to the RBW has the nominal value and tolerance shown. The RBW can also be annotated by its noise bandwidth instead of this 3 dB bandwidth. The accuracy of this annotated value is similar to that shown in the power bandwidth accuracy specification.

- c. Resolution Bandwidth Accuracy can be observed at slower sweep times than auto-coupled conditions. Normal sweep rates cause the shape of the RBW filter displayed on the analyzer screen to widen by nominally 6%. This widening declines to 0.6% nominal when the Swp Time Rules key is set to Accuracy instead of Normal. The true bandwidth, which determines the response to impulsive signals and noise-like signals, is not affected by the sweep rate.

Description	Specification	Supplemental information
Analysis Bandwidth^a		
Standard	10 MHz	
With <i>Option B25</i> ^b	25 MHz	
With <i>Option B40</i>	40 MHz	

- a. Analysis bandwidth is the instantaneous bandwidth available about a center frequency over which the input signal can be digitized for further analysis or processing in the time, frequency, or modulation domain.
- b. *Option B25* is standard for instruments ordered after May 1, 2011.

Description	Specifications	Supplemental Information	
Preselector Bandwidth		Relevant to many options, such as B25 Wide IF Bandwidth, in Bands 1 and higher. Nominal.	
Mean Bandwidth at CF ^a		Freq option ≤ 526	Freq option > 526
5 GHz		58 MHz	46 MHz
10 GHz		57 MHz	52 MHz
15 GHz		59 MHz	53 MHz
20 GHz		64 MHz	55 MHz
25 GHz		74 MHz	56 MHz
35 GHz			62 MHz
44 GHz			70 MHz
Standard Deviation		9%	7%
−3 dB Bandwidth		−7.5% relative to −4 dB bandwidth, nominal	

- a. The preselector can have a significant passband ripple. To avoid ambiguous results, the −4 dB bandwidth is characterized.

Agilent EXA Signal Analyzer
Frequency and Time

Description	Specifications	Supplemental Information
Video Bandwidth (VBW) Range Accuracy	Same as Resolution Bandwidth range plus wide-open VBW (labeled 50 MHz)	 $\pm 6\%$ (nominal) in swept mode and zero span ^a

- a. For FFT processing, the selected VBW is used to determine a number of averages for FFT results. That number is chosen to give roughly equivalent display smoothing to VBW filtering in a swept measurement. For example, if $VBW = 0.1 \times RBW$, four FFTs are averaged to generate one result.

Amplitude Accuracy and Range

Description	Specifications	Supplemental Information
Measurement Range Preamp Off Preamp On Input Attenuation Range Standard With <i>Option FSA</i>	Displayed Average Noise Level to +23 dBm Displayed Average Noise Level to +23 dBm 0 to 60 dB, in 10 dB steps 0 to 60 dB, in 2 dB steps	<i>Option P03, P07, P13, P26, P32, P44</i>

Description	Specifications	Supplemental Information
Maximum Safe Input Level Average Total Power Peak Pulse Power (≤10 μs pulse width, ≤1% duty cycle, input attenuation ≥ 30 dB) DC voltage DC Coupled AC Coupled	 +30 dBm (1 W) +50 dBm (100 W) ±0.2 Vdc ±100 Vdc	Applies with or without preamp (<i>Option P03, P07, P13, P26, P32, P44</i>)

Description	Specifications	Supplemental Information
Display Range Log Scale Linear Scale	Ten divisions displayed; 0.1 to 1.0 dB/division in 0.1 dB steps, and 1 to 20 dB/division in 1 dB steps Ten divisions	

Agilent EXA Signal Analyzer
Amplitude Accuracy and Range

Description	Specifications	Supplemental Information
Marker Readout Resolution Log (decibel) units Trace Averaging Off, on-screen Trace Averaging On or remote Linear units resolution	0.01 dB 0.001 dB	≤1% of signal level (nominal)

Frequency Response

Description	Specifications	Supplemental Information
Frequency Response (Maximum error relative to reference condition (50 MHz) Mechanical attenuator only ^b Swept operation ^c , Attenuation 10 dB Option 532 or 544 (mmW) Option 503, 507, 513, or 526 (RF/μW)		Refer to the footnote for Band Overlaps on page 19 . Freq <i>Option 526</i> only: Modes above 18 GHz ^a
	20 to 30°C Full range	95th Percentile (≈2σ)
9 kHz to 10 MHz	±0.8 dB ±1.0 dB	±0.40 dB
9 kHz to 10 MHz	±0.6 dB ±0.8 dB	±0.28 dB
10 MHz ^d to 3.6 GHz	±0.6 dB ±0.65 dB	±0.21 dB
10 to 50 MHz	±0.45 dB ±0.57 dB	±0.21 dB
50 MHz to 3.6 GHz	±0.45 dB ±0.70 dB	±0.20 dB
3.5 to 7 GHz ^{ef}	±2.0 dB ±3.0 dB	±0.69 dB
3.5 to 5.2 GHz ^{ef}	±1.7 dB ±3.5 dB	±0.91 dB
5.2 to 8.4 GHz ^{ef}	±1.5 dB ±2.7 dB	±0.61 dB
7 to 13.6 GHz	±2.5 dB ±3.2 dB	
8.3 to 13.6 GHz ^{ef}	±2.0 dB ±2.7 dB	±0.61 dB
13.5 to 22 GHz ^{ef}	±3.0 dB ±3.7 dB	
13.5 to 17.1 GHz ^{ef}	±2.0 dB ±2.7 dB	±0.67 dB
17.0 to 22 GHz ^{ef}	±2.0 dB ±3.0 dB	±0.78 dB
22.0 to 26.5 GHz ^{ef}	±3.2 dB ±4.2 dB	
22.0 to 26.5 GHz ^{ef}	±2.5 dB ±3.5 dB	±0.72 dB
26.4 to 34.5 GHz ^{ef}	±2.5 dB ±3.5 dB	±1.11 dB
34.4 to 44 GHz ^{ef}	±3.2 dB ±4.9 dB	±1.42 dB

- Signal frequencies between 18 and 26.5 GHz are prone to additional response errors due to modes in the Type-N connector used with frequency *Option 526*. With the use of Type-N to APC 3.5 mm adapter part number 1250-1744, there are nominally six such modes. The effect of these modes with this connector are included within these specifications.
- See the Electronic Attenuator (*Option EA3*) chapter for Frequency Response using the electronic attenuator.
- For Sweep Type = FFT, add the RF flatness errors of this table to the IF Frequency Response errors. An additional error source, the error in switching between swept and FFT sweep types, is nominally ±0.01 dB and is included within the “Absolute Amplitude Error” specifications.
- Specifications apply with DC coupling at all frequencies. With AC coupling, specifications apply at frequencies of 50 MHz and higher. Statistical observations at 10 MHz show that most instruments meet the specifications, but a few percent of instruments can be expected to have errors exceeding 0.5 dB at 10 MHz at the temperature extreme. The effect at 20 to 50 MHz is negligible, but not warranted.
- Specifications for frequencies > 3.5 GHz apply for sweep rates ≤100 MHz/ms.
- Preselector centering applied.

Agilent EXA Signal Analyzer
Amplitude Accuracy and Range

Description			Specifications	Supplemental Information		
IF Frequency Response^a (Demodulation and FFT response relative to the center frequency)				Modes above 18 GHz ^b		
Center Freq (GHz)	Span^c (MHz)	Preselector	Max Error^d (Exception^e)	Midwidth Error (95th Percentile)	Slope (dB/MHz) (95th Percentile)	RMS^f (nominal)
<3.6	≤10		±0.40 dB	±0.12 dB	±0.10	0.04 dB
≥3.6, ≤26.5	≤10	On				0.25 dB
≥3.6	≤10	Off ^g	±0.45 dB	±0.12 dB	±0.10	0.04 dB
>26.5	≤10	On				0.35 dB

- a. The IF frequency response includes effects due to RF circuits such as input filters, that are a function of RF frequency, in addition to the IF passband effects.
- b. Signal frequencies between 18 and 26.5 GHz are prone to additional response errors due to modes in the Type-N connector used with frequency *Option 526*. With the use of Type-N to APC 3.5 mm adapter part number 1250-1744, there are nominally six such modes. These modes cause nominally up to -0.35 dB amplitude change, with phase errors of nominally up to ±1.2°.
- c. This column applies to the instantaneous analysis bandwidth in use. In the Spectrum Analyzer Mode, this would be the FFT width.
- d. The maximum error at an offset (f) from the center of the FFT width is given by the expression $\pm [\text{Midwidth Error} + (f \times \text{Slope})]$, but never exceeds ±Max Error. Here the Midwidth Error is the error at the center frequency for a given FFT span. Usually, the span is no larger than the FFT width in which case the center of the FFT width is the center frequency of the analyzer. When using the Spectrum Analyzer mode with an analyzer span is wider than the FFT width, the span is made up of multiple concatenated FFT results, and thus has multiple centers of FFT widths; in this case the f in the equation is the offset from the nearest center. Performance is nominally three times better at most center frequencies.
- e. The specification does not apply for frequencies greater than 3.6 MHz from the center in FFT widths of 7.2 to 8 MHz.
- f. The “rms” nominal performance is the standard deviation of the response relative to the center frequency, integrated across the span. This performance measure was observed at a center frequency in each harmonic mixing band, which is representative of all center frequencies; it is not the worst case frequency.
- g. *Option MPB* is installed and enabled.

Description			Specifications	Supplemental Information	
IF Phase Linearity				Deviation from mean phase linearity Modes above 18 GHz ^a	
Center Freq (GHz)	Span (MHz)	Preselector		Peak-to-peak (nominal)	RMS (nominal)^b
≥0.02, <3.6	≤10	n/a		0.4°	0.1°
≥3.6,	≤10	Off ^c		0.4°	0.1°
≥3.6 (<i>Option ≤ 526</i>)	≤10	On		1.0°	0.2°

- a. Signal frequencies between 18 and 26.5 GHz are prone to additional response errors due to modes in the Type-N connector used with frequency *Option 526*. With the use Type-N to APC 3.5 mm adapter part number 1250-1744, there are nominally six such modes. These modes cause nominally up to -0.35 dB amplitude change, with phase errors of nominally up to ±1.2°.
- b. The listed performance is the standard deviation of the phase deviation relative to the mean phase deviation from a linear phase condition, where the rms is computed across the span shown and over the range of center frequencies shown.
- c. *Option MPB* is installed and enabled.

Agilent EXA Signal Analyzer
Amplitude Accuracy and Range

Description	Specifications	Supplemental Information
Absolute Amplitude Accuracy At 50 MHz ^a 20 to 30°C Full temperature range At all frequencies ^a 20 to 30°C Full temperature range 95th Percentile Absolute Amplitude Accuracy ^b (Wide range of signal levels, RBWs, RLs, etc., 0.01 to 3.6 GHz, Atten = 10 dB) Amplitude Reference Accuracy Preamp On ^c	 ± 0.40 dB ± 0.43 dB $\pm(0.40$ dB + frequency response) $\pm(0.43$ dB + frequency response)	 ± 0.15 dB (95th percentile) ± 0.27 dB ± 0.05 dB (nominal) $\pm(0.39$ dB + frequency response) (nominal)

a. Absolute amplitude accuracy is the total of all amplitude measurement errors, and applies over the following subset of settings and conditions: 1 Hz ≤ RBW ≤ 1 MHz; Input signal –10 to –50 dBm (details below); Input attenuation 10 dB; span < 5 MHz (nominal additional error for span ≥ 5 MHz is 0.02 dB); all settings auto-coupled except Swp Time Rules = Accuracy; combinations of low signal level and wide RBW use VBW ≤ 30 kHz to reduce noise. When using FFT sweeps, the signal must be at the center frequency.

This absolute amplitude accuracy specification includes the sum of the following individual specifications under the conditions listed above: Scale Fidelity, Reference Level Accuracy, Display Scale Switching Uncertainty, Resolution Bandwidth Switching Uncertainty, 50 MHz Amplitude Reference Accuracy, and the accuracy with which the instrument aligns its internal gains to the 50 MHz Amplitude Reference.

The only difference between signals within the range ending at –50 dBm and those signals below that level is the scale fidelity. Our specifications show the possibility of increased errors below –80 dBm at the mixer, thus –70 dBm at the input. Therefore, one reasonably conservative approach to estimating the Absolute Amplitude Uncertainty below –70 dBm at the mixer would be to add an additional ±0.10 dB (the difference between the above –80 dBm at the mixer scale fidelity at the lower level scale fidelity) to the Absolute Amplitude Uncertainty.

- b. Absolute Amplitude Accuracy for a wide range of signal and measurement settings, covers the 95th percentile proportion with 95% confidence. Here are the details of what is covered and how the computation is made:

The wide range of conditions of RBW, signal level, VBW, reference level and display scale are discussed in footnote a. There are 44 quasi-random combinations used, tested at a 50 MHz signal frequency. We compute the 95th percentile proportion with 95% confidence for this set observed over a statistically significant number of instruments. Also, the frequency response relative to the 50 MHz response is characterized by varying the signal across a large number of quasi-random verification frequencies that are chosen to not correspond with the frequency response adjustment frequencies. We again compute the 95th percentile proportion with 95% confidence for this set observed over a statistically significant number of instruments. We also compute the 95th percentile accuracy of tracing the calibration of the 50 MHz absolute amplitude accuracy to a national standards organization. We also compute the 95th percentile accuracy of tracing the calibration of the relative frequency response to a national standards organization. We take the root-sum-square of these four independent Gaussian parameters. To that rss we add the environmental effects of temperature variations across the 20 to 30°C range. These computations and measurements are made with the mechanical attenuator only in circuit, set to the reference state of 10 dB.

A similar process is used for computing the result when using the electronic attenuator under a wide range of settings: all even settings from 4 through 24 dB inclusive, with the mechanical attenuator set to 10 dB. Then the worst of the two computed 95th percentile results (they are very close) is shown.

- c. Same settings as footnote a, except that the signal level at the preamp input is -40 to -80 dBm. Total power at preamp (dBm) = total power at input (dBm) minus input attenuation (dB). This specification applies for signal frequencies above 100 kHz.

Description	Specifications	Supplemental Information
<p>Input Attenuation Switching Uncertainty</p> <p>50 MHz (reference frequency) Attenuation > 2 dB, preamp off (Relative to 10 dB (reference setting))</p> <p>9 kHz to 3.6 GHz 3.5 to 7.0 GHz 7.0 to 13.6 GHz 13.5 to 26.5 GHz 26.5 to 44 GHz</p>	<p>±0.20 dB</p>	<p>Refer to the footnote for Band Overlaps on page 19</p> <p>±0.08 dB (typical)</p> <p>±0.3 dB (nominal) ±0.5 dB (nominal) ±0.7 dB (nominal) ±0.7 dB (nominal) ±1.0 dB (nominal)</p>

Agilent EXA Signal Analyzer
Amplitude Accuracy and Range

Description	Specifications	Supplemental Information
RF Input VSWR at tuned frequency, DC Coupled 10 dB attenuation, 50 MHz Frequency <i>Option ≤526</i> 10 MHz to 3.6 GHz 3.6 to 26.5 GHz <i>Option >526</i> 10 MHz to 3.6 GHz 3.6 to 26.5 GHz 26.5 to 44 GHz RF calibrator (e.g. 50 MHz) is On Alignments running Preselector Centering		Nominal ^a 1.07:1 Input Attenuation 0 dB ≥10 dB <2.2:1 <1.2:1 <1.8:1 <2.2:1 <1.2:1 <1.5:1 <1.8:1 Open input Open input for some, unless "All but RF" is selected Open input

a. The nominal SWR stated is at the worst case RF frequency in three representative instruments.

Description	Specifications	Supplemental Information
Resolution Bandwidth Switching Uncertainty 1.0 Hz to 3 MHz RBW Manually selected wide RBWs: 4, 5, 6, 8 MHz	±0.10 dB ±1.0 dB	Relative to reference BW of 30 kHz

Description	Specifications	Supplemental Information
Reference Level Range Log Units Linear Units Accuracy	-170 to +23 dBm, in 0.01 dB steps 707 pV to 3.16 V, with 0.01 dB resolution (0.11%) 0 dB ^a	

a. Because reference level affects only the display, not the measurement, it causes no additional error in measurement results from trace data or markers.

Description	Specifications	Supplemental Information
Display Scale Switching Uncertainty Switching between Linear and Log Log Scale Switching	0 dB ^a 0 dB ^a	

- a. Because Log/Lin and Log Scale Switching affect only the display, not the measurement, they cause no additional error in measurement results from trace data or markers.

Description	Specifications	Supplemental Information
Display Scale Fidelity^{ab} Absolute Log-Linear Fidelity (Relative to the reference condition: –25 dBm input through 10 dB attenuation, thus –35 dBm at the input mixer) Input mixer level^c –80 dBm ≤ ML ≤ –10 dBm ML < –80 dBm Relative Fidelity ^d Sum of the following terms: high level term instability term slope term prefilter term	Linearity ±0.15 dB ±0.25 dB	Applies for mixer level ^c range from –10 to –80 dBm, mechanical attenuator only, preamp off, and dither on. Nominal Up to ±0.045 dB ^e Up to ±0.018 dB From equation ^f Up to ±0.005 dB ^g

- a. Supplemental information: The amplitude detection linearity specification applies at all levels below –10 dBm at the input mixer; however, noise will reduce the accuracy of low level measurements. The amplitude error due to noise is determined by the signal-to-noise ratio, S/N. If the S/N is large (20 dB or better), the amplitude error due to noise can be estimated from the equation below, given for the 3-sigma (three standard deviations) level.

$$3\sigma = 3(20dB)\log\langle 1 + 10^{-((S/N + 3dB)/20dB)} \rangle$$

The errors due to S/N ratio can be further reduced by averaging results. For large S/N (20 dB or better), the 3-sigma level can be reduced proportional to the square root of the number of averages taken.

- b. The scale fidelity is warranted with ADC dither set to Medium. Dither increases the noise level by nominally only 0.1 dB for the most sensitive case (preamp Off, best DANL frequencies). With dither Off, scale fidelity for low level signals, around –60 dBm or lower, will nominally degrade by 0.2 dB.
- c. Mixer level = Input Level – Input Attenuation

Agilent EXA Signal Analyzer
Amplitude Accuracy and Range

- d. The relative fidelity is the error in the measured difference between two signal levels. It is so small in many cases that it cannot be verified without being dominated by measurement uncertainty of the verification. Because of this verification difficulty, this specification gives nominal performance, based on numbers that are as conservatively determined as those used in warranted specifications. We will consider one example of the use of the error equation to compute the nominal performance.
Example: the accuracy of the relative level of a sideband around -60 dBm, with a carrier at -5 dBm, using attenuation = 10 dB, RBW = 3 kHz, evaluated with swept analysis. The high level term is evaluated with $P1 = -15$ dBm and $P2 = -70$ dBm at the mixer. This gives a maximum error within ± 0.025 dB. The instability term is ± 0.018 dB. The slope term evaluates to ± 0.050 dB. The prefilter term applies and evaluates to the limit of ± 0.005 dB. The sum of all these terms is ± 0.098 dB.
- e. Errors at high mixer levels will nominally be well within the range of $\pm 0.045 \text{ dB} \times \{ \exp[(P1 - \text{Pref})/(8.69 \text{ dB})] - \exp[(P2 - \text{Pref})/(8.69 \text{ dB})] \}$ (exp is the natural exponent function, e^x). In this expression, P1 and P2 are the powers of the two signals, in decibel units, whose relative power is being measured. Pref is -10 dBm (-10 dBm is the highest power for which linearity is specified). All these levels are referred to the mixer level.
- f. Slope error will nominally be well within the range of $\pm 0.0009 \times (P1 - P2)$. P1 and P2 are defined in footnote e.
- g. A small additional error is possible. In FFT sweeps, this error is possible for spans under 4.01 kHz. For non-FFT measurements, it is possible for RBWs of 3.9 kHz or less. The error is well within the range of $\pm 0.0021 \times (P1 - P2)$ subject to a maximum of ± 0.005 dB. (The maximum dominates for all but very small differences.) P1 and P2 are defined in footnote e.

Description	Specifications	Supplemental Information
Available Detectors	Normal, Peak, Sample, Negative Peak, Average	Average detector works on RMS, Voltage and Logarithmic scales

Dynamic Range

Gain Compression

Description	Specifications	Supplemental Information																		
<p>1 dB Gain Compression Point (Two-tone)^{abc} 20 MHz to 26.5 GHz (<i>Option ≤526</i>) 20 MHz to 26.5 GHz (<i>Option >526</i>) 26.5 to 44 GHz (<i>Option >526</i>)</p> <p>Clipping (ADC Over-range) Any signal offset</p> <p>Signal offset > 5 times IF prefilter bandwidth and IF Gain set to Low</p> <p>IF Prefilter Bandwidth</p> <table border="0"> <tr> <td>Zero Span or Swept, RBW =</td> <td>Sweep Type = FFT, FFT Width =</td> <td></td> </tr> <tr> <td>≤3.9 kHz</td> <td><4.01 kHz</td> <td></td> </tr> <tr> <td>4.3 to 27 kHz</td> <td><28.81 kHz</td> <td></td> </tr> <tr> <td>30 to 160 kHz</td> <td><167.4 kHz</td> <td></td> </tr> <tr> <td>180 to 390 kHz</td> <td><411.9 kHz</td> <td></td> </tr> <tr> <td>430 kHz to 8 MHz</td> <td><7.99 MHz</td> <td></td> </tr> </table>	Zero Span or Swept, RBW =	Sweep Type = FFT, FFT Width =		≤3.9 kHz	<4.01 kHz		4.3 to 27 kHz	<28.81 kHz		30 to 160 kHz	<167.4 kHz		180 to 390 kHz	<411.9 kHz		430 kHz to 8 MHz	<7.99 MHz		-10 dBm	<p>Maximum power at mixer^d (nominal) +9 dBm (nominal) +6 dBm (nominal) 0 dBm (nominal)</p> <p>Low frequency exceptions^d +12 dBm (nominal)</p> <p>-3 dB Bandwidth (nominal) 8.9 kHz 79 kHz 303 kHz 966 kHz 10.9 MHz</p>
Zero Span or Swept, RBW =	Sweep Type = FFT, FFT Width =																			
≤3.9 kHz	<4.01 kHz																			
4.3 to 27 kHz	<28.81 kHz																			
30 to 160 kHz	<167.4 kHz																			
180 to 390 kHz	<411.9 kHz																			
430 kHz to 8 MHz	<7.99 MHz																			

- a. Large signals, even at frequencies not shown on the screen, can cause the analyzer to incorrectly measure on-screen signals because of two-tone gain compression. This specification tells how large an interfering signal must be in order to cause a 1 dB change in an on-screen signal.
- b. Specified at 1 kHz RBW with 100 kHz tone spacing. The compression point will nominally equal the specification for tone spacing greater than 5 times the prefilter bandwidth. At smaller spacings, ADC clipping may occur at a level lower than the 1 dB compression point.

- c. Reference level and off-screen performance: The reference level (RL) behavior differs from some earlier analyzers in a way that makes this analyzer more flexible. In other analyzers, the RL controlled how the measurement was performed as well as how it was displayed. Because the logarithmic amplifier in these analyzers had both range and resolution limitations, this behavior was necessary for optimum measurement accuracy. The logarithmic amplifier in this signal analyzer, however, is implemented digitally such that the range and resolution greatly exceed other instrument limitations. Because of this, the analyzer can make measurements largely independent of the setting of the RL without compromising accuracy. Because the RL becomes a display function, not a measurement function, a marker can read out results that are off-screen, either above or below, without any change in accuracy. The only exception to the independence of RL and the way in which the measurement is performed is in the input attenuation setting: When the input attenuation is set to auto, the rules for the determination of the input attenuation include dependence on the reference level. Because the input attenuation setting controls the tradeoff between large signal behaviors (third-order intermodulation, compression, and display scale fidelity) and small signal effects (noise), the measurement results can change with RL changes when the input attenuation is set to auto.
- d. The ADC clipping level declines at low frequencies (below 50 MHz) when the LO feedthrough (the signal that appears at 0 Hz) is within 5 times the prefilter bandwidth (see table) and must be handled by the ADC. For example, with a 300 kHz RBW and prefilter bandwidth at 966 kHz, the clipping level reduces for signal frequencies below 4.83 MHz. For signal frequencies below 2.5 times the prefilter bandwidth, there will be additional reduction due to the presence of the image signal (the signal that appears at the negative of the input signal frequency) at the ADC.

Displayed Average Noise Level

Description			Specifications		Supplemental Information
Displayed Average Noise Level (DANL)^a			Input terminated Sample or Average detector Averaging type = Log 0 dB input attenuation IF Gain = High 1 Hz Resolution Bandwidth		Refer to the footnote for Band Overlaps on page 19.
mmW without <i>Option B40, DP2, or MPB</i>					
mmW with <i>Option B40, DP2, or MPB</i>					
RF/ μ W(<i>Option 503, 507, 513, or 526</i>)	▼	▼	20 to 30°C	Full range	Typical
10 Hz	x	x			-90 dBm (nominal)
20 Hz	x	x			-100 dBm (nominal)
100 Hz	x	x			-110 dBm (nominal)
1 kHz	x	x			-120 dBm (nominal)
9 kHz to 1 MHz	x				-125 dBm (nominal)
9 kHz to 1 MHz		x			-130 dBm
1 to 10 MHz ^b	x		-147 dBm	-145 dBm	-149 dBm
1 MHz to 1.2 GHz		x	-152 dBm	-151 dBm	-155 dBm
10 MHz to 2.1 GHz	x		-148 dBm	-146 dBm	-150 dBm
1.2 to 2.1 GHz		x	-151 dBm	-150 dBm	-154 dBm
2.1 to 3.6 GHz	x		-147 dBm	-145 dBm	-149 dBm
2.1 to 3.6 GHz		x	-149 dBm	-148 dBm	-152 dBm
3.6 to 7 GHz	x		-147 dBm	-145 dBm	-149 dBm
3.5 to 4.2 GHz		x	-142 dBm	-140 dBm	-146 dBm
3.5 to 4.2 GHz			x	-144 dBm	-147 dBm
4.2 to 8.4 GHz		x	-143 dBm	-141 dBm	-148 dBm
4.2 to 8.4 GHz			x	-145 dBm	-150 dBm
7 to 13.6 GHz	x		-143 dBm	-141 dBm	-147 dBm
8.3 to 13.6 GHz		x	-145 dBm	-143 dBm	-148 dBm
8.3 to 13.6 GHz			x	-147 dBm	-150 dBm
13.5 to 22 GHz	x		-137 dBm	-134 dBm	-142 dBm
13.5 to 20 GHz		x	-142 dBm	-140 dBm	-146 dBm
13.5 to 20 GHz			x	-145 dBm	-148 dBm

Agilent EXA Signal Analyzer
Dynamic Range

Description				Specifications		Supplemental Information
22 to 26.5 GHz	x			-134 dBm	-130 dBm	-140 dBm
20 to 26.5 GHz		x		-139 dBm	-137 dBm	-143 dBm
20 to 26.5 GHz			x	-142 dBm	-140 dBm	-145 dBm
26.4 to 34 GHz		x		-137 dBm	-133 dBm	-142 dBm
26.4 to 34 GHz			x	-140 dBm	-136 dBm	-144 dBm
33.9 to 44 GHz		x		-131 dBm	-127 dBm	-137 dBm
33.9 to 44 GHz			x	-135 dBm	-131 dBm	-140 dBm
Additional DANL, IF Gain=Low ^c	x	x	x			-160.5 dBm (nominal)

- a. DANL for zero span and swept is measured in a 1 kHz RBW and normalized to the narrowest available RBW, because the noise figure does not depend on RBW and 1 kHz measurements are faster.
- b. DANL below 10 MHz is affected by phase noise around the LO feedthrough signal. Specifications apply with the best setting of the Phase Noise Optimization control, which is to choose the "Best Close-in ϕ Noise" for frequencies below 25 kHz, and "Best Wide Offset ϕ Noise" for frequencies above 25 kHz.
- c. Setting the IF Gain to Low is often desirable in order to allow higher power into the mixer without overload, better compression and better third-order intermodulation. When the Swept IF Gain is set to Low, either by auto coupling or manual coupling, there is noise added above that specified in this table for the IF Gain = High case. That excess noise appears as an additional noise at the input mixer. This level has sub-decibel dependence on center frequency. To find the total displayed average noise at the mixer for Swept IF Gain = Low, sum the powers of the DANL for IF Gain = High with this additional DANL. To do that summation, compute $DANL_{total} = 10 \times \log(10^{(DANL_{high}/10)} + 10^{(Additional-DANL / 10)})$. In FFT sweeps, the same behavior occurs, except that FFT IF Gain can be set to autorange, where it varies with the input signal level, in addition to forced High and Low settings.

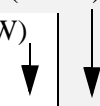
Spurious Responses

Description	Specifications	Supplemental Information		
Spurious Responses (see Band Overlaps on page 19)		Preamp Off ^a		
Residual Responses ^b 200 kHz to 8.4 GHz (swept) Zero span or FFT or other frequencies	-100 dBm	-100 dBm (nominal)		
Image Responses				
Tuned Freq (f)	Excitation Freq	Mixer Level^c	Response	
10 MHz to 26.5 GHz	f+45 MHz	-10 dBm	-75 dBc	-99 dBc (typical)
10 MHz to 3.6 GHz	f+10245 MHz	-10 dBm	-80 dBc	-103 dBc (typical)
10 MHz to 3.6 GHz	f+645 MHz	-10 dBm	-80 dBc	-107 dBc (typical)
3.5 to 13.6 GHz	f+645 MHz	-10 dBm	-75 dBc	-87 dBc (typical)
13.5 to 17.1 GHz	f+645 MHz	-10 dBm	-71 dBc	-85 dBc (typical)
17.0 to 22 GHz	f+645 MHz	-10 dBm	-68 dBc	-82 dBc (typical)
22 to 26.5 GHz	f+645 MHz	-10 dBm	-66 dBc	-78 dBc (typical)
26.5 to 34.5 GHz	f+645 MHz	-30 dBm	-70 dBc	-94 dBc (typical)
34.4 to 44 GHz	f+645 MHz	-30 dBm	-60 dBc	-79 dBc (typical)
Other Spurious Responses				
Carrier Frequency ≤ 26.5 GHz First RF Order ^d (f ≥ 10 MHz from carrier)	-10 dBm	-68 dBc + $20 \times \log(N^e)$		Includes IF feedthrough, LO harmonic mixing responses
Higher RF Order ^f (f ≥ 10 MHz from carrier)	-40 dBm	-80 dBc + $20 \times \log(N^e)$		Includes higher order mixer responses
Carrier Frequency > 26.5 GHz First RF Order ^d (f ≥ 10 MHz from carrier)	-30 dBm			-90 dBc (nominal)
Higher RF Order ^f (f ≥ 10 MHz from carrier)	-30 dBm			-90 dBc (nominal)
LO-Related Spurious Responses (f > 600 MHz from carrier 10 MHz to 3.6 GHz)	-10 dBm	-60 dBc ^g + $20 \times \log(N^e)$		-90 dBc + $20 \times \log(N)$ (typical)
Sidebands, offset from CW signal				
≤ 200 Hz				-70 dBc ^g (nominal)
200 Hz to 3 kHz				-73 dBc ^g (nominal)
3 kHz to 30 kHz				-73 dBc (nominal)
30 kHz to 10 MHz				-80 dBc (nominal)

Agilent EXA Signal Analyzer
Dynamic Range

- a. The spurious response specifications only apply with the preamp turned off. When the preamp is turned on, performance is nominally the same as long as the mixer level is interpreted to be: Mixer Level = Input Level – Input Attenuation + Preamp Gain
- b. Input terminated, 0 dB input attenuation.
- c. Mixer Level = Input Level – Input Attenuation.
- d. With first RF order spurious products, the indicated frequency will change at the same rate as the input, with higher order, the indicated frequency will change at a rate faster than the input.
- e. N is the LO multiplication factor.
- f. RBW=100 Hz. With higher RF order spurious responses, the observed frequency will change at a rate faster than the input frequency.
- g. Nominally –40 dBc under large magnetic (0.38 Gauss rms) or vibrational (0.21 g rms) environmental stimuli.

Second Harmonic Distortion

Description	Specifications	Supplemental Information
Second Harmonic Distortion		SHI ^a (nominal)
<i>Option 532, or 544 (mmW)</i>		
<i>Option 503, 507, 513, or 526 (RF/μW)</i>		
		
10 MHz to 1.8 GHz	x x	+45 dBm
1.8 to 7 GHz	x	+65 dBm
1.8 to 6.5 GHz	x	+65 dBm
7 to 11 GHz	x	+55 dBm
6.5 to 10 GHz	x	+60 dBm
11 to 13.25 GHz	x	+50 dBm
10 to 13.25 GHz	x	+55 dBm
13.25 to 22 GHz	x	+50 dBm

- a. SHI = second harmonic intercept. The SHI is given by the mixer power in dBm minus the second harmonic distortion level relative to the mixer tone in dBc.

Third Order Intermodulation

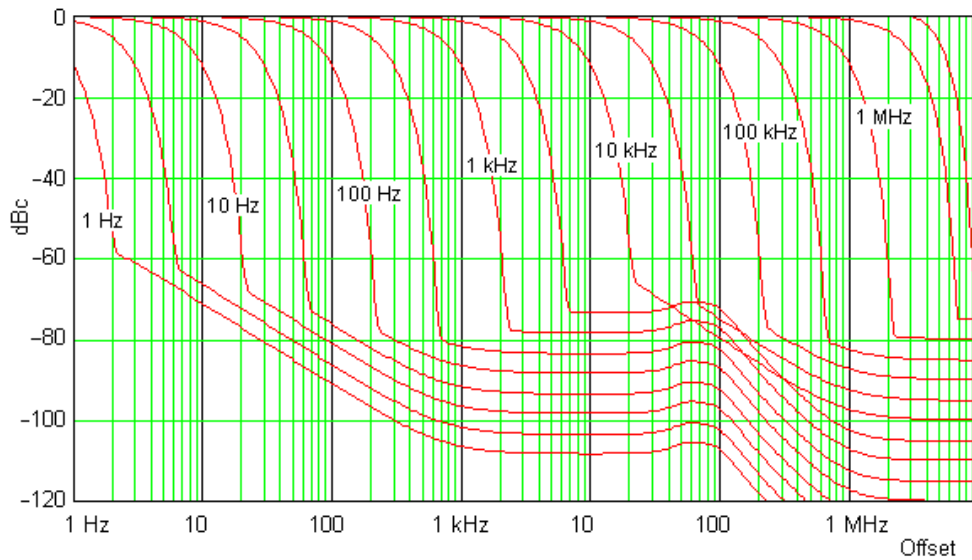
Description				Specifications	Supplemental Information
Third Order Intermodulation (Tone separation > 5 times IF Prefilter Bandwidth ^a Verification conditions ^b)					Refer to the footnote for Band Overlaps on page 19.
mmW Option 532, or 544					
RF/μW Option ≤526 (SN prefix <MY/SG/US5340)					
RF/μW Option ≤526 (SN prefix ≥MY/SG/US5340, ship standard with N9010A-EP3)					
20 to 30°C	↓	↓	↓	Intercept^c	Intercept (typical)
10 to 100 MHz			x	+12 dBm	+17 dBm
100 to 400 MHz	x			+13 dBm	+17 dBm
100 to 400 MHz		x		+10 dBm	+14 dBm
400 MHz to 3.6 GHz	x			+14 dBm	+18 dBm
400 MHz to 1.7 GHz		x		+11 dBm	+15 dBm
1.7 to 3.6 GHz		x		+13 dBm	+17 dBm
100 MHz to 3.95 GHz			x	+15 dBm	+19 dBm
3.6 to 13.6 GHz	x			+14 dBm	+18 dBm
3.6 to 5.1 GHz		x		+11 dBm	+17 dBm
5.1 to 7 GHz		x		+13 dBm	+17 dBm
3.95 to 8.4 GHz			x	+15 dBm	+18 dBm
7 to 13.6 GHz		x		+11 dBm	+15 dBm
8.3 to 13.6 GHz			x	+15 dBm	+18 dBm
13.6 to 26.5 GHz	x			+12 dBm	+16 dBm
13.6 to 26.5 GHz		x		+9 dBm	+14 dBm
13.5 to 17.1 GHz			x	+11 dBm	+17 dBm
17.0 to 26.5 GHz			x	+10 dBm	+17 dBm (nominal)
26.5 to 44 GHz			x		+13 dBm (nominal)

Agilent EXA Signal Analyzer
Dynamic Range

Description				Specifications	Supplemental Information
Full temperature range					
10 to 100 MHz			x	+10 dBm	
100 to 400 MHz	x			+10 dBm	
100 to 400 MHz		x		+9 dBm	
400 MHz to 3.6 GHz	x			+12 dBm	
400 MHz to 1.7 GHz		x		+10 dBm	
1.7 to 3.6 GHz		x		+12 dBm	
100 MHz to 3.95 GHz			x	+13 dBm	
3.6 to 13.6 GHz	x			+12 dBm	
3.6 to 5.1 GHz		x		+10 dBm	
5.1 to 7 GHz		x		+12 dBm	
3.95 to 8.4 GHz			x	+13 dBm	
7 to 13.6 GHz		x		+10 dBm	
8.3 to 13.6 GHz			x	+13 dBm	
13.6 to 26.5 GHz	x			+10 dBm	
13.6 to 26.5 GHz		x		+7 dBm	
13.5 to 17.1 GHz			x	+9 dBm	
17.0 to 26.5 GHz			x	+8 dBm	

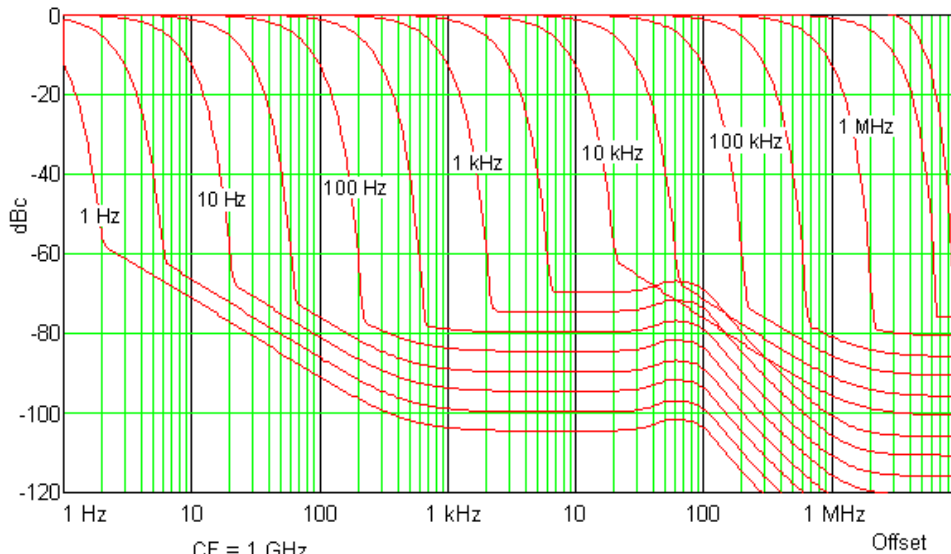
- a. See the IF Prefilter Bandwidth table in the Gain Compression specifications on [page 41](#). When the tone separation condition is met, the effect on TOI of the setting of IF Gain is negligible. TOI is verified with IF Gain set to its best case condition, which is IF Gain = Low.
- b. TOI is verified with two tones, each at -16 dBm at the mixer, spaced by 100 kHz.
- c. Intercept = TOI = third order intercept. The TOI is given by the mixer tone level (in dBm) minus (distortion/2) where distortion is the relative level of the distortion tones in dBc.

Nominal Dynamic Range vs. Offset Frequency vs. RBW for Freq *Option* ≤ 526 [Plot]
(SN prefix ≥MY/SG/US5340, ship standard with N9010A-EP3)



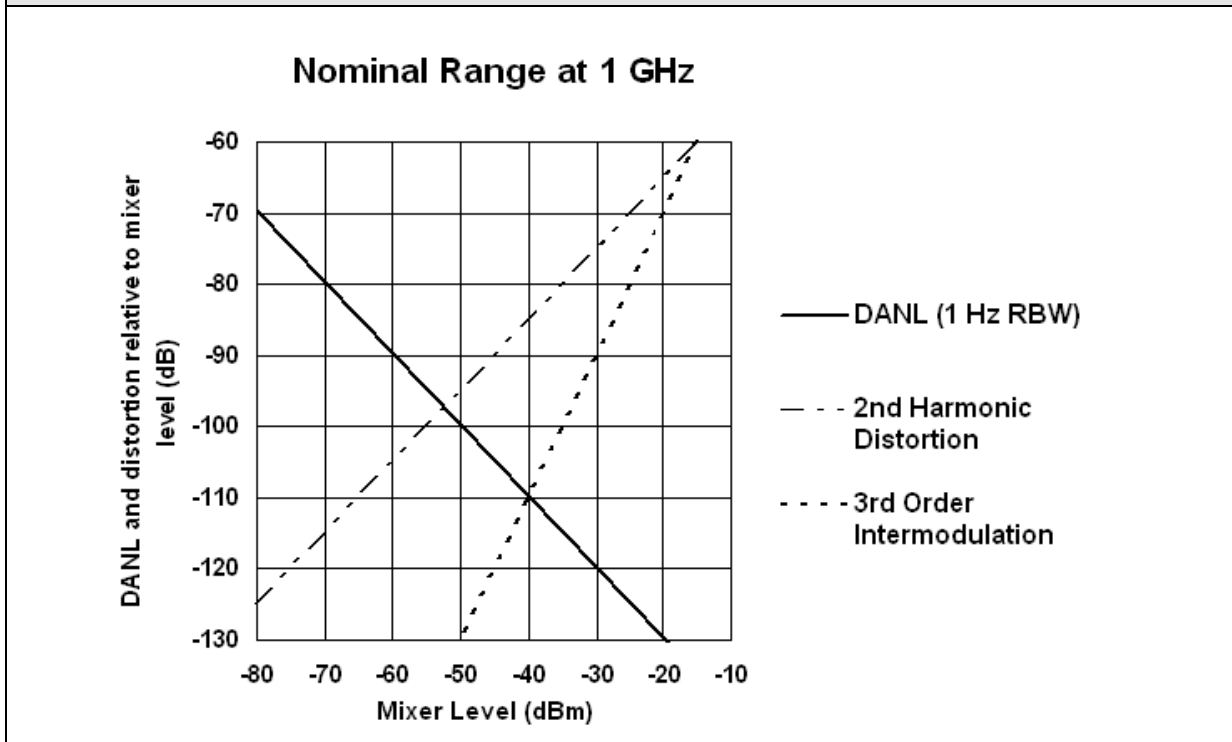
Conditions:
 CF = 1 GHz
 Mixer Level = -10 dBm
 Only 2 per decade of the 24/decade RBWs are shown
 RBWs 3 kHz and below are shown with phase noise optimized for $f_m < 20$ kHz
 RBWs 10 kHz and above are shown with phase noise optimized for $f_m > 30$ kHz
 Average Type = Log

Nominal Dynamic Range vs. Offset Frequency vs. RBW for Freq *Option* ≤ 526 [Plot]
(SN prefix <MY/SG/US5340)

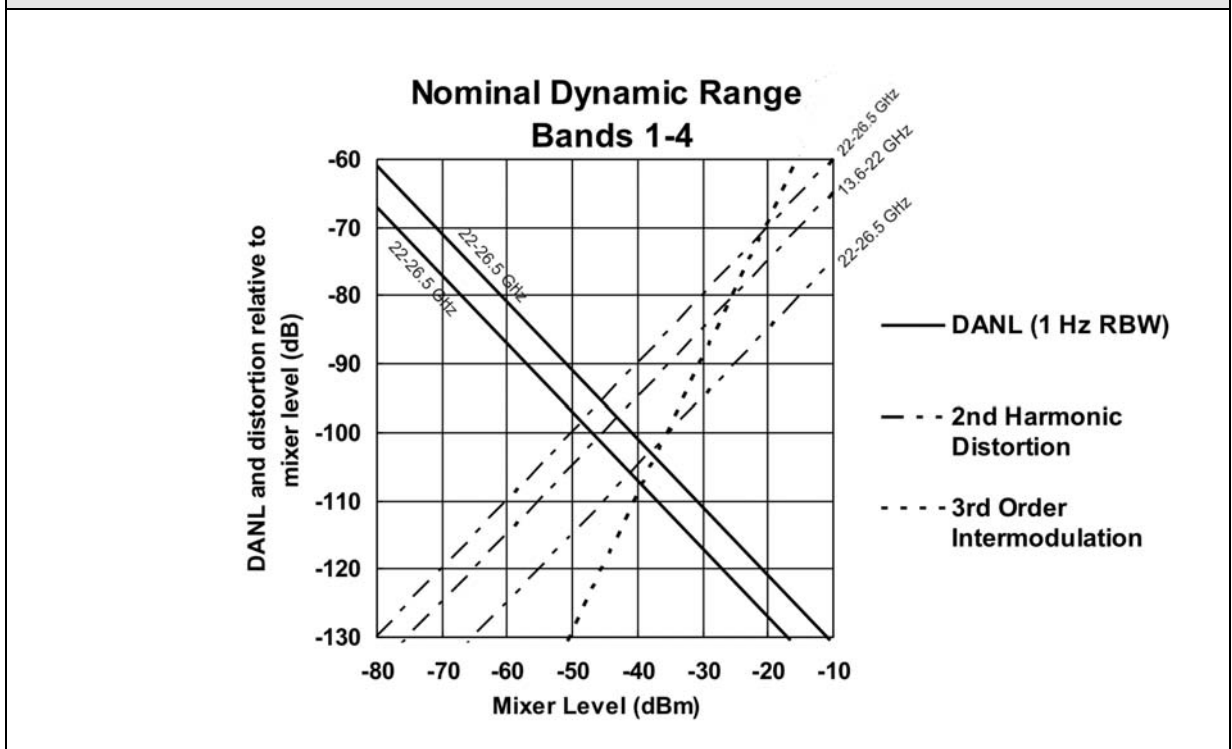


Conditions:
 CF = 1 GHz
 Mixer Level = -10 dBm
 Only 2 per decade of the 24/decade RBWs are shown
 RBWs 3 kHz and below are shown with phase noise optimized for $f_m < 20$ kHz
 RBWs 10 kHz and above are shown with phase noise optimized for $f_m > 30$ kHz
 Average Type = Log

Nominal Dynamic Range at 1 GHz for Freq *Option* ≤ 526 [Plot]



Nominal Dynamic Range Bands 1-4 for Freq *Option* ≤ 526 [Plot]



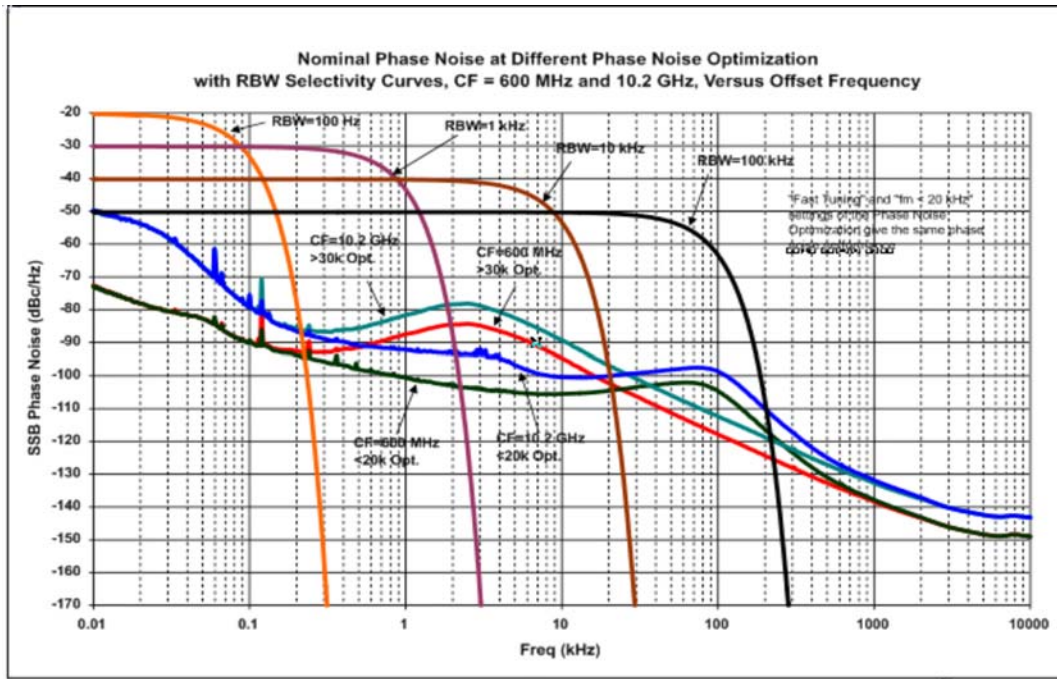
Phase Noise

Description	Specifications			Supplemental Information	
Phase Noise (Center Frequency = 1 GHz ^a , Best-case Optimization ^b , Internal Reference ^c) <i>Option 532, or 544 (mmW)</i> RF/ μ W <i>Option</i> ≤ 526 , (SN prefix < MY/SG/US5340) RF/ μ W <i>Option</i> ≤ 526 , (SN prefix \geq MY/SG/US5340, ship standard with N9010A-EP3)				Noise Sidebands	
			20 to 30°C	Full range	
				Typical	
100 Hz	x	x	-84 dBc/Hz	-82 dBc/Hz	-88 dBc/Hz
1 kHz	x	x			-98 dBc/Hz (nominal)
1 kHz					-101 dBc/Hz (nominal)
10 kHz	x		-103 dBc/Hz	-101 dBc/Hz	-105 dBc/Hz
10 kHz		x	-99 dBc/Hz	-98 dBc/Hz	-102 dBc/Hz
10 kHz			-103 dBc/Hz	-101 dBc/Hz	-106 dBc/Hz
100 kHz	x		-115 dBc/Hz	-114 dBc/Hz	-117 dBc/Hz
100 kHz		x	-112 dBc/Hz	-111 dBc/Hz	-114 dBc/Hz
100 kHz			-115 dBc/Hz	-114 dBc/Hz	-116 dBc/Hz
1 MHz	x		-135 dBc/Hz	-134 dBc/Hz	-137 dBc/Hz
1 MHz		x	-132 dBc/Hz	-131 dBc/Hz	-135 dBc/Hz
1 MHz			-135 dBc/Hz	-134 dBc/Hz	-137 dBc/Hz
10 MHz	x				-148 dBc/Hz (nominal)
10 MHz		x			-143 dBc/Hz (nominal)
10 MHz					-149 dBc/Hz (nominal)

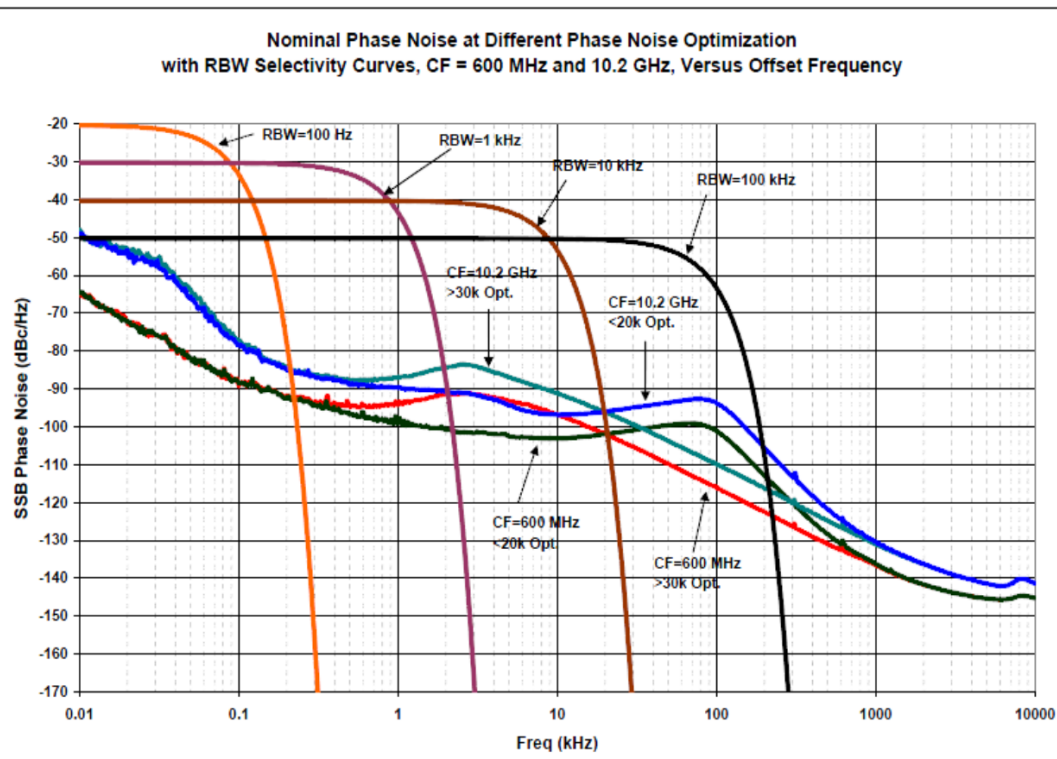
- a. The nominal performance of the phase noise at center frequencies different than the one at which the specifications apply (1 GHz) depends on the center frequency, band and the offset. For low offset frequencies, offsets well under 100 Hz, the phase noise increases by $20 \times \log[(f + 0.3225)/1.3225]$. For mid-offset frequencies such as 10 kHz, band 0 phase noise increases as $20 \times \log[(f + 5.1225)/6.1225]$. For mid-offset frequencies in other bands, phase noise changes as $20 \times \log[(f + 0.3225)/6.1225]$ except f in this expression should never be lower than 5.8. For wide offset frequencies, offsets above about 100 kHz, phase noise increases as $20 \times \log(N)$. N is the LO Multiple as shown on page 19; f is in GHz units in all these relationships; all increases are in units of decibels.
- b. Noise sidebands for lower offset frequencies, for example, 10 kHz, apply with the phase noise optimization (**PhNoise Opt**) set to **Best Close-in ϕ Noise**. Noise sidebands for higher offset frequencies, for example, 1 MHz, as shown apply with the phase noise optimization set to **Best Wide-offset ϕ Noise**.

- c. Specifications are given with the internal frequency reference. The phase noise at offsets below 100 Hz is impacted or dominated by noise from the reference. Thus, performance with external references will not follow the curves and specifications. The internal 10 MHz reference phase noise is about -120 dBc/Hz at 10 Hz offset; external references with poorer phase noise than this will cause poorer performance than shown.

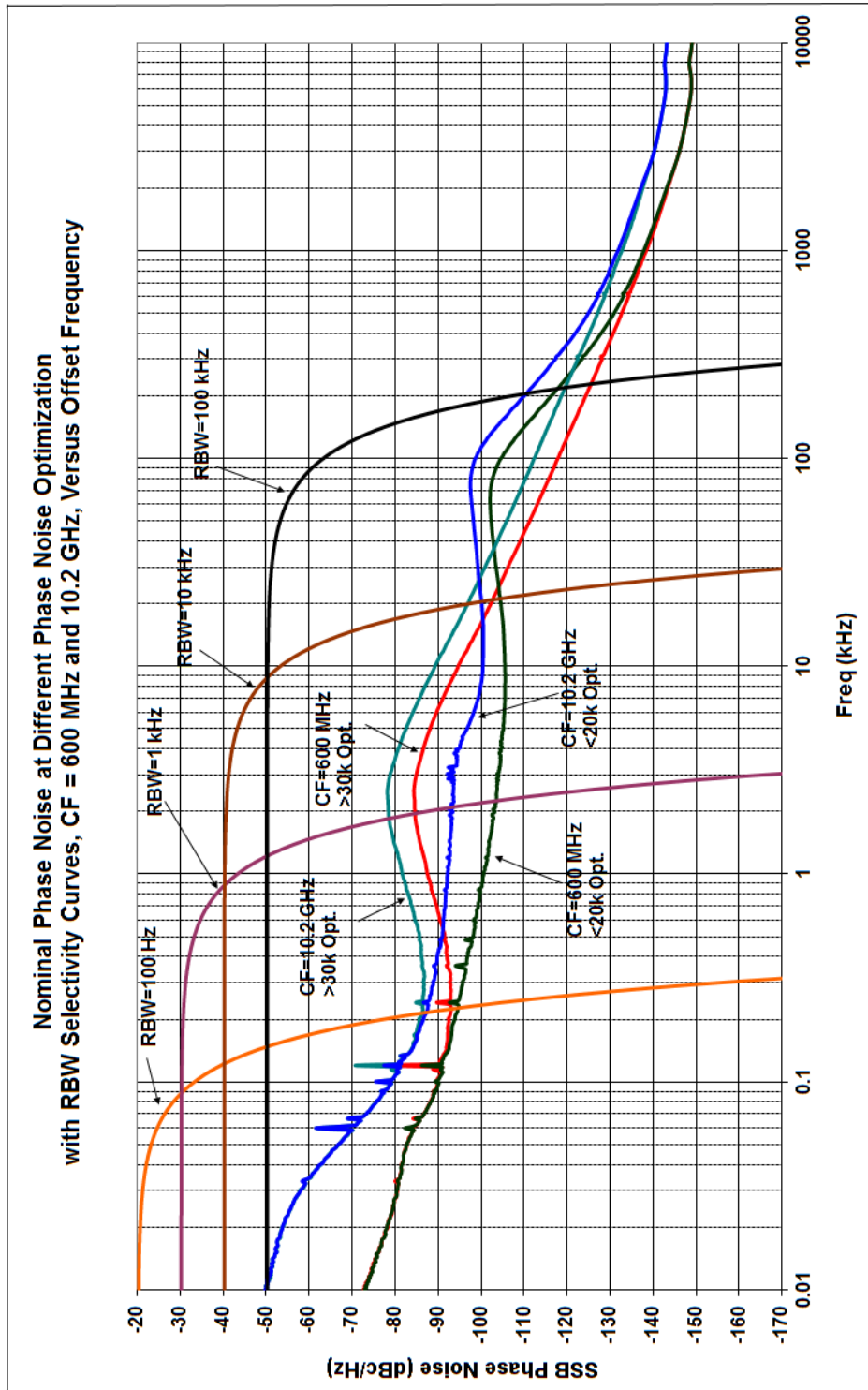
Nominal Phase Noise of Different LO Optimizations for Freq *Option* ≤ 526 [Plot]
(SN prefix ≥MY/SG/US5340, Ship standard with N9010A-EP3)



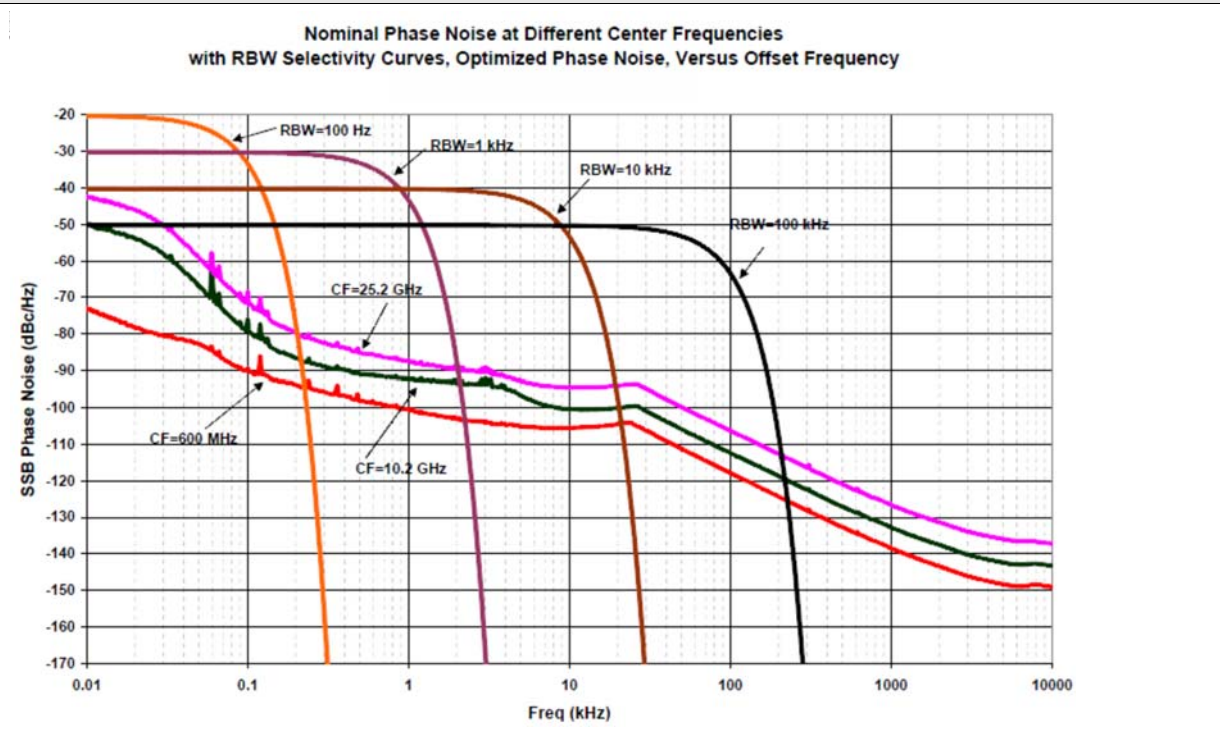
Nominal Phase Noise of Different LO Optimizations for Freq *Option* ≤ 526 [Plot]
(SN prefix <MY/SG/US5340)



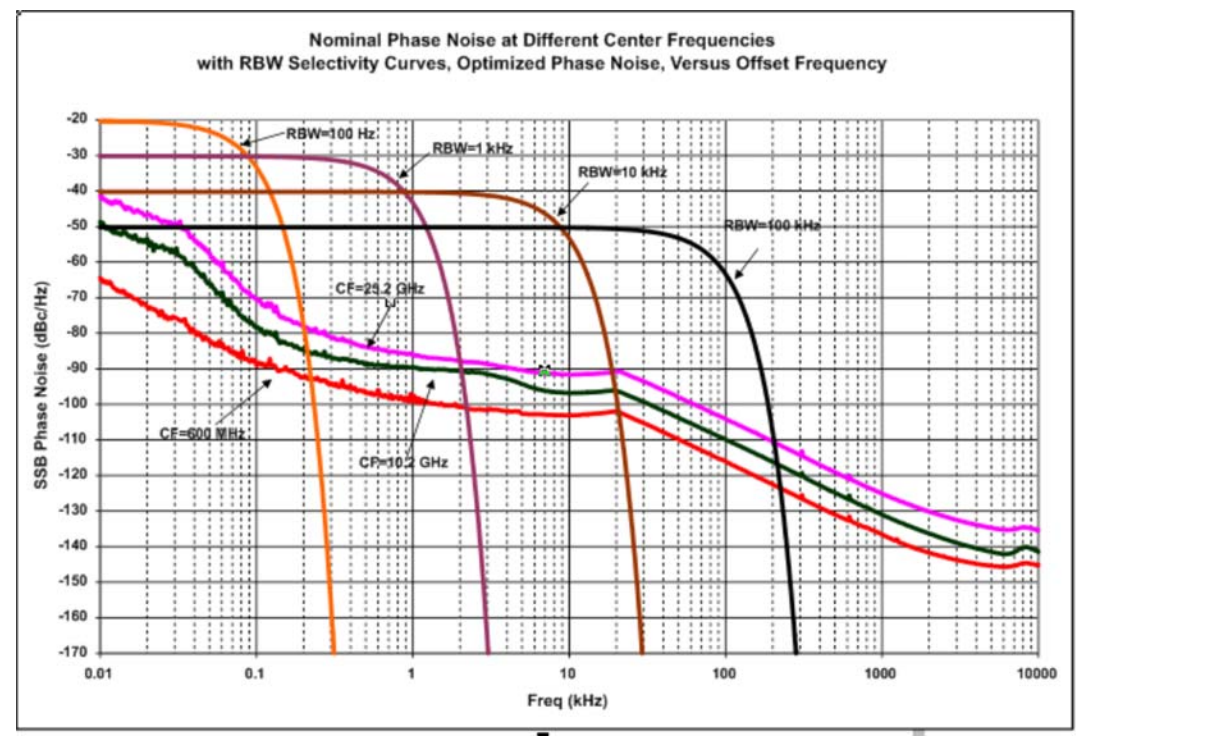
Nominal Phase Noise of Different LO Optimizations for Freq Option > 526 [Plot]



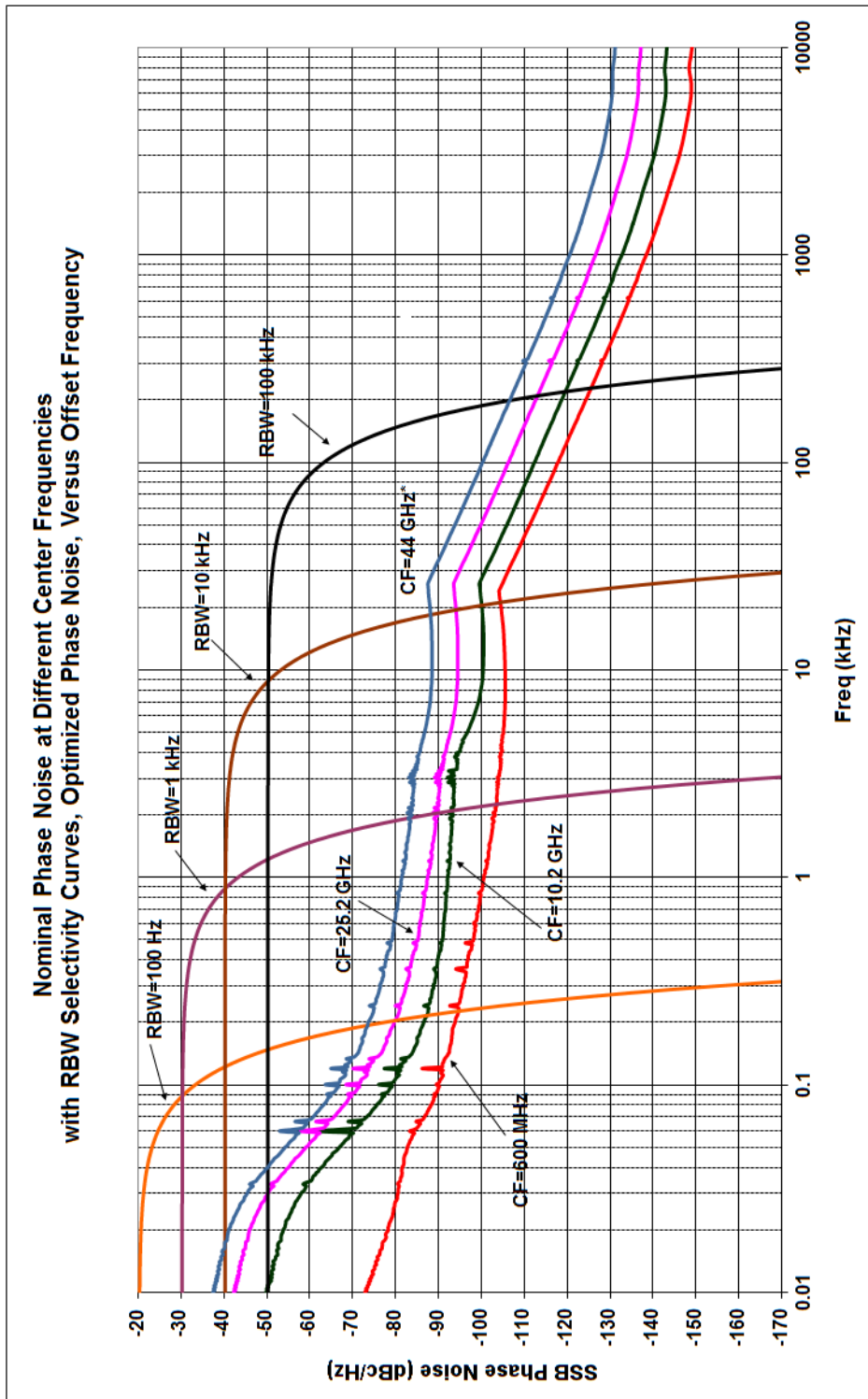
Nominal Phase Noise of Different Center Frequencies for Freq *Option* ≤ 526 [Plot]
(SN prefix ≥MY/SG/US5340, Ship standard with N9010A-EP3)



Nominal Phase Noise of Different Center Frequencies for Freq *Option* ≤ 526 [Plot]
(SN prefix <MY/SG/US5340)



Nominal Phase Noise of Different Center Frequencies for Freq *Option* >526 [Plot]



*: Unlike other curves, which are measured results from the measurement of excellent sources, the CF = 44 GHz curve is the predicted, not observed, phase noise, computed from the 25.2 GHz observation. See the Frequency Stability section for the details of phase noise performance versus center frequency.

Power Suite Measurements

The specifications for this section apply only to instruments with Frequency *Option 503, 507, 513, or 526*. For instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Description	Specifications	Supplemental Information
Channel Power Amplitude Accuracy Case: Radio Std = 3GPP W-CDMA, or IS-95 Absolute Power Accuracy (20 to 30°C, Attenuation = 10 dB)	±01.04 dB	Absolute Amplitude Accuracy ^a + Power Bandwidth Accuracy ^{bc} ±0.27 dB (95 th percentile)

- a. See “Absolute Amplitude Accuracy” on page 36.
- b. See “Frequency and Time” on page 19.
- c. Expressed in dB.

Description	Specifications	Supplemental Information
Occupied Bandwidth Frequency Accuracy		±(Span/1000) (nominal)

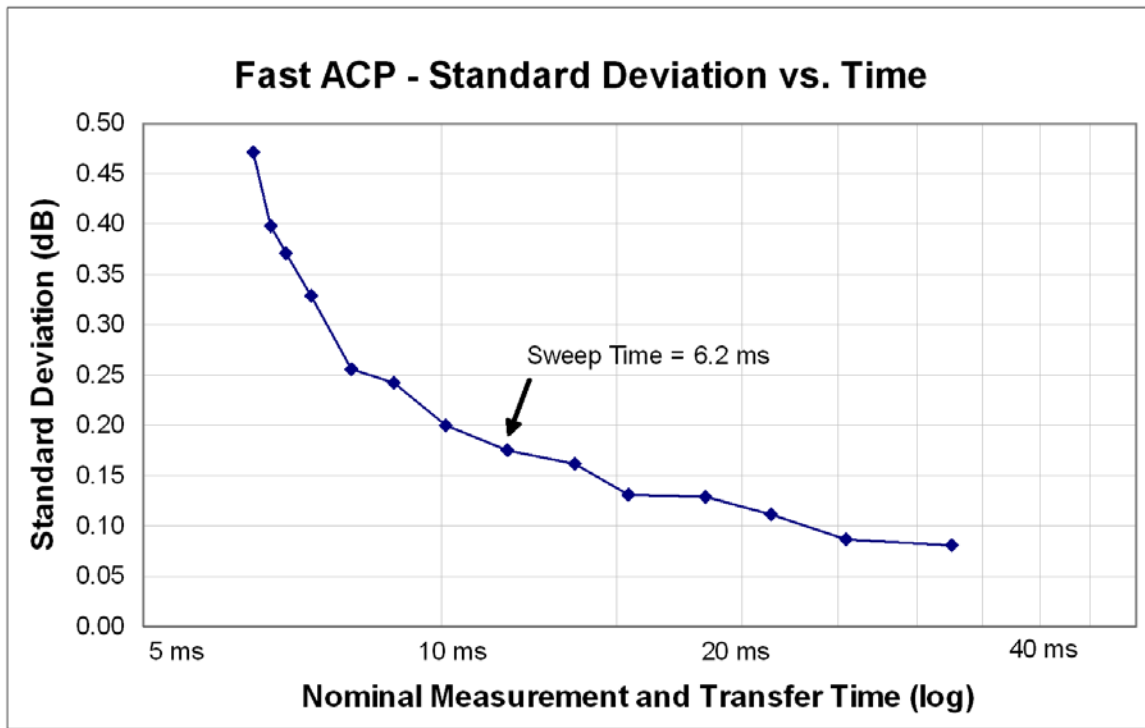
Description	Specifications	Supplemental Information		
Adjacent Channel Power (ACP)				
Case: Radio Std = None				
Accuracy of ACP Ratio (dBc)		Display Scale Fidelity ^a		
Accuracy of ACP Absolute Power (dBm or dBm/Hz)		Absolute Amplitude Accuracy ^b + Power Bandwidth Accuracy ^{cd}		
Accuracy of Carrier Power (dBm), or Carrier Power PSD (dBm/Hz)		Absolute Amplitude Accuracy ^b + Power Bandwidth Accuracy ^{cd}		
Passband Width ^e	-3 dB			
Case: Radio Std = 3GPP W-CDMA				
Minimum power at RF Input		(ACPR; ACLR) ^f -36 dBm (nominal)		
ACPR Accuracy ^g		RRC weighted, 3.84 MHz noise bandwidth, method ≠ RBW		
Radio	Offset Freq			
MS (UE)	5 MHz	±0.18 dB		
MS (UE)	10 MHz	±0.26 dB		
BTS	5 MHz	±0.79 dB		
BTS	10 MHz	±0.62 dB		
BTS	5 MHz	±0.34 dB		
Dynamic Range		RRC weighted, 3.84 MHz noise bandwidth		
Noise Correction	Offset Freq	Optimum ML^m (Nominal)		
	Method	ACLR (typical)^l		
Off	5 MHz	Filtered IBW	-68 dB	-8 dBm
Off	5 MHz	Fast	-67 dB	-9 dBm
Off	10 MHz	Filtered IBW	-74 dB	-2 dBm
On	5 MHz	Filtered IBW	-73 dB	-8 dBm
On	10 MHz	Filtered IBW	-76 dB	-2 dBm
RRC Weighting Accuracy ⁿ				
White noise in Adjacent Channel		0.00 dB nominal		
TOI-induced spectrum		0.001 dB nominal		
rms CW error		0.012 dB nominal		

- a. The effect of scale fidelity on the ratio of two powers is called the relative scale fidelity. The scale fidelity specified in the Amplitude section is an absolute scale fidelity with -35 dBm at the input mixer as the reference point. The relative scale fidelity is nominally only 0.01 dB larger than the absolute scale fidelity.
- b. See Amplitude Accuracy and Range section.
- c. See Frequency and Time section.

- d. Expressed in decibels.
- e. An ACP measurement measures the power in adjacent channels. The shape of the response versus frequency of those adjacent channels is occasionally critical. One parameter of the shape is its 3 dB bandwidth. When the bandwidth (called the Ref BW) of the adjacent channel is set, it is the 3 dB bandwidth that is set. The passband response is given by the convolution of two functions: a rectangle of width equal to Ref BW and the power response versus frequency of the RBW filter used. Measurements and specifications of analog radio ACPs are often based on defined bandwidths of measuring receivers, and these are defined by their -6 dB widths, not their -3 dB widths. To achieve a passband whose -6 dB width is x , set the Ref BW to be $x - 0.572 \times \text{RBW}$.
- f. Most versions of adjacent channel power measurements use negative numbers, in units of dBc, to refer to the power in an adjacent channel relative to the power in a main channel, in accordance with ITU standards. The standards for W-CDMA analysis include ACLR, a positive number represented in dB units. In order to be consistent with other kinds of ACP measurements, this measurement and its specifications will use negative dBc results, and refer to them as ACPR, instead of positive dB results referred to as ACLR. The ACLR can be determined from the ACPR reported by merely reversing the sign.
- g. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately $-37 \text{ dBm} - (\text{ACPR}/3)$, where the ACPR is given in (negative) decibels.
- h. To meet this specified accuracy when measuring mobile station (MS) or user equipment (UE) within 3 dB of the required -33 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -22 dBm, so the input attenuation must be set as close as possible to the average input power $-(-22 \text{ dBm})$. For example, if the average input power is -6 dBm, set the attenuation to 16 dB. This specification applies for the normal 3.5 dB peak-to-average ratio of a single code. Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- i. ACPR accuracy at 10 MHz offset is warranted when the input attenuator is set to give an average mixer level of -14 dBm.
- j. In order to meet this specified accuracy, the mixer level must be optimized for accuracy when measuring node B Base Transmission Station (BTS) within 3 dB of the required -45 dBc ACPR. This optimum mixer level is -19 dBm, so the input attenuation must be set as close as possible to the average input power $-(-19 \text{ dBm})$. For example, if the average input power is -7 dBm, set the attenuation to 12 dB. This specification applies for the normal 10 dB peak-to-average ratio (at 0.01% probability) for Test Model 1. Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- k. Accuracy can be excellent even at low ACPR levels assuming that the user sets the mixer level to optimize the dynamic range, and assuming that the analyzer and UUT distortions are incoherent. When the errors from the UUT and the analyzer are incoherent, optimizing dynamic range is equivalent to minimizing the contribution of analyzer noise and distortion to accuracy, though the higher mixer level increases the display scale fidelity errors. This incoherent addition case is commonly used in the industry and can be useful for comparison of analysis equipment, but this incoherent addition model is rarely justified. This derived accuracy specification is based on a mixer level of -14 dBm.

- l. Agilent measures 100% of the signal analyzers for dynamic range in the factory production process. This measurement requires a near-ideal signal, which is impractical for field and customer use. Because field verification is impractical, Agilent only gives a typical result. More than 80% of prototype instruments met this “typical” specification; the factory test line limit is set commensurate with an on-going 80% yield to this typical.
The ACPR dynamic range is verified only at 2 GHz, where Agilent has the near-perfect signal available. The dynamic range is specified for the optimum mixer drive level, which is different in different instruments and different conditions. The test signal is a 1 DPCH signal.
The ACPR dynamic range is the observed range. This typical specification includes no measurement uncertainty.
- m. ML is Mixer Level, which is defined to be the input signal level minus attenuation.
- n. 3GPP requires the use of a root-raised-cosine filter in evaluating the ACLR of a device. The accuracy of the passband shape of the filter is not specified in standards, nor is any method of evaluating that accuracy. This footnote discusses the performance of the filter in this instrument. The effect of the RRC filter and the effect of the RBW used in the measurement interact. The analyzer compensates the shape of the RRC filter to accommodate the RBW filter. The effectiveness of this compensation is summarized in three ways:
 - White noise in Adj Ch: The compensated RRC filter nominally has no errors if the adjacent channel has a spectrum that is flat across its width.
 - TOI-induced spectrum: If the spectrum is due to third-order intermodulation, it has a distinctive shape. The computed errors of the compensated filter are -0.001 dB for the 100 kHz RBW used for UE testing with the IBW method. It is 0.000 dB for the 27 kHz RBW filter used for BTS testing with the Filtered IBW method. The worst error for RBWs between 27 and 390 kHz is 0.05 dB for a 330 kHz RBW filter.
 - rms CW error: This error is a measure of the error in measuring a CW-like spurious component. It is evaluated by computing the root of the mean of the square of the power error across all frequencies within the adjacent channel. The computed rms error of the compensated filter is 0.012 dB for the 100 kHz RBW used for UE testing with the IBW method. It is 0.000 dB for the 27 kHz RBW filter used for BTS testing. The worst error for RBWs between 27 kHz and 470 kHz is 0.057 dB for a 430 kHz RBW filter.

Fast ACPR Test [Plot^a]



- a. Observation conditions for ACP speed:
 Display Off, signal is Test Model 1 with 64 DPCH, Method set to Fast. Measured with an IBM compatible PC with a 3 GHz Pentium 4 running Windows XP Professional Version 2002. The communications medium was PCI GPIB IEEE 488.2. The Test Application Language was .NET C#. The Application Communication Layer was Agilent T&M Programmer's Toolkit For Visual Studio (Version 1.1), Agilent I/O Libraries (Version M.01.01.41_beta).

Description	Specifications	Supplemental Information
Power Statistics CCDF Histogram Resolution ^a	0.01 dB	

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Burst Power Methods Results	Power above threshold Power within burst width Output power, average Output power, single burst Maximum power Minimum power within burst Burst width	

Description	Specifications	Supplemental Information
TOI (Third Order Intermodulation) Results	Relative IM tone powers (dBc) Absolute tone powers (dBm) Intercept (dBm)	Measures TOI of a signal with two dominant tones

Description	Specifications	Supplemental Information
Harmonic Distortion Maximum harmonic number Results	10th Fundamental Power (dBm) Relative harmonics power (dBc) Total harmonic distortion (% , dBc)	

Description	Specifications	Supplemental Information
Spurious Emissions Case: Radio Std = 3GPP W-CDMA Dynamic Range ^a (1 to 3.6 GHz) Sensitivity, absolute (1 to 3.6 GHz) Accuracy 9 kHz to 3.6 GHz 3.5 to 8.4 GHz 8.3 to 13.6 GHz	 93.9 dB -82.4 dBm	Table-driven spurious signals; search across regions 98.7 dB (typical) -86.4 dBm (typical) Attenuation = 10 dB ±0.38 dB (95th percentile) ±1.22 dB (95th percentile) ±1.59 dB (95th percentile)

- a. The dynamic range is specified with the mixer level at +3 dBm, where up to 1 dB of compression can occur, degrading accuracy by 1 dB.

Description	Specifications	Supplemental Information
Spectrum Emission Mask		Table-driven spurious signals; measurement near carriers
Case: Radio Std = cdma2000		
Dynamic Range, relative (750 kHz offset ^{ab})	74.3 dB	81.4 dB (typical)
Sensitivity, absolute (750 kHz offset ^c)	-97.7 dBm	-101.7 dBm (typical)
Accuracy (750 kHz offset)		
Relative ^d	±0.11 dB	
Absolute ^e (20 to 30°C)	±1.15 dB	±0.31 dB (95th percentile ≈ 2σ)
Case: Radio Std = 3GPP W-CDMA		
Dynamic Range, relative (2.515 MHz offset ^{ad})	78.5 dB	84.2 dB (typical)
Sensitivity, absolute (2.515 MHz offset ^c)	-97.7 dBm	-101.7 dBm (typical)
Accuracy (2.515 MHz offset)		
Relative ^d	±0.12 dB	
Absolute ^e (20 to 30°C)	±1.15 dB	±0.31 dB (95th percentile ≈ 2σ)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 30 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -18 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 30 kHz RBW, at a center frequency of 2 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- e. The absolute accuracy of SEM measurement is the same as the absolute accuracy of the spectrum analyzer. See “[Absolute Amplitude Accuracy](#)” on page 36 for more information. The numbers shown are for 0 to 3.6 GHz, with attenuation set to 10 dB.

Options

The following options and applications affect instrument specifications.

Option 503:	Frequency range, 10 Hz to 3.6 GHz
Option 507:	Frequency range, 10 Hz to 7 GHz
Option 513:	Frequency range, 10 Hz to 13.6 GHz
Option 526:	Frequency range, 10 Hz to 26.5 GHz
Option 532:	Frequency range, 10 Hz to 32 GHz
Option 544:	Frequency range, 10 Hz to 44 GHz
Option B25:	Analysis bandwidth, 25 MHz
Option B40:	Analysis bandwidth, 40 MHz
Option CR3:	Connector Rear, second IF Out
Option CRP:	Connector Rear, arbitrary IF Out
Option EA3:	Electronic attenuator, 3.6 GHz
Option EMC:	Precompliance EMC Features
Option ESC:	External source control
Option EXM:	External mixing
Option FSA:	2 dB fine step attenuator
Option MPB:	Preselector bypass
Option P03:	Preamplifier, 3.6 GHz
Option P07:	Preamplifier, 7 GHz
Option P13:	Preamplifier, 13.6 GHz
Option P26:	Preamplifier, 26.5 GHz
Option P32:	Preamplifier, 32 GHz
Option P44:	Preamplifier, 44 GHz
Option PC4:	Upgrade to dual core processor with removable solid state drive
Option PFR:	Precision frequency reference
Option YAS:	Y-Axis Screen Video output
N6149A:	iDEN/WiDEN/MotoTalk measurement application
N6152A:	Digital Cable TV measurement application
N6153A:	DVB-T/H measurement application
N6155A:	ISDB-T with T2 measurement application
N6156A:	DTMB measurement application
N6158A:	CMMB measurement application
N9051A:	Pulse measurement software
N9063A:	Analog Demodulation measurement application
N9064A:	VXA Vector Signal and WLAN measurement application
N9068A:	Phase Noise measurement application

N9069A:	Noise Figure measurement application
N9071A:	GSM/EDGE/EDGE Evolution measurement application
N9072A:	cdma2000/cdmaOne measurement application
N9073A:	W-CDMA/HSPA/HSPA+ measurement application
N9074A:	Single Acquisition Combined Fixed WiMAX measurement application
N9075A:	802.16 OFDMA measurement application
N9076A:	1xEV-DO measurement application
N9077A:	WLAN measurement application
N9079A:	TD-SCDMA measurement application
N9080A:	LTE-FDD measurement application
N9081A:	Bluetooth measurement application
N9082A:	LTE-TDD measurement application
N9083A:	Multi-Standard Radio (MSR) measurement application

General

Description	Specifications	Supplemental Information
Calibration Cycle	2 years	

Description	Specifications	Supplemental Information
Temperature Range Operating ^a Altitude ≤ 2,300 m Altitude = 4,500 m Derating ^b Storage ^c Altitude^d Humidity Relative humidity	0 to 55°C 0 to 47°C –40 to +70°C 4,500 m (approx 15,000 feet)	 Type tested at 95%, +40°C (non-condensing)

- a. For earlier instruments (S/N prefix <MY/SG/US5052), the operating temperature ranges from 5 to 50°C.
- b. The maximum operating temperature derates linearly from altitude of 4,500 m to 2,300 m.
- c. For earlier instruments (S/N prefix <MY/SG/US5052), and installed with hard disk drives, the storage temperature ranges from –40 to +65°C.
- d. For earlier instrument (S/N prefix <MY/SG/US5052), the altitude was specified as 3,000 m (approximately 10,000 feet).

Description	Specifications	Supplemental Information
Environmental and Military Specifications		Samples of this product have been type tested in accordance with the Agilent Environmental Test Manual and verified to be robust against the environmental stresses of Storage, Transportation and End-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions. Test Methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

Description	Specifications
EMC	<p>Complies with European EMC Directive 2004/108/EC</p> <ul style="list-style-type: none"> — IEC/EN 61326-1 or IEC/EN 61326-2-1 — CISPR Pub 11 Group 1, class A — AS/NZS CISPR 11^a — ICES/NMB-001 <p>This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.</p>

- a. The N9010A is in full compliance with CISPR 11, Class A emission limits and is declared as such. In addition, the N9010A has been type tested and shown to meet CISPR 11, Class B emission limits when no USB cable/device connections are made to the front or rear panel. Information regarding the Class B emission performance of the N9010A is provided as a convenience to the user and is not intended to be a regulatory declaration.

Acoustic statement (European Machinery Directive 2002/42/EC, 1.7.4.2u)	
<p>Acoustic noise emission</p> <p>LpA <70 dB</p> <p>Operator position</p> <p>Normal operation mode</p>	

Description	Specification	Supplemental Information
<p>Acoustic Noise--Further Information</p> <p>Ambient Temperature</p> <p>< 40°C</p> <p>≥ 40°C</p>		<p>Values given are per ISO 7779 standard in the "Operator Sitting" position</p> <p>Nominally under 55 dBA Sound Pressure. 55 dBA is generally considered suitable for use in quiet office environments.</p> <p>Nominally under 65 dBA Sound Pressure. 65 dBA is generally considered suitable for use in noisy office environments. (The fan speed, and thus the noise level, increases with increasing ambient temperature.)</p>

Description	Specifications
Safety	<p>Complies with European Low Voltage Directive 2006/95/EC</p> <ul style="list-style-type: none"> — IEC/EN 61010-1 3rd Edition — Canada: CSA C22.2 No. 61010-1-12 — USA: UL 61010-1 3rd Edition

Description	Specification	Supplemental Information
Power Requirements		
Low Range		
Voltage	100 to 120 V	
Frequency		
Serial Prefix < MY4801, SG4801, or US4801	50 or 60 Hz	
Serial Prefix ≥ MY4801, SG4801, or US4801	50, 60 or 400 Hz	
High Range		
Voltage	220 to 240 V	
Frequency	50 or 60 Hz	
Power Consumption, On	350 W	Maximum
Power Consumption, Standby	20 W	Standby power is not supplied to frequency reference oscillator.
Typical instrument configuration		
Base 3.6 GHz instrument (N9010A-503)		Power (nominal) 176 W
Base 8.4 GHz instrument (N9010A-508)		179 W
Base 13 GHz instrument (N9010A-513)		183 W
Base 26.5 GHz instrument (N9010A-526)		194 W
Base 32/44 GHz instrument (N9010A-532/544)		225 W
Adding <i>Option B40, MPB, or DP2</i> to base instrument		+45 W

Description	Supplemental Information	
Measurement Speed^a	Nominal	
	Standard	w/ <i>Option PC4</i>
Local measurement and display update rate ^{bc}	11 ms (90/s)	4 ms (250/s)
Remote measurement and LAN transfer rate ^{bc}	6 ms (167/s)	5 ms (200/s)
Marker Peak Search	5 ms	1.5 ms
Center Frequency Tune and Transfer (RF)	22 ms	20 ms
Center Frequency Tune and Transfer (μ W)	49 ms	47 ms
Measurement/Mode Switching	75 ms	39 ms
W-CDMA ACLR measurement time	See page 61	
Measurement Time vs. Span	See page 27	

- a. Sweep Points = 101.
- b. Factory preset, fixed center frequency, RBW = 1 MHz, 10 MHz < span ≤ 600 MHz, stop frequency ≤ 3.6 GHz, Auto Align Off.
- c. Phase Noise Optimization set to Fast Tuning, Display Off, 32 bit integer format, markers Off, single sweep, measured with IBM compatible PC with 2.99 GHz Pentium® 4 with 2 GB RAM running Windows® XP, Agilent I/O Libraries Suite Version 14.1, one meter GPIB cable, National Instruments PCI-GPIB Card and NI-488.2 DLL.

Description	Specifications	Supplemental Information
Display^a		
Resolution	1024 × 768	XGA
Size		213 mm (8.4 in) diagonal (nominal)

- a. The LCD display is manufactured using high precision technology. However, there may be up to six bright points (white, blue, red or green in color) that constantly appear on the LCD screen. These points are normal in the manufacturing process and do not affect the measurement integrity of the product in any way.

Agilent EXA Signal Analyzer
General

Description	Specifications	Supplemental Information
Data Storage		
Standard		
Internal Total		Removable solid state drive (≥ 80 GB) ^a
Internal User		≥ 9 GB available for user data
With <i>Option PC4</i>		
Internal Total		Removeable solid state drive (≥ 80 GB) ^b
Internal User		≥ 9 GB available on separate partition for user data

- a. For earlier instruments (<MY50210341/SG50210026/US50210103), a removable hard disk drive (>80 GB) was installed. For even older instruments, a fixed hard disk (40 GB) drive was installed.
- b. For earlier instruments (<MY50210341/SG50210026/US50210103), a removable hard disk drive (>80 GB) was installed with *Option PC2* unless *Option SSD* was ordered.

Description	Specifications	Supplemental Information
Weight		Weight without options
Net		16 kg (35 lbs) (nominal)
Shipping		28 kg (62 lbs) (nominal)
Cabinet Dimensions		Cabinet dimensions exclude front and rear protrusions.
Height	177 mm (7.0 in)	
Width	426 mm (16.8 in)	
Length	368 mm (14.5 in)	

Inputs/Outputs

Front Panel

Description	Specifications	Supplemental Information
RF Input Connector Standard Impedance	Type-N female 2.4 mm male	Frequency option 503, 507, 513, and 526 Frequency option 532 and 544 50Ω (nominal)

Description	Specifications	Supplemental Information
Probe Power Voltage/Current		+15 Vdc, ±7% at 0 to 150 mA (nominal) -12.6 Vdc, ±10% at 0 to 150 mA (nominal) GND

Description	Specifications	Supplemental Information
USB 2.0 Ports Master (2 ports) Connector Output Current	USB Type "A" (female)	See Rear Panel for other ports 0.5 A (nominal)

Description	Specifications	Supplemental Information
Headphone Jack Connector Output Power	miniature stereo audio jack	3.5 mm (also known as "1/8 inch") 90 mW per channel into 16Ω (nominal)

Rear Panel

Description	Specifications	Supplemental Information
10 MHz Out Connector Impedance Output Amplitude Output Configuration Frequency	BNC female AC coupled, sinusoidal 10 MHz × (1 + frequency reference accuracy)	50Ω (nominal) ≥0 dBm (nominal)

Description	Specifications	Supplemental Information
Ext Ref In Connector Impedance Input Amplitude Range sine wave square wave Input Frequency Lock range	BNC female $\pm 5 \times 10^{-6}$ of ideal external reference input frequency	Note: Analyzer noise sidebands and spurious response performance may be affected by the quality of the external reference used. See footnote ^c in the Phase Noise specifications within the Dynamic Range section on page 51 . 50Ω (nominal) –5 to +10 dBm (nominal) 0.2 to 1.5 V peak-to-peak (nominal) 10 MHz (nominal)

Description	Specifications	Supplemental Information
Sync Connector	BNC female	Reserved for future use

Description	Specifications	Supplemental Information
Trigger Inputs (Trigger 1 In, Trigger 2 In) Connector Impedance Trigger Level Range	BNC female –5 to +5 V	Either trigger source may be selected 10 kΩ (nominal) 1.5 V (TTL) factory preset

Description	Specifications	Supplemental Information
Trigger Outputs (Trigger 1 Out, Trigger 2 Out) Connector Impedance Level	BNC female	50Ω (nominal) 0 to 5 V (CMOS)

Description	Specifications	Supplemental Information
Monitor Output Connector Format Resolution	VGA compatible, 15-pin mini D-SUB 1024 × 768	XGA (60 Hz vertical sync rates, non-interlaced) Analog RGB

Description	Specifications	Supplemental Information
Analog Out Connector Impedance	BNC female	Refer to Chapter 15 , “ Option YAS - Y-Axis Screen Video Output ,” on page 151 for more details. <140Ω (nominal)

Description	Specifications	Supplemental Information
Noise Source Drive +28 V (Pulsed) Connector Output voltage on Output voltage off	BNC female 28.0 ± 0.1 V < 1.0 V	60 mA maximum current

Description	Specs	Supplemental Information
SNS Series Noise Source		For use with Agilent Technologies SNS Series noise sources

Description	Specifications	Supplemental Information
Digital Bus Connector	MDR-80	This port is intended for use with the Agilent N5105 and N5106 products only. It is not available for general purpose use.

Agilent EXA Signal Analyzer
Inputs/Outputs

Description	Specifications	Supplemental Information
USB 2.0 Ports Master (4 ports) Connector Output Current Slave (1 port) Connector	USB Type “A” (female) USB Type “B” (female)	See Front Panel for additional ports 0.5 A (nominal)

Description	Specifications	Supplemental Information
GPIB Interface Connector GPIB Codes Mode	IEEE-488 bus connector	SH1, AH1, T6, SR1, RL1, PP0, DC1, C1, C2, C3 and C28, DT1, L4, C0 Controller or device








Description	Specifications	Supplemental Information
LAN TCP/IP Interface	RJ45 Ethertwist	1000BaseT ^a

a. 100BaseT for older instruments (S/N prefix <MY/SG/US5006) unless *Option PC2* is installed.

Regulatory Information

This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010 3rd ed, and 664 respectively.

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

	The CE mark is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven). This product complies with all relevant directives.
ICES/NMB-001	“This ISM device complies with Canadian ICES-001.” “Cet appareil ISM est conforme a la norme NMB du Canada.”
ISM 1-A (GRP.1 CLASS A)	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 4)
	The CSA mark is a registered trademark of the CSA International.
	The C-Tick mark is a registered trademark of the Australian/New Zealand Spectrum Management Agency. This product complies with the relevant EMC regulations.
	This symbol indicates separate collection for electrical and electronic equipment mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive 2002/96/EC). To return unwanted products, contact your local Agilent office, or see http://www.agilent.com/environment/product/index.shtml for more information.
	China RoHS regulations include requirements related to packaging, and require compliance to China standard GB18455-2001.
	This symbol indicates compliance with the China RoHS regulations for paper/fiberboard packaging.
	<p>South Korean Class A EMC Declaration A 급 기기 (업무용 방송통신기자재)</p> <p>이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라 며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.</p> <p>This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.</p>

Declaration of Conformity

A copy of the Manufacturer's European Declaration of Conformity for this instrument can be obtained by contacting your local Agilent Technologies sales representative.

This chapter contains specifications for the I/Q Analyzer measurement application (Basic Mode).

Specifications Affected by I/Q Analyzer

Specification Name	Information
Number of Frequency Display Trace Points (buckets)	Does not apply.
Resolution Bandwidth	See “Frequency” on page 79 in this chapter.
Video Bandwidth	Not available.
Clipping-to-Noise Dynamic Range	See “Clipping-to-Noise Dynamic Range” on page 80 in this chapter.
Resolution Bandwidth Switching Uncertainty	Not specified because it is negligible.
Available Detectors	Does not apply.
Spurious Responses	The “Spurious Responses” on page 45 of core specifications still apply. Additional bandwidth-option-dependent spurious responses are given in the Analysis Bandwidth chapter for any optional bandwidths in use.
IF Amplitude Flatness	See “IF Frequency Response” on page 34 of the core specifications for the 10 MHz bandwidth. Specifications for wider bandwidths are given in the Analysis Bandwidth chapter for any optional bandwidths in use.
IF Phase Linearity	See “IF Phase Linearity” on page 35 of the core specifications for the 10 MHz bandwidth. Specifications for wider bandwidths are given in the Analysis Bandwidth chapter for any optional bandwidths in use.
Data Acquisition	See “Data Acquisition” on page 81 in this chapter for the 10 MHz bandwidth. Specifications for wider bandwidths are given in the Analysis Bandwidth chapter for any optional bandwidths in use.

Frequency

Description	Specifications	Supplemental Information
<p>Frequency Span</p> <p>Standard instrument</p> <p><i>Option B25</i></p> <p><i>Option B40</i></p> <p>Resolution Bandwidth (Spectrum Measurement)</p> <p>Range</p> <p>Overall</p> <p>Span = 1 MHz</p> <p>Span = 10 kHz</p> <p>Span = 100 Hz</p> <p>Window Shapes</p> <p>Analysis Bandwidth (Span) (Waveform Measurement)</p> <p>Standard instrument</p> <p><i>Option B25</i></p> <p><i>Option B40</i></p>	<p>10 Hz to 10 MHz</p> <p>10 Hz to 25 MHz</p> <p>10 Hz to 40 MHz</p> <p>100 mHz to 3 MHz</p> <p>50 Hz to 1 MHz</p> <p>1 Hz to 10 kHz</p> <p>100 mHz to 100 Hz</p> <p>Flat Top, Uniform, Hanning, Hamming, Gaussian, Blackman, Blackman-Harris, Kaiser Bessel (K-B 70 dB, K-B 90 dB & K-B 110 dB)</p> <p>10 Hz to 10 MHz</p> <p>10 Hz to 25 MHz</p> <p>10 Hz to 40 MHz</p>	

Clipping-to-Noise Dynamic Range

Description	Specifications	Supplemental Information
Clipping-to-Noise Dynamic Range^a		Excluding residuals and spurious responses
Clipping Level at Mixer		Center frequency ≥ 20 MHz
IF Gain = Low	-10 dBm	-8 dBm (nominal)
IF Gain = High	-20 dBm	-17.5 dBm (nominal)
Noise Density at Mixer at center frequency ^b	(DANL ^c + IFGainEffect ^d) + 2.25 dB ^e	Example ^f

- This specification is defined to be the ratio of the clipping level (also known as “ADC Over Range”) to the noise density. In decibel units, it can be defined as $\text{clipping_level [dBm]} - \text{noise_density [dBm/Hz]}$; the result has units of dBFS/Hz (fs is “full scale”).
- The noise density depends on the input frequency. It is lowest for a broad range of input frequencies near the center frequency, and these specifications apply there. The noise density can increase toward the edges of the span. The effect is nominally well under 1 dB.
- The primary determining element in the noise density is the “[Displayed Average Noise Level](#)” on [page 43](#).
- DANL is specified with the IF Gain set to High, which is the best case for DANL but not for Clipping-to-noise dynamic range. The core specifications “[Displayed Average Noise Level](#)” on [page 43](#), gives a line entry on the excess noise added by using IF Gain = Low, and a footnote explaining how to combine the IF Gain noise with the DANL.
- DANL is specified for log averaging, not power averaging, and thus is 2.51 dB lower than the true noise density. It is also specified in the narrowest RBW, 1 Hz, which has a noise bandwidth slightly wider than 1 Hz. These two effects together add up to 2.25 dB.
- As an example computation, consider this: For the case where DANL = -151 dBm in 1 Hz, IF Gain is set to low, and the “Additional DANL” is -160 dBm, the total noise density computes to -148.2 dBm/Hz and the Clipping-to-noise ratio for a -10 dBm clipping level is -138.2 dBFS/Hz.

Data Acquisition

Description	Specifications	Supplemental Information
Time Record Length (IQ pairs)		
IQ Analyzer	4,000,000 IQ sample pairs	≈335 ms at 10 MHz Span
Sample Rate		
At ADC		
<i>Option DP2, B40, or MPB</i>	100 MSa/s	
None of the above	90 MSa/s	
IQ Pairs		Integer submultiple of 15 Mpairs/s
		depending on the span for spans of
		8 MHz or narrower.
ADC Resolution		
<i>Option DP2, B40, or MPB</i>	16 bits	
None of the above	14 bits	

VXA Vector Signal and WLAN Modulation Analysis Application

This chapter contains specifications for the N9064A¹ VXA vector signal and WLAN modulation analysis measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513 or 526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Specs & Nominals

These specifications summarize the performance for the X-Series Signal Analyzer and apply to the VXA measurement application inside the analyzer. Values shown in the column labeled "Specs & Nominals" are a mix of warranted specifications, guaranteed-by-design parameters, and conservative but not warranted observations of performance of sample instruments.

1. In software versions prior to A.06.00, the VXA measurement application product number was 89601X. Software versions A.06.00 and beyond have renamed 89601X to N9064A.

Vector Signal Analysis Performance (N9064A-1FP/1TP)

Frequency

Description	Specs & Nominals			Supplemental Information	
Range				See “Frequency Range” on page 19	
Center Frequency					
Tuning Resolution	1 mHz				
Frequency Span, Maximum	10 MHz (standard)				
FFT Spectrum	25 MHz (<i>Option B25</i>) 40 MHz (<i>Option B40</i>)				
Frequency Points per Span	Calibrated points: 51 to 409,601 Displayed points: 51 to 524,288				
FFT Window Type				The window choices allow the user to optimize as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.	
	Window	Selectivity	Passband Flatness		Rejection
	Flat Top	0.41	0.01 dB		>95 dBc
	Gaussian Top	0.25	0.68 dB		>125 dBc
	Hanning	0.11	1.5 dB		>31 dBc
	Uniform	0.0014	4.0 dB		>13 dBc

Input

Description	Specs & Nominals	Supplemental Information
<p>Range</p> <p>standard</p> <p><i>Option FSA or EA3</i></p> <p><i>Option P03, P07, P13, P26, P32, P44 with neither FSA or EA3</i></p> <p><i>Options P03, P07, P13, P26, P32, P44 and either FSA or EA3</i></p> <p><i>Option P07, P13, P26, P32, or P44</i></p> <p>ADC overload</p>	<p>–20 dBm to 20 dBm, 10 dB steps</p> <p>–20 dBm to 22 dBm, 2 dB steps</p> <p>–40 dBm to 20 dBm, 10 dB steps, up to 3.6 GHz</p> <p>–40 dBm to 22 dBm, 2 dB steps, up to 3.6 GHz</p> <p>–40 dBm to 20 dBm, 10 dB steps, above 3.6 GHz</p> <p>+2 dBFS</p>	<p>Full Scale, combines attenuator setting and ADC gain</p>

Amplitude Accuracy

Description	Specs & Nominals	Supplemental Information
<p>Absolute Amplitude Accuracy</p> <p>Amplitude Linearity</p> <p>IF Flatness</p> <p>Span ≤ 10 MHz</p> <p>Span ≤ 25 MHz (<i>Option B25</i>)</p> <p>Span ≤ 40 MHz (<i>Option B40</i>)</p> <p>Sensitivity</p> <p>–20 dBm range</p> <p>–40 dBm range</p>		<p>See “Absolute Amplitude Accuracy” on page 36</p> <p>See “Display Scale Fidelity” on page 39</p> <p>See “IF Frequency Response” on page 34</p> <p>See “IF Frequency Response” on page 96</p> <p>See “IF Frequency Response” on page 102</p> <p>Compute from DANL^a; see “Displayed Average Noise Level (DANL)” on page 43</p> <p>Requires preamp option. Compute from Preamp DANL^a; see “Displayed Average Noise Level (DANL)Preamp On” on page 143</p>

- a. DANL is specified in the narrowest resolution bandwidth (1 Hz) with log averaging, in accordance with industry and historic standards. The effect of log averaging is to reduce the noise level by 2.51 dB. The effect of using a 1 Hz RBW is to increase the measured noise because the noise bandwidth of the 1 Hz RBW filter is nominally 1.056 Hz, thus adding 0.23 dB to the level. The combination of these effects makes the sensitivity, in units of dBm/Hz, 2.27 dB higher than DANL in units of dBm in a 1 Hz RBW.

Dynamic Range

Description	Specs & Nominals	Supplemental Information
Third Order Intermodulation distortion (Two -20 dBFS tones, 400 MHz to 13.6 GHz, tone separation > 5 × IF Prefilter BW)		-84 dBc (nominal)
Noise Density at 1 GHz Input Range ≥ -10 dBm -20 dBm to -12 dBm -30 dBm to -22 dBm -40 dBm to -32 dBm	-137 dBFS/Hz -127 dBFS/Hz -129 dBFS/Hz -119 dBFS/Hz	requires preamp option requires preamp option
Residual Responses (Range ≥ -10 dBm)		-90 dBFS (nominal)
Image Responses (10 MHz to 13.6 GHz, <8 MHz span)	-75 dBc	
LO Related Spurious (10 MHz to 3.6 GHz, f > 600 MHz from carrier)	-60 dBc	
Other Spurious (<8 MHz span) 100 Hz < f < 10 MHz from carrier f ≥ 10 MHz from carrier		-70 dBc (nominal) -70 dBc (nominal)

Analog Modulation Analysis (N9064A-1FP/1TP)

Description	Specs & Nominals	Supplemental Information
AM Demodulation (Span \leq 12 MHz, Carrier \leq -17 dBFS)		
Demodulator Bandwidth	Same as selected measurement span	
Modulation Index Accuracy	$\pm 1\%$	
Harmonic Distortion	-55 dBc	Relative to 100% modulation index
Spurious	-60 dBc	Relative to 100% modulation index
Cross Demodulation	0.5% AM on an FM signal with 50 kHz modulation rate, 200 kHz deviation	
PM Demodulation (Deviation $<$ 180°, modulation rate \leq 500 kHz, span \leq 12 MHz)		
Demodulator Bandwidth	Same as selected measurement span, except as noted	
Modulation Index Accuracy	$\pm 0.5^\circ$	
Harmonic Distortion	0.5%	
Spurious	-60 dBc	
Cross Demodulation	1° PM on an 80% modulation index AM signal, modulation rate \leq 1 MHz	

Description	Specs & Nominals	Supplemental Information
FM Demodulation Demodulator Bandwidth Modulation Index Accuracy (deviation ≤ 2 MHz, modulation rate ≤ 500 kHz) Harmonic Distortion Modulation Rate Deviation ≤ 50 kHz ≤ 200 kHz ≤ 500 kHz ≤ 2 MHz Spurious Modulation Rate Deviation ≤ 50 kHz ≤ 200 kHz ≤ 500 kHz ≤ 2 MHz Cross Demodulation	Same as selected measurement span $\pm 0.1\%$ of span -50 dBc -45 dBc -50 dBc -45 dBc 0.5% of span of FM on an 80% modulation index AM signal, modulation rate ≤ 1 MHz	

Flexible Digital Modulation Analysis (N9064A-2FP/2TP)

Description	Specs & Nominals	Supplemental Information
Accuracy		Formats other than FSK, 8/16VSB, 16/32 APSK, and OQPSK. Conditions: Full scale signal, fully contained in the measurement span, frequency < 3.6 GHz, random data sequence, range ≥ -30 dBm, start frequency ≥ 15% of span, alpha/BT ≥ 0.3 (0.3 to 0.7 for OQPSK), and symbol rate ≥ 1 kHz. For symbol rates < 1 kHz, accuracy may be limited by phase noise. Averaging = 10
Residual Errors	Result = 150 symbols averages = 10	
Residual EVM		
Span		
≤100 kHz ^a	0.50% rms	
≤1 MHz	0.50% rms	
≤10 MHz	1.00% rms	
≤22 MHz ^b	1.20% rms	
≤25 MHz ^b	1.50% rms	
Magnitude Error		
Span		
≤100 kHz	0.30% rms	
≤1 MHz	0.50% rms	
≤10 MHz	1.00% rms	
≤22 MHz ^b	1.00% rms	
≤25 MHz ^b	1.20% rms	
Phase Error		
Span		
≤100 kHz ^a	0.3° rms	
≤1 MHz	0.4° rms	
≤10 MHz	0.6° rms	
≤22 MHz ^b	0.8° rms	
≤25 MHz ^b	1.0° rms	
Frequency Error	Symbol rate/500,000	Added to frequency accuracy if applicable
IQ Origin Offset	-60 dB	

Description	Specs & Nominals	Supplemental Information
Residual EVM for Video Modulation Formats 8 or 16 VSB 16, 32, 64, 128, 256, 512, or 1024 QAM	1.5% (SNR 36 dB) 1.0% (SNR 40 dB)	Symbol rate = 10.762 MHz, $\alpha = 0.115$, frequency < 3.6 GHz, 7 MHz span, full-scale signal, range ≥ -30 dBm, result length = 800, averages = 10 Symbol rate = 6.9 MHz, $\alpha = 0.15$, frequency < 3.6 GHz, 8 MHz span, full-scale signal, range ≥ -30 dBm, result length = 800, averages = 10

- a. 1.0% rms EVM and 0.8 deg RMS phase error for frequency > 3.6 GHz
- b. Without *Option B25*, span is restricted to ≤ 10 MHz. Without *Option B40*, span is restricted to ≤ 25 MHz.

WLAN Modulation Analysis (N9064A-3FP/3TP)

Description	Specs & Nominals	Supplemental Information
IEEE 802.11a/g OFDM		20 averages
Center Frequency/Level combinations at which nominal performance has been characterized	2.4 GHz, with input range ≥ -30 dBm, within 2 dB of full scale 5.8 GHz, with input range ≥ -20 dBm	
Residual EVM		
Equalizer training = chan est seq and data	-47 dB	
Equalizer training = chan est seq	-45 dB	
Frequency Error		
Subcarrier spacing	312.5 kHz default user settable	Maximum subcarrier spacing is approximately the analysis BW/57, thus 438 kHz for <i>Option B25</i> (25 MHz BW), and 700 kHz for <i>Option B40</i> (40 MHz BW).
Lock range	$\pm 2 \times$ sub-carrier spacing, ± 625 kHz default	
Frequency accuracy	± 8 Hz + tfa ^a	
IEEE 802.11b/g DSSS		
Center Frequency/Level combination at which nominal performance has been characterized	2.4 GHz with total power within 2 dB of full scale	
Residual EVM		
without equalizer	1.5%	
with equalizer enabled	0.5%	Reference filter = Transmit filter = Gaussian with BT = 0.5
Frequency Error		
Lock Range	± 2.5 MHz	
Accuracy	± 8 Hz + tfa ^a	

a. tfa = transmitter frequency \times frequency reference accuracy.

4

Option B25 - 25 MHz Analysis Bandwidth

This chapter contains specifications for the *Option B25* 25 MHz Analysis Bandwidth, and are unique to this IF Path.

Specifications Affected by Analysis Bandwidth

The specifications in this chapter apply when the 25 MHz path is in use. In IQ Analyzer, this will occur when the IF Path is set to 25 MHz, whether by Auto selection (depending on Span) or manually.

Specification Name	Information
IF Frequency Response	See specifications in this chapter.
IF Phase Linearity	See specifications in this chapter.
Spurious and Residual Responses	The “ Spurious Responses ” on page 45 still apply. Further, bandwidth-option-dependent spurious responses are contained within this chapter.
Displayed Average Noise Level, Third-Order Intermodulation and Phase Noise	The performance of the analyzer will degrade by an unspecified extent when using this bandwidth option. This extent is not substantial enough to justify statistical process control.

Other Analysis Bandwidth Specifications

Description	Specifications	Supplemental Information	
IF Spurious Response^a		Preamp Off ^b	
IF Second Harmonic			
Apparent Freq Excitation Freq Mixer Level^c IF Gain			
Any on-screen f	$(f + f_c + 22.5 \text{ MHz})/2$	-15 dBm Low	-54 dBc (nominal)
		-25 dBm High	-54 dBc (nominal)
IF Conversion Image			
Apparent Freq Excitation Freq Mixer Level^c IF Gain			
Any on-screen f	$2 \times f_c - f + 45 \text{ MHz}$	-10 dBm Low	-70 dBc (nominal)
		-20 dBm High	-70 dBc (nominal)

- The level of these spurs is not warranted. The relationship between the spurious response and its excitation is described in order to make it easier for the user to distinguish whether a questionable response is due to these mechanisms. f is the apparent frequency of the spurious signal, f_c is the measurement center frequency.
- The spurious response specifications only apply with the preamp turned off. When the preamp is turned on, performance is nominally the same as long as the mixer level is interpreted to be Mixer Level = Input Level – Input Attenuation – Preamp Gain.
- Mixer Level = Input Level – Input Attenuation.

Option B25 - 25 MHz Analysis Bandwidth
Other Analysis Bandwidth Specifications

Description			Specifications		Supplemental Information		
IF Frequency Response^a (Demodulation and FFT response relative to the center frequency)					Modes above 18 GHz ^b		
Center Freq (GHz)	Span^c (MHz)	Preselector	Max Error^d (Exceptions ^e) 20 to 30°C Full range		Midwidth Error (95th Percentile)	Slope (dB/MHz) (95th Percentile)	RMS^f (nominal)
≤3.6	10 to ≤25	n/a	±0.45 dB	±0.45 dB	±0.12 dB	±0.10	0.051 dB
>3.6	10 to ≤25 ^g	On					0.45 dB
>3.6	10 to ≤25 ^h	Off ^h	±0.45 dB	±0.80 dB	±0.12 dB	±0.10	0.071 dB

- a. The IF frequency response includes effects due to RF circuits such as input filters, that are a function of RF frequency, in addition to the IF passband effects.
- b. Signal frequencies between 18 and 26.5 GHz are prone to additional response errors due to modes in the Type-N connector used with frequency *Option 526*. With the use of Type-N to APC 3.5 mm adapter part number 1250-1744, there are nominally six such modes. These modes cause nominally up to -0.35 dB amplitude change, with phase errors of nominally up to ±1.2°.
- c. This column applies to the instantaneous analysis bandwidth in use. In the Spectrum analyzer Mode, this would be the FFT width. For Span < 10 MHz. see “[IF Frequency Response](#)” on page 34.
- d. The maximum error at an offset (f) from the center of the FFT width is given by the expression ± [Midwidth Error + (f × Slope)], but never exceeds ±Max Error. Here the Midwidth Error is the error at the center frequency for the given FFT span. Usually, the span is no larger than the FFT width in which case the center of the FFT width is the center frequency of the analyzer. In the Spectrum Analyzer mode, when the analyzer span is wider than the FFT width, the span is made up of multiple concatenated FFT results, and thus has multiple centers of FFT widths so the f in the equation is the offset from the nearest center. These specifications include the effect of RF frequency response as well as IF frequency response at the worst case center frequency. Performance is nominally three times better at most center frequencies.
- e. The specification does not apply for frequencies greater than 3.6 MHz from the center in FFT widths of 7.2 to 8 MHz.
- f. The “RMS” nominal performance is the standard deviation of the response relative to the center frequency, integrated across the span. This performance measure was observed at a center frequency in each harmonic mixing band, which is representative of all center frequencies; it is not the worst case frequency.
- g. For information on the preselector which affects the passband for frequencies above 3.6 GHz when *Option MPB* is not in use, see “[Preselector Bandwidth](#)” on page 29.
- h. *Option MPB* is installed and enabled.

Description			Specifications	Supplemental Information	
IF Phase Linearity				Deviation from mean phase linearity Modes above 18 GHz ^a	
Center Freq (GHz)	Span (MHz)	Preselector		Peak-to-peak (nominal)	RMS (nominal) ^b
≥0.02, <3.6	≤25	n/a		0.6°	0.14°
≥3.6	≤25	Off ^c		1.9°	0.42°
≥3.6(Option 526)	≤25	On		4.5°	1.2°

- Signal frequencies between 18 and 26.5 GHz are prone to additional response errors due to modes in the Type-N connector used with frequency *Option 526*. With the use of Type-N to APC 3.5 mm adapter part number 1250-1744, there are nominally six such modes. These modes cause nominally up to -0.35 dB amplitude change, with phase errors of nominally up to $\pm 1.2^\circ$.
- The listed performance is the standard deviation of the phase deviation relative to the mean phase deviation from a linear phase condition, where the RMS is computed across the span shown.
- Option MPB* is installed and enabled.

Description	Specification	Supplemental Information
Full Scale (ADC Clipping)^a Default settings, signal at CF (IF Gain = Low) Band 0 Band 1 through 4		-8 dBm mixer level ^b (nominal) -7 dBm mixer level ^b (nominal)
High Gain setting, signal at CF (IF Gain = High) Band 0 Band 1 through 6		-18 dBm mixer level ^b (nominal), subject to gain limitations ^c -17 dBm mixer level ^b (nominal), subject to gain limitations ^c
Effect of signal frequency \neq CF		up to ± 3 dB (nominal)

- This table is meant to help predict the full-scale level, defined as the signal level for which ADC overload (clipping) occurs. The prediction is imperfect, but can serve as a starting point for finding that level experimentally. A SCPI command is also available for that purpose.
- Mixer level is signal level minus input attenuation.
- The available gain to reach the predicted mixer level will vary with center frequency. Combinations of high gains and high frequencies will not achieve the gain required, increasing the full scale level.

Data Acquisition

Description	Specifications	Supplemental Information
Time Record Length (IQ pairs) IQ Analyzer 89600 VSA software or N9064A ^a VXA <i>Option DP2, B40, B85, B1A, B1X, or MPB</i> None of the above	4,000,000 IQ sample pairs 32-bit Data Packing 64-bit Data Packing 536 MSa (2^{29} Sa) 268 MSa (2^{28} Sa) 4,000,000 Sa (independent of data packing)	≈88.9 ms at 25 MHz span Memory 2 GB
Sample Rate At ADC <i>Option DP2, B40, or MPB</i> None of the above	100 MSa/s 90 MSa/s	Span dependent
IQ Pairs ADC Resolution <i>Option DP2, B40, or MPB</i> None of the above	16 bits 14 bits	

- a. In software versions prior to A.06.00, the VXA measurement application product number was 89601X. Software versions A.06.00 and beyond have renamed 89601X to N9064A.

5

Option B40 - 40 MHz Analysis Bandwidth

This chapter contains specifications for the *Option B40* 40 MHz Analysis Bandwidth, and are unique to this IF Path.

Specifications Affected by Analysis Bandwidth

The specifications in this chapter apply when the 40 MHz path is in use. In IQ Analyzer, this will occur when the IF Path is set to 40 MHz, whether by Auto selection (depending on Span) or manually.

Specification Name	Information
IF Frequency Response	See specifications in this chapter.
IF Phase Linearity	See specifications in this chapter.
Spurious Responses	There are three effects of the use of <i>Option B40</i> on spurious responses. Most of the warranted elements of the “ Spurious Responses ” on page 45 still apply without changes, but the revised-version of the table on page 45 , modified to reflect the effect of <i>Option B40</i> , is shown in its place in this chapter. The image responses part of that table have the same warranted limits, but apply at different frequencies as shown in the table. The "higher order RF spurs" line is slightly degraded. Also, spurious-free dynamic range specifications are given in this chapter, as well as IF Residuals.
Phase Noise	The performance of the analyzer will degrade by an unspecified extent when using wideband analysis. This extent is not substantial enough to justify statistical process control.
Absolute Amplitude Accuracy	Nominally 0.5 dB degradation from base instrument absolute amplitude accuracy. (Refer to Absolute Amplitude Accuracy on page 36.)
Frequency Range Over Which Specifications Apply	Specifications on this bandwidth only apply with center frequencies of 30 MHz and higher.

Other Analysis Bandwidth Specifications

Description	Specifications	Supplemental Information
Spurious Responses^a (see Band Overlaps on page 20)		Preamp Off ^b
Residual Responses ^c		-100 dBm (nominal)
Image Responses ^d		
Tuned Freq (f)	Excitation Freq	Response
10 MHz to 3.6 GHz	f+10100 MHz	-119 dBc (nominal)
10 MHz to 3.6 GHz	f+500 MHz	-121 dBc (nominal)
3.5 to 13.6 GHz	f+500 MHz	-89 dBc (nominal)
13.5 to 17.1 GHz	f+500 MHz	-83 dBc (nominal)
17.0 to 22 GHz	f+500 MHz	-82 dBc (nominal)
22 to 26.5 GHz	f+500 MHz	-79 dBc (nominal)
>26.5 GHz	f+500 MHz	-79 dBc (nominal)
Other Spurious Responses		
Carrier Frequency ≤ 26.5 GHz		
First RF Order ^e (f ≥ 10 MHz from carrier)	-10 dBm	-112 dBc (nominal)
Higher RF Order ^f f ≥ 10 MHz from carrier	-40 dBm	-100 dBc (nominal)
Carrier Frequency >26.5 GHz		
First RF Order ^e (f ≥ 10 MHz from carrier)	-30 dBm	-100 dBc (nominal)
Higher RF Order ^f (f ≥ 10 MHz from carrier)	-30 dBm	-100 dBc (nominal)
LO-Related Spurious Response f > 600 MHz from carrier	-10 dBm	-90 dBc + 20 × log(N) (nominal)
10 MHz to 3.6 GHz		
Sidebands, offset from CW signal		
≤200 Hz		-70 dBc ^g (nominal)
200 Hz to 3 kHz		-73 dBc ^g (nominal)
3 kHz to 30 kHz		-73 dBc (nominal)
30 kHz to 10 MHz		-80 dBc (nominal)

a. Preselector enabled for frequencies >3.6 GHz.

b. The spurious response specifications only apply with the preamp turned off. When the preamp is turned on, performance is nominally the same as long as the mixer level is interpreted to be: Mixer Level = Input Level – Input Attenuation – Preamp Gain

c. Input terminated, 0 dB input attenuation.

Option B40 - 40 MHz Analysis Bandwidth
Other Analysis Bandwidth Specifications

- d. Mixer Level is -10 dBm for all except >26.5 GHz, which is -30 dBm.
- e. With first RF order spurious products, the indicated frequency will change at the same rate as the input, with higher order, the indicated frequency will change at a rate faster than the input.
- f. RBW=100 Hz. With higher RF order spurious responses, the observed frequency will change at a rate faster than the input frequency.
- g. Nominally -40 dBc under large magnetic (0.38 Gauss rms) or vibrational (0.21 g rms) environmental stimuli.

Description			Specifications	Supplemental Information	
IF Frequency Response^a				Relative to center frequency Modes above 18 GHz ^b	
Center Freq (GHz)	Span (MHz)	Preselector		Nominal	RMS (nominal)^c
≥0.03, <3.6	≤40	n/a		±0.3 dB	0.08 dB
>3.6, ≤26.5	≤40	Off ^d		±0.25 dB	0.08 dB
>26.5	≤40	Off ^d		±0.25 dB	0.12 dB
≥3.6	≤40	On		See footnote ^e	

- a. The IF frequency response includes effects due to RF circuits such as input filters, that are a function of RF frequency, in addition to the IF passband effects.
- b. Signal frequencies above 18 GHz are prone to additional response errors due to modes in the Type-N connector used. With the use Type-N to APC 3.5 mm adapter part number 1250-1744, there are nominally six such modes. These modes cause nominally up to -0.35 dB amplitude change, with phase errors of nominally up to ±1.2°.
- c. The listed performance is the rms of the amplitude deviation from the mean amplitude response of a span/CF combination. 50% of the combinations of prototype instruments, center frequencies and spans had performance better than the listed values.
- d. *Option MPB* is installed and enabled.
- e. The passband shape will be greatly affected by the preselector. See [“Preselector Bandwidth” on page 29](#).

Description			Specifications	Supplemental Information	
IF Phase Linearity				Deviation from mean phase linearity Modes above 18 GHz ^a	
Center Freq (GHz)	Span (MHz)	Preselector		Peak-to-peak (nominal)	RMS (nominal) ^b
≥0.02, <3.6	40	n/a		0.2°	0.05°
≥3.6	40	Off ^c		5°	1.4°

- Signal frequencies above 18 GHz are prone to additional response errors due to modes in the Type-N connector used. With the use Type-N to APC 3.5 mm adapter part number 1250-1744, there are nominally six such modes. These modes cause nominally up to -0.35 dB amplitude change, with phase errors of nominally up to ±1.2°.
- The listed performance is the standard deviation of the phase deviation relative to the mean phase deviation from a linear phase condition, where the RMS is computed across the span shown.
- Option MPB is installed and enabled.

Description	Specification	Supplemental Information
Full Scale (ADC Clipping)^a Default settings, signal at CF (IF Gain = Low; IF Gain Offset = 0 dB) Band 0 Band 1 through 6 High Gain setting, signal at CF (IF Gain = High; IF Gain Offset = 0 dB) Band 0 Band 1 through 6 IF Gain Offset ≠ 0 dB, signal at CF Effect of signal frequency ≠ CF		-8 dBm mixer level ^b (nominal) -7 dBm mixer level ^b (nominal) -18 dBm mixer level ^b (nominal), subject to gain limitations ^c -17 dBm mixer level ^b (nominal), subject to gain limitations ^c See formula ^d , subject to gain limitations ^c up to ±3 dB (nominal)

- This table is meant to help predict the full-scale level, defined as the signal level for which ADC overload (clipping) occurs. The prediction is imperfect, but can serve as a starting point for finding that level experimentally. A SCPI command is also available for that purpose.
- Mixer level is signal level minus input attenuation.
- The available gain to reach the predicted mixer level will vary with center frequency. Combinations of high gains and high frequencies will not achieve the gain required, increasing the full scale level.
- The mixer level for ADC clipping is nominally given by that for the default settings, minus IF Gain Offset, minus 10 dB if IF Gain is set to High.

Option B40 - 40 MHz Analysis Bandwidth
Other Analysis Bandwidth Specifications

Description	Specification	Supplemental Information
EVM (EVM measurement floor for an 802.11g OFDM signal, MCS7, using 89600 VSA software equalization on channel estimation sequence and data, pilot tracking on) 2.4 GHz 5.8 GHz with <i>Option MPB</i>		0.35% (nominal) 0.50% (nominal)

Description	Specification	Supplemental Information
Signal to Noise Ratio Example: 1.8 GHz		Ratio of clipping level ^a to noise level 134 dBc/Hz, IF Gain = Low, IF Gain Offset = 0 dB

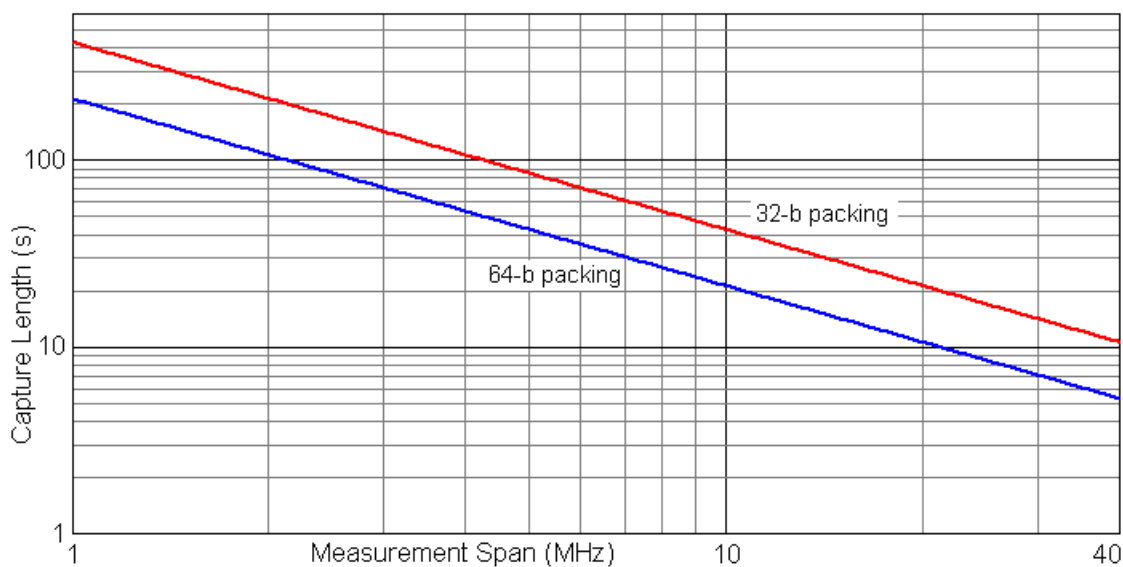
- a. For the clipping level, see the table above, "Full Scale." Note that the clipping level is not a warranted specification, and has particularly high uncertainty at high microwave frequencies.

Data Acquisition

Description	Specifications	Supplemental Information
Time Record Length	4,000,000 IQ sample pairs	
IQ Analyzer		89600 VSA software or N9064A ^a VXA
Advanced Tools	Data Packing	2 GB total memory
	32-bit	Samples/(Span × 1.28)
Length (IQ sample pairs)	536 MSa (2 ²⁹ Sa)	
Length (time units)	268 MSa (2 ²⁸ Sa)	
Sample Rate		
At ADC	200 MSa/s	
IQ Pairs		Span dependent
ADC Resolution	12 bits	

- a. In software versions prior to A.06.00, the VXA measurement application product number was 89601X. Software versions A.06.00 and beyond have renamed 89601X to N9064A.

Capture Time [Plot]



NOTE This plot is based on the full access to the 2 GB deep capture memory which requires either the 89600 VSA or the N9064A VXA

Option B40 - 40 MHz Analysis Bandwidth
Data Acquisition

6**Option CR3 - Connector Rear, 2nd IF
Output**

This chapter contains specifications for *Option CR3*, Connector Rear, 2nd IF Output.

Specifications Affected by Connector Rear, 2nd IF Output

No other analyzer specifications are affected by the presence or use of this option. New specifications are given in the following page.

Other Connector Rear, 2nd IF Output Specifications

Aux IF Out Port

Description	Specifications	Supplemental Information
Connector	SMA female	Shared with other options
Impedance		50Ω (nominal)

Second IF Out

Description	Specifications	Supplemental Information
Second IF Out		
Output Center Frequency		322.5 MHz
SA Mode		
I/Q Analyzer Mode		322.5 MHz
IF Path ≤ 25 MHz		250 MHz
IF Path 40 MHz		
Conversion Gain at 2nd IF output center frequency		-1 to +4 dB (nominal) plus RF frequency response ^a
Bandwidth		
Low band		Up to 140 MHz (nominal) ^b
High band		
With preselector		Depends on RF center frequency ^c
Preselector bypassed (Option MPB)		Up to 410 MHz nominal ^d
Residual Output Signals		-94 dBm or lower (nominal)

- a. "Conversion Gain" is defined from RF input to IF Output with 0 dB mechanical attenuation and the electronic attenuator off. The nominal performance applies in zero span.
- b. The passband width at -3 dB nominally extends from IF frequencies of 230 to 370 MHz. When using IF paths with center frequencies of 250 MHz or 322.5 MHz, the passband will therefore be asymmetric.
- c. The YIG-tuned preselector bandwidth nominally varies from 55 MHz for a center frequencies of 3.6 GHz through 57 MHz at 15 GHz to 75 MHz at 26.5 GHz. (Refer to page 23 for details.) The preselector effect will dominate the passband width.
- d. The passband width at -6 dB nominally extends from 100 to 510 MHz. Thus, the maximum width is not centered around the IF output center frequency.

Option CR3 - Connector Rear, 2nd IF Output
Other Connector Rear, 2nd IF Output Specifications

Option CRP - Connector Rear, Arbitrary IF Output

This chapter contains specifications for *Option CRP*, Connector Rear, Arbitrary IF Output.

Specifications Affected by Connector Rear, Arbitrary IF Output

No other analyzer specifications are affected by the presence or use of this option. New specifications are given in the following page.

Other Connector Rear, Arbitrary IF Output Specifications

Aux IF Out Port

Description	Specifications	Supplemental Information
Connector	SMA female	Shared with other options
Impedance		50Ω (nominal)

Arbitrary IF Out

Description	Specifications	Supplemental Information
Arbitrary IF Out		
IF Output Center Frequency		
Range	10 to 75 MHz	
Resolution	0.5 MHz	
Conversion Gain at the RF Center Frequency		-1 to +4 dB (nominal) plus RF frequency response ^a
Bandwidth		
Highpass corner frequency		5 MHz (nominal) at -3 dB
Lowpass corner frequency		120 MHz (nominal) at -3 dB
Output at 70 MHz center		
Low band; also, high band with preselector bypassed		100 MHz (nominal) ^b
Preselected bands		Depends on RF center frequency ^c
Lower output frequencies		Subject to folding ^d
Phase Noise		Added noise above analyzer noise ^e
Residual Output Signals		-88 dBm or lower (nominal) ^f

- “Conversion Gain” is defined from RF input to IF Output with 0 dB mechanical attenuation and the electronic attenuator off. The nominal performance applies with zero span.
- The bandwidth shown is in non-preselected bands. The combination with preselection (see footnote c) will reduce the bandwidth.
- See “Preselector Bandwidth” on page 29.
- As the output center frequency declines, the lower edge of the passband will fold around zero hertz. This phenomenon is most severe for output frequencies around and below 20 MHz. For more information on frequency folding, refer to *X-Series Spectrum Analyzer User’s and Programmer’s Reference*.
- The added phase noise in the conversion process of generating this IF is nominally -88, -106, and -130 dBc/Hz at offsets of 10, 100, and 1000 kHz respectively.
- Measured from 1 MHz to 150 MHz.

Option CRP - Connector Rear, Arbitrary IF Output
Other Connector Rear, Arbitrary IF Output Specifications

8**Option EA3 - Electronic Attenuator,
3.6 GHz**

This chapter contains specifications for the *Option EA3* Electronic Attenuator, 3.6 GHz.

Specifications Affected by Electronic Attenuator

Specification Name	Information
Frequency Range	See “Range (Frequency and Attenuation)” on page 117.
1 dB Gain Compression Point	See “Distortions and Noise” on page 118.
Displayed Average Noise Level	See “Distortions and Noise” on page 118.
Frequency Response	See “Frequency Response” on page 119.
Attenuator Switching Uncertainty	The recommended operation of the electronic attenuator is with the reference setting (10 dB) of the mechanical attenuator. In this operating condition, the Attenuator Switching Uncertainty specification of the mechanical attenuator in the core specifications does not apply, and any switching uncertainty of the electronic attenuator is included within the “Electronic Attenuator Switching Uncertainty” on page 120.
Absolute Amplitude Accuracy,	See “Absolute Amplitude Accuracy” on page 119.
Second Harmonic Distortion	See “Distortions and Noise” on page 118.
Third Order Intermodulation Distortion	See “Distortions and Noise” on page 118.

Other Electronic Attenuator Specifications

Description	Specifications	Supplemental Information
Range (Frequency and Attenuation)		
Frequency Range	10 Hz to 3.6 GHz	
Attenuation Range		
Electronic Attenuator Range	0 to 24 dB, 1 dB steps	Electronic attenuator is calibrated with 10 dB mechanical attenuation
Calibrated Range	0 to 24 dB, 2 dB steps	
Full Attenuation Range	0 to 84 dB, 1 dB steps	

Option EA3 - Electronic Attenuator, 3.6 GHz
Other Electronic Attenuator Specifications

Description	Specifications	Supplemental Information
Distortions and Noise 1 dB Gain Compression Point Displayed Average Noise Level Second Harmonic Distortion Third-order Intermodulation Distortion		<p>When using the electronic attenuator, the mechanical attenuator is also in-circuit. The full mechanical attenuator range is available^a.</p> <p>The 1 dB compression point will be nominally higher with the electronic attenuator “Enabled” than with it not Enabled by the loss,^b except with high settings of electronic attenuation^c.</p> <p>Instrument Displayed Average Noise Level will nominally be worse with the electronic attenuator “Enabled” than with it not Enabled by the loss^b.</p> <p>Instrument Second Harmonic Distortion will nominally be better in terms of the second harmonic intercept (SHI) with the electronic attenuator “Enabled” than with it not Enabled by the loss^b.</p> <p>Instrument TOI will nominally be better with the electronic attenuator “Enabled” than with it not Enabled by the loss^b except for the combination of high attenuation setting and high signal frequency^d.</p>

- a. The electronic attenuator is calibrated for its frequency response only with the mechanical attenuator set to its preferred setting of 10 dB.
- b. The loss of the electronic attenuator is nominally given by its attenuation plus its excess loss. That excess loss is nominally 2 dB from 0 – 500 MHz and increases by nominally another 1 dB/GHz for frequencies above 500 MHz.
- c. An additional compression mechanism is present at high electronic attenuator settings. The mechanism gives nominally 1 dB compression at +20 dBm at the internal electronic attenuator input. The compression threshold at the RF input is higher than that at the internal electronic attenuator input by the mechanical attenuation. The mechanism has negligible effect for electronic attenuations of 0 through 14 dB.
- d. The TOI performance improvement due to electronic attenuator loss is limited at high frequencies, such that the TOI reaches a limit of nominally +45 dBm at 3.6 GHz, with the preferred mechanical attenuator setting of 10 dB, and the maximum electronic attenuation of 24 dB. The TOI will change in direct proportion to changes in mechanical attenuation.

Description	Specifications		Supplemental Information
Frequency Response (Maximum error relative to reference condition (50 MHz))			Mech atten set to default/calibrated setting of 10 dB.
	20 to 30°C	Full Range	95th Percentile ($\approx 2\sigma$)
Attenuation = 4 to 24 dB, even steps			
9 kHz to 10 MHz	± 0.75 dB	± 0.90 dB	± 0.32 dB
10 MHz to 50 MHz	± 0.65 dB	± 0.69 dB	± 0.27 dB
<i>Option ≤ 526</i>			
50 MHz to 2.2 GHz	± 0.48 dB	± 0.60 dB	± 0.19 dB
2.2 to 3.6 GHz	± 0.55 dB	± 0.67 dB	± 0.20 dB
<i>Option > 526</i>			
50 MHz to 2.2 GHz	± 0.48 dB	± 0.70 dB	± 0.19 dB
2.2 to 3.6 GHz	± 0.55 dB	± 0.70 dB	± 0.22 dB
Attenuation = 0, 1, 2 and odd steps, 3 to 23 dB			
10 MHz to 3.6 GHz			± 0.30 dB

Description	Specifications	Supplemental Information
Absolute Amplitude Accuracy		
At 50 MHz ^a		
20 to 30°C	± 0.44 dB	
Full temperature range	± 0.47 dB	
At all frequencies ^a		
20 to 30°C	$\pm(0.44$ dB + frequency response)	
Full temperature range	$\pm(0.47$ dB + frequency response)	

a. Absolute amplitude accuracy is the total of all amplitude measurement errors, and applies over the following subset of settings and conditions: 1 Hz \leq RBW \leq 1 MHz; Input signal -10 to -50 dBm; Input attenuation 10 dB; all settings auto-coupled except Swp Time Rules = Accuracy; combinations of low signal level and wide RBW use VBW \leq 30 kHz to reduce noise. When using FFT sweeps, the signal must be at the center frequency.

This absolute amplitude accuracy specification includes the sum of the following individual specifications under the conditions listed above: Scale Fidelity, Reference Level Accuracy, Display Scale Switching Uncertainty, Resolution Bandwidth Switching Uncertainty, 50 MHz Amplitude Reference Accuracy, and the accuracy with which the instrument aligns its internal gains to the 50 MHz Amplitude Reference.

Option EA3 - Electronic Attenuator, 3.6 GHz
Other Electronic Attenuator Specifications

Description	Specifications	Supplemental Information
Electronic Attenuator Switching Uncertainty (Error relative to reference condition: 50 MHz, 10 dB mechanical attenuation, 10 dB electronic attenuation) Attenuation = 0 to 24 dB 9 kHz to 3.6 GHz	See note ^a	

- a. The specification is ± 0.14 dB. Note that this small relative uncertainty does not apply in estimating absolute amplitude accuracy. It is included within the absolute amplitude accuracy for measurements done with the electronic attenuator. (Measurements made without the electronic attenuator are treated differently; the absolute amplitude accuracy specification for these measurements does not include attenuator switching uncertainty.)

Option EMC - Precompliance EMI Features

This chapter contains specifications for the *Option EMC* precompliance EMI features.

Frequency

Description	Specifications	Supplemental information
Frequency Range		10 Hz to 3.6, 7, 13.6, 26.5, 32, or 44 GHz depending on the frequency option.
EMI Resolution Bandwidths		See Table 9-1 on page 123 and Table 9-2 on page 123 for CISPR and MIL-STD frequency ranges.
CISPR		Available when the EMC Standard is CISPR.
200 Hz, 9 kHz, 120 kHz, 1 MHz		Meet CISPR standard ^a , –6 dB bandwidths, subject to masks
Non-CISPR bandwidths	10, 30, 100, 300 Hz, 1, 3, 30, 300 kHz, 3, 10 MHz	–6 dB bandwidths
MIL STD		Available when the EMC Standard is MIL
10, 100 Hz, 1, 10, 100 kHz, 1 MHz		Meets MIL-STD ^b , –6 dB bandwidths
Non-MIL STD bandwidths	30, 300 Hz, 3, 30, 300 kHz, 3, 10 MHz	–6 dB bandwidths

a. CISPR 16-1-1(2010)

b. MIL-STD 461 D/E/F (20 Aug. 1999)

Table 9-1 CISPR Preset Settings

CISPR Band	Frequency Range	CISPR RBW	Data Points
Band A	9 to 150 kHz	200 Hz	1413
Band B	150 kHz to 30 MHz	9 kHz	6637
Band C	30 to 300 MHz	120 kHz	4503
Band D	300 MHz to 1 GHz	120 kHz	11671
Band C/D	30 MHz to 1 GHz	120 kHz	16171
Band E	1 to 18 GHz	1 MHz	34001

Table 9-2 MIL-STD 461D/E/F Frequency Ranges and Bandwidths

Frequency Range	6 dB Bandwidth	Minimum Measurement Time
30 Hz to 1 kHz	10 Hz	0.015 s/Hz
1 kHz to 10 kHz	100 Hz	0.15 s/kHz
10 kHz to 150 kHz	1 kHz	0.015 s/kHz
150 kHz to 30 MHz	10 kHz	1.5 s/MHz
30 MHz to 1 GHz	100 kHz	0.15 s/MHz
Above 1 GHz	1 MHz	15 s/GHz

Amplitude

Description	Specifications	Supplemental Information
<p>EMI Average Detector</p> <p>Default Average Type</p> <p>Quasi-Peak Detector</p> <p>Absolute Amplitude Accuracy for reference spectral intensities</p> <p>Relative amplitude accuracy versus pulse repetition rate</p> <p>Quasi-Peak to average response ratio</p> <p>Dynamic range</p> <p> Pulse repetition rates ≥ 20 Hz</p> <p> Pulse repetition rates ≤ 10 Hz</p> <p>RMS Average Detector</p>		<p>Used for CISPR-compliant average measurements and, with 1 MHz RBW, for frequencies above 1 GHz</p> <p>All filtering is done on the linear (voltage) scale even when the display scale is log.</p> <p>Used with CISPR-compliant RBWs, for frequencies ≤ 1 GHz</p> <p>Meets CISPR standards^a</p> <p>Meets CISPR standards^a</p> <p>Meets CISPR standards^a</p> <p>Meets CISPR standards^a</p> <p>Does not meet CISPR standards in some cases with DC pulse excitation.</p> <p>Meets CISPR standards^a</p>

a. CISPR 16-1-1 (2010)

This chapter contains specifications for the *Option ESC*, External Source Control.

General Specifications

Description	Specification	Supplemental Information
Frequency Range		
SA Operating range		
N9010A-503	10 Hz to 3.6 GHz	
N9010A-507	10 Hz to 7 GHz	
N9010A-513	10 Hz to 13.6 GHz	
N9010A-526	10 Hz to 26.5 GHz	
N9010A-532	10 Hz to 32 GHz	
N9010A-544	10 Hz to 44 GHz	
Source Operating range		
N5171B-501	9 kHz to 1 GHz	
N5171B/72B/81B/82B-503	9 kHz to 3 GHz	
N5171B/72B/81B/82B-506	9 kHz to 6 GHz	
N5181A/N5182A-503	100 kHz to 3 GHz	
N5181A/N5182A-506	100 kHz to 6 GHz	
N5183A-520	100 kHz to 20 GHz	
N5183A-532	100 kHz to 32 GHz	
N5183A-540	100 kHz to 40 GHz	
E8257D-520	250 kHz to 20 GHz	
E8257D-532	250 kHz to 32 GHz	
E8257D-540	250 kHz to 40 GHz	
E8257D-550	250 kHz to 50 GHz	
E8257D-567	250 kHz to 67 GHz	
E8267D-520	250 kHz to 20 GHz	
E8267D-532	250 kHz to 31.8 GHz	
E8267D-544	250 kHz to 44 GHz	
Span Limitations		
Span limitations due to source range		Limited by the source and SA operating range
Offset Sweep		
Sweep offset setting range		Limited by the source and SA operating range
Sweep offset setting resolution	1 Hz	
Harmonic Sweep		
Harmonic sweep setting range ^a		
Multiplier numerator		N = 1 to 1000
Multiplier denominator		N = 1 to 1000
Sweep Direction^b		Normal, Reversed

a. Limited by the frequency range of the source to be controlled.

- b. The analyzer always sweeps in a positive direction, but the source may be configured to sweep in the opposite direction. This can be useful for analyzing negative mixing products in a mixer under test, for example.

Description	Specification	Supplemental Information																				
<p>Dynamic Range</p> <p>(10 MHz to 3 GHz, Input terminated, sample detector, average type = log, 20 to 30°C)</p> <table border="1"> <thead> <tr> <th>SA span</th> <th>SA RBW</th> <th>Option ≤ 526</th> <th>Option >526</th> </tr> </thead> <tbody> <tr> <td>1 MHz</td> <td>2 kHz</td> <td>101.0 dB</td> <td>104.0 dB</td> </tr> <tr> <td>10 MHz</td> <td>6.8 kHz</td> <td>95.7 dB</td> <td>98.0 dB</td> </tr> <tr> <td>100 MHz</td> <td>20 kHz</td> <td>91.0 dB</td> <td>94.0 dB</td> </tr> <tr> <td>1000 MHz</td> <td>68 kHz</td> <td>85.7 dB</td> <td>88.0 dB</td> </tr> </tbody> </table> <p>Amplitude Accuracy</p>	SA span	SA RBW	Option ≤ 526	Option >526	1 MHz	2 kHz	101.0 dB	104.0 dB	10 MHz	6.8 kHz	95.7 dB	98.0 dB	100 MHz	20 kHz	91.0 dB	94.0 dB	1000 MHz	68 kHz	85.7 dB	88.0 dB		<p>Dynamic Range = $-10 \text{ dBm} - \text{DANL} - 10 \times \log(\text{RBW})^a$</p> <p>Multiple contributors^b Linearity^c Source and Analyzer Flatness^d YTF Instability^e VSWR effects^f</p>
SA span	SA RBW	Option ≤ 526	Option >526																			
1 MHz	2 kHz	101.0 dB	104.0 dB																			
10 MHz	6.8 kHz	95.7 dB	98.0 dB																			
100 MHz	20 kHz	91.0 dB	94.0 dB																			
1000 MHz	68 kHz	85.7 dB	88.0 dB																			

- a. The dynamic range is given by this computation: $-10 \text{ dBm} - \text{DANL} - 10 \times \log(\text{RBW})$ where DANL is the displayed average noise level specification, normalized to 1 Hz RBW, and the RBW used in the measurement is in hertz units. The dynamic range can be increased by reducing the RBW at the expense of increased sweep time.
- b. The following footnotes discuss the biggest contributors to amplitude accuracy.
- c. One amplitude accuracy contributor is the linearity with which amplitude levels are detected by the analyzer. This is called "scale fidelity" by most spectrum analyzer users, and "dynamic amplitude accuracy" by most network analyzer users. This small term is documented in the Amplitude section of the Specifications Guide. It is negligibly small in most cases.
- d. The amplitude accuracy versus frequency in the source and the analyzer can contribute to amplitude errors. This error source is eliminated when using normalization in low band (0 to 3.6 GHz). In high band the gain instability of the YIG-tuned prefilter in the analyzer keeps normalization errors nominally in the 0.25 to 0.5 dB range.
- e. In the worst case, the center frequency of the YIG-tuned prefilter can vary enough to cause very substantial errors, much higher than the nominal 0.25 to 0.5 dB nominal errors discussed in the previous footnote. In this case, or as a matter of good practice, the prefilter should be centered. See the user's manual for instructions on centering the preselector.
- f. VSWR interaction effects, caused by RF reflections due to mismatches in impedance, are usually the dominant error source. These reflections can be minimized by using 10 dB or more attenuation in the analyzer, and using well-matched attenuators in the measurement configuration.

Option ESC - External Source Control
General Specifications

Description	Specification	Supplemental Information
Power Sweep Range		Limited by source amplitude range

Description	Specification	Supplemental Information		
Measurement Time		Nominal ^a		
		RF MXG (N5181A/N5182A)^b		
		Band 0	Band 1	
<i>Option 503, 507, 513, 526, 532, 544</i>				
201 Sweep points (default setting)		450 ms	1.1 s	
601 Sweep points		1.25 s	3.7 s	
		μW MXG (N5183A)^b		
		Band 0	Band 1	
<i>Option 503, 507, 513, 526</i>				
201 Sweep points (default setting)		450 ms	1.2 s	2.4 s
601 Sweep points		1.2 s	3.7 s	6.9 s
<i>Option 532, 544</i>				
201 Sweep points (default setting)		450 ms	6.5 s	6.6 s
601 Sweep points		1.2 s	19 s	19.1 s
		PSG (E8257D)/(E8267D)^c		
		Band 0	Band 1	
<i>Option 503, 507, 513, 526</i>				
201 Sweep points (default setting)		2.2 s	2.2 s	2.5 s
601 Sweep points		6.1 s	6.5 s	7.1 s
<i>Option 532, 544</i>				
201 Sweep points (default setting)		2.2 s	6.6 s	6.6 s
601 Sweep points		6.1 s	19.5 s	19.1 s

- a. These measurement times were observed with a span of 100 MHz, RBW of 20 kHz, and the point triggering method being set to Ext Trigger1. The measurement times will not change significantly with span when the RBW is automatically selected. If the RBW is decreased, the sweep time increase would be approximately 23.8 times Npoints/RBW.
- b. Based on MXG firmware version A.01.80 and *Option UNZ* installed.
- c. Based on PSG firmware version C.06.15 and *Option UNZ* installed.

Description	Specification	Supplemental Information
Supported External Sources Agilent EXG Agilent MXG Agilent PSG IO interface connection between EXG/MXG and SA between PSG and SA		N5171B/72B (firmware B.01.01 or later) ^{ab} N5181B/82B (firmware B.01.01 or later) ^{ab} N5181A (firmware A.01.80 or later) N5182A (firmware A.01.80 or later) N5183A (firmware A.01.80 or later) E8257D (firmware C.06.15 or later) E8267D (firmware C.06.15 or later) LAN, GPIB, or USB LAN or GPIB

- a. Firmware revision A.11.00 or later is required for the signal analyzer to control the analog X-Series EXG (N5171B) and MXG (N5181B).
- b. Firmware revision A.12.00 or later is required for the signal analyzer to control the vector X-Series EXG (N5172B) and MXG (N5182B).

Option ESC - External Source Control
General Specifications

This chapter contains specifications for the *Option EXM* External Mixing.

Specifications Affected by External mixing

Specification Name	Information
RF-Related Specifications, such as TOI, DANL, SHI, Amplitude Accuracy, and so forth.	Specifications do not apply; some related specifications are contained in IF Input in this chapter
IF-Related Specifications, such as RBW range, RBW accuracy, RBW switching uncertainty, and so forth.	Specifications unchanged, except IF Frequency Response - see specifications in this chapter.
New specifications: IF Input Mixer Bias LO Output	See specifications in this chapter.

Other External Mixing Specifications

Description	Specifications	Supplemental Information
Connection Port EXT MIXER		
Connector	SMA, female	
Impedance		50Ω (nominal) at IF and LO frequencies
Functions	Triplexed for Mixer Bias, IF Input and LO output	
Mixer Bias		
Bias Current		Short circuit current
Range	±10 mA	
Resolution	10 μA	
Accuracy		±20 μA (nominal)
Output impedance		477Ω (nominal)
Bias Voltage		Open circuit
Range		±3.7 V (nominal)
IF Input		
Maximum Safe Level	+7 dBm	
Center Frequency		
Standard (or <i>Option B25^a</i>)	322.5 MHz	
<i>Option B40^a</i>	250.0 MHz	
Bandwidth		Supports all optional IFs
ADC Clipping Level ^b		-14.5 ±1.5 dBm (nominal)
1 dB Gain Compression ^b		-2 dBm (nominal)
Gain Accuracy ^c	20 to 30°C Full Range	
Standard (or <i>Option B25^a</i>)	±1.2 dB ±2.5 dB	Swept and narrowband
<i>Option B40^a</i>		±1.2 dB (nominal)
IF Frequency Response		RMS (nominal)
CF Width		
322.5 MHz ±5 MHz		0.05 dB
322.5 MHz ±12.5 MHz		0.07 dB
250 MHz ±20 MHz		0.15 dB
Noise Figure (322.5 MHz, swept operation)		9 dB (nominal)
VSWR		1.3:1 (nominal)

a. *Option B25, and B40* are only available in "I/Q Analyzer" mode.

b. These specifications apply at the IF input port. The on-screen and mixer-input levels scale with the conversion loss and corrections values.

Option EXM - External Mixing
Other External Mixing Specifications

- c. The amplitude accuracy of a measurement includes this term and the accuracy with which the settings of corrections model the loss of the external mixer.

Description	Specifications	Supplemental Information								
LO Output Frequency Range Output Power ^a 3.75 to 7.0 GHz ^b 7.0 to 8.72 GHz ^b 7.8 to 14.0 GHz ^c Second Harmonic Fundamental Feedthrough and Undesired Harmonics ^c VSWR	3.75 to 14.0 GHz <table border="0"> <tr> <td>20 to 30°C</td> <td>Full Range</td> </tr> <tr> <td>+15.0 to 18.0 dBm</td> <td>+14.5 to 18.5 dBm</td> </tr> <tr> <td>+15.0 to 18.0 dBm</td> <td>+13.5 to 18.8 dBm</td> </tr> <tr> <td>+14.0 to 18.5 dBm</td> <td>Not specified</td> </tr> </table>	20 to 30°C	Full Range	+15.0 to 18.0 dBm	+14.5 to 18.5 dBm	+15.0 to 18.0 dBm	+13.5 to 18.8 dBm	+14.0 to 18.5 dBm	Not specified	 –20 dB (nominal) –15 dB (nominal) <2.2:1 (nominal)
20 to 30°C	Full Range									
+15.0 to 18.0 dBm	+14.5 to 18.5 dBm									
+15.0 to 18.0 dBm	+13.5 to 18.8 dBm									
+14.0 to 18.5 dBm	Not specified									

- a. The LO output port power is compatible with Agilent M1970 and 11970 Series mixers except for the 11970K. The power is specified at the connector. Cable loss will affect the power available at the mixer. With non-Agilent mixer units, supplied loss calibration data may be valid only at a specified LO power that may differ from the power available at the mixer. In such cases, additional uncertainties apply.
- b. LO Doubler = Off settings.
- c. LO Doubler = On setting. Fundamental frequency = 3.9 to 7.0 GHz.

This chapter contains specifications for the *Option MPB*, Microwave Preselector Bypass.

Specifications Affected by Microwave Preselector Bypass

Specification Name	Information
Displayed Average Noise Level	<p>For analyzers with frequency Option 526 (26.5 GHz) or lower: Performance is not identical, but nominally the same, as without <i>Option MPB</i>.</p> <p>For analyzers with frequency option higher than Option 526 (26.5 GHz): Performance is nominally 3 dB better than without <i>Option MPB</i>.</p>
IF Frequency Response and IF Phase Linearity	<p>See “IF Frequency Response” on page 34 and “IF Phase Linearity” on page 35 for the standard 10 MHz analysis bandwidth; also, see the associated "Analysis Bandwidth" chapter for any optional bandwidths.</p>
Frequency Response VSWR	<p>See specifications in this chapter.</p> <p>The magnitude of the mismatch over the range of frequencies will be very similar between MPB and non-MPB operation, but the details, such as the frequencies of the peaks and valleys, will shift.</p>
Additional Spurious Responses	<p>In addition to the “Spurious Responses” on page 45 of the core specifications, “Additional Spurious Responses” on page 138 of this chapter also apply.</p>

Other Microwave Preselector Bypass Specifications

Description	Specifications		Supplemental Information
Frequency Response (Maximum error relative to reference condition (50 MHz) Swept operation ^a , Attenuation 10 dB)			Refer to the footnote for Band Overlaps on page 19 . Modes above 18 GHz ^b
	20 to 30°C	Full Range	95th Percentile ($\approx 2\sigma$)
3.5 to 8.4 GHz	±0.9 dB	±1.5 dB	±0.42 dB
8.3 to 13.6 GHz	±1.0 dB	±2.0 dB	±0.50 dB
13.5 to 17.1 GHz	±1.3 dB	±2.0 dB	±0.50 dB
17.0 to 22.0 GHz	±1.3 dB	±2.0 dB	±0.53 dB
22.0 to 26.5 GHz	±2.0 dB	±2.8 dB	±0.66 dB
26.4 to 34.5 GHz	±2.0 dB	±3.0 dB	±0.80 dB
34.4 to 44 GHz	±3.1 dB	±4.8 dB	±1.21 dB

- a. For Sweep Type = FFT, add the RF flatness errors of this table to the IF Frequency Response errors. An additional error source, the error in switching between swept and FFT sweep types, is nominally ±0.01 dB and is included within the “Absolute Amplitude Error” specifications.
- b. Signal frequencies between 18 and 26.5 GHz are prone to additional response errors due to modes in the Type-N connector used with frequency *Option 526*. With the use Type-N to APC 3.5 mm adapter part number 1250-1744, there are nominally six such modes. The effect of these modes with this connector are included within these specifications.

Option MPB - Microwave Preselector Bypass
Other Microwave Preselector Bypass Specifications

Description	Specifications	Supplemental Information
Additional Spurious Responses^a		
Tuned		
Frequency (f)	Excitation	
Image Response		
3.5 to 26.5 GHz	$f + f_{IF}^b$	0 dBc (nominal), High Band Image Suppression is lost with <i>Option MPB</i> .
LO Harmonic and Subharmonic Responses		
3.5 to 8.4 GHz	$N(f + f_{IF}) \pm f_{IF}^b$	-10 dBc (nominal), N = 2, 3
8.3 to 26.5 GHz	$[N(f + f_{IF})/2] \pm f_{IF}^b$	-10 dBc (nominal), N = 1, 3, 4
Second Harmonic Response		
3.5 to 13.6 GHz	$f/2$	-72 dBc (nominal) for -40 dBm mixer level
13.5 to 26.5 GHz	$f/2$	-68 dBc (nominal) for -40 dBm mixer level
IF Feedthrough Response		
3.5 to 13.6 GHz	f_{IF}^b	-100 dBc (nominal)
13.5 to 26.5 GHz	f_{IF}^b	-90 dBc (nominal)

- a. Dominate spurious responses are described here. Generally, other *Option MPB*-specific spurious responses will be substantially lower than those listed here, but may exceed core specifications.
- b. $f_{IF} = 322.5$ MHz except $f_{IF} = 250$ MHz with *Option B40* and the 40 MHz IF path enabled.

**Option P03, P07, P13, P26, P32 and P44
- Preamplifier**

This chapter contains specifications for the EXA Signal Analyzer *Option P03, P07, P13, P26, P32 and P44* preamplifiers.

Specifications Affected by Preamp

Specification Name	Information
Nominal Dynamic Range vs. Offset Frequency vs. RBW	The graphic from the core specifications does not apply with Preamp On.
Measurement Range	The measurement range depends on DANL. See “Amplitude Accuracy and Range” on page 31.
Gain Compression	See specifications in this chapter.
Displayed Average Noise Level	See specifications in this chapter.
Displayed Average Noise Level with <i>Option MPB</i> for <i>Option 532</i> or <i>544</i>	Performance is nominally 3 dB worse than without <i>Option MPB</i> .
Frequency Response	See specifications in this chapter.
Absolute Amplitude Accuracy	See “Absolute Amplitude Accuracy” on page 36 of the core specifications.
RF Input VSWR	See plot in this chapter.
Display Scale Fidelity	See “Display Scale Fidelity” on page 39 of the core specifications. Then, adjust the mixer levels given downward by the preamp gain given in this chapter.
Second Harmonic Distortion	SHI with preamplifiers is not specified.
Third Order Intermodulation Distortion	See specifications in this chapter.
Other Input Related Spurious	See “Spurious Responses” on page 45 of the core specifications. Preamp performance is not warranted but is nominally the same as non-preamp performance.
Dynamic Range	See plot in this chapter.
Gain	See “Preamp” specifications in this chapter.
Noise Figure	See “Preamp” specifications in this chapter.

Other Preamp Specifications

Description	Specifications	Supplemental Information
<p>Preamp (Options P03, P07, P13, P26, P32 and P44)^a</p> <p>Gain 100 kHz to 3.6 GHz 3.6 to 26.5 GHz 26.5 to 44 GHz</p> <p>Noise figure 100 kHz to 3.6 GHz 3.6 to 8.4 GHz 8.4 to 13.6 GHz 13.6 to 44 GHz</p>		<p>Maximum^b +20 dB (nominal) +35 dB (nominal) +40 dB (nominal)</p> <p>8 to 12 dB(proportional to frequency) (nominal) 9 dB (nominal) 10 dB (nominal) Noise Figure is DANL + 176.24 dB (nominal)^c Note on DC coupling^d</p>

- a. The preamp follows the input attenuator, AC/DC coupling switch, and precedes the input mixer. In low-band, it follows the 3.6 GHz low-pass filter. In high-band, it precedes the preselector.
- b. Preamp Gain directly affects distortion and noise performance, but it also affects the range of levels that are free of final IF overload. The user interface has a designed relationship between input attenuation and reference level to prevent on-screen signal levels from causing final IF overloads. That design is based on the maximum preamp gains shown. Actual preamp gains are modestly lower, by up to nominally 5 dB for frequencies from 100 kHz to 3.6 GHz, and by up to nominally 10 dB for frequencies from 3.6 to 44 GHz.
- c. Nominally, the noise figure of the spectrum analyzer is given by

$$NF = D - (K - L + N + B)$$
 where, D is the DANL (displayed average noise level) specification (Refer to [page 143](#) for DANL with Preamp),
 K is kTB (-173.98 dBm in a 1 Hz bandwidth at 290 K),
 L is 2.51 dB (the effect of log averaging used in DANL verifications)
 N is 0.24 dB (the ratio of the noise bandwidth of the RBW filter with which DANL is specified to an ideal noise bandwidth)
 B is ten times the base-10 logarithm of the RBW (in hertz) in which the DANL is specified. B is 0 dB for the 1 Hz RBW.
 The actual NF will vary from the nominal due to frequency response errors.
- d. The effect of AC coupling is negligible for frequencies above 40 MHz. Below 40 MHz, DC coupling is recommended for the best measurements. The instrument NF nominally degrades by 0.2 dB at 30 MHz and 1 dB at 10 MHz with AC coupling.

Option P03, P07, P13, P26, P32 and P44 - Preamplifier
Other Preamp Specifications

Description	Specifications	Supplemental Information
<p>1 dB Gain Compression Point (Two-tone)^a (Preamp On (<i>Option P03, P07, P13, P26, P32, P44</i>)) Maximum power at the preamp^b for 1 dB gain compression)</p> <p>10 MHz to 3.6 GHz 3.6 to 26.5 GHz Tone spacing 100 kHz to 20 MHz Tone spacing > 70 MHz >26.5 GHz</p>		<p>–14 dBm (nominal)</p> <p>–28 dBm (nominal)</p> <p>–20 dBm (nominal)</p> <p>–30 dBm (nominal)</p>

- a. Large signals, even at frequencies not shown on the screen, can cause the analyzer to mismeasure on-screen signals because of two-tone gain compression. This specification tells how large an interfering signal must be in order to cause a 1 dB change in an on-screen signal.
- b. Total power at the preamp (dBm) = total power at the input (dBm) – input attenuation (dB).

Description	Specifications	Supplemental Information
Displayed Average Noise Level (DANL) Preamp On^a	Input terminated Sample or Average detector Averaging type = Log 0 dB input attenuation IF Gain = High 1 Hz Resolution Bandwidth	Refer to the footnote for Band Overlaps on page 19.
mmW without <i>Option B40, DP2, or MPB</i>		
mmW with <i>Option B40, DP2, or MPB</i>		
RF/μW (<i>Option 503, 507, 513, or 526</i>)		
<i>Option P03, P07, P13, P26, P32, P44</i>	20 to 30°C Full range	Typical
100 kHz to 1 MHz ^b	x	-146 dBm (nominal)
100 kHz to 1 MHz	x	-148 dBm
1 to 10 MHz	x	-161 dBm (nominal)
1 to 10 MHz	x	-165 dBm
10 MHz to 2.1 GHz	x	-163 dBm
10 MHz to 1.2 GHz	x	-165 dBm
1.2 to 2.1 GHz	x	-164 dBm
2.1 to 3.6 GHz	x	-162 dBm
2.1 to 3.6 GHz	x	-163 dBm
<i>Option P07, P13, P26, P32, P44</i>		
3.5 to 7.0. GHz	x	-162 dBm
3.5 to 7.0 GHz	x	-161 dBm
3.5 to 7.0 GHz	x	-162 dBm
<i>Option P13, P26, P32, P44</i>		
7 to 13.6 GHz	x	-163 dBm
13.5 to 17.1 GHz	x	-160 dBm
17.0 to 20.0. GHz	x	-159 dBm
7.0 to 20 GHz	x	-161 dBm
7.0 to 20 GHz	x	-162 dBm

Option P03, P07, P13, P26, P32 and P44 - Preamplifier
Other Preamp Specifications

Description			Specifications	Supplemental Information
20 to 26.5 GHz	x		-150 dBm -147 dBm	-156 dBm
20 to 26.5 GHz		x	-157 dBm -155 dBm	-159 dBm
20 to 26.5 GHz		x	-158 dBm -156 dBm	-160 dBm
26.5 to 32 GHz		x	-155 dBm -152 dBm	-158 dBm
26.5 to 32 GHz		x	-156 dBm -153 dBm	-159 dBm
<i>Option P44</i>				
32 to 34 GHz		x	-155 dBm -152 dBm	-158 dBm
32 to 34 GHz		x	-156 dBm -153 dBm	-159 dBm
33.9 to 40 GHz		x	-152 dBm -148 dBm	-154 dBm
33.9 to 40 GHz		x	-153 dBm -150 dBm	-155 dBm
40 to 44 GHz		x	-148 dBm -144 dBm	-152 dBm
40 to 44 GHz		x	-149 dBm -146 dBm	-153 dBm

- DANL is measured in a 1 kHz RBW and normalized to the narrowest available RBW, because the noise figure does not depend on RBW and 1 kHz measurements are faster.
- Specifications apply only when the Phase Noise Optimization control is set to “Best Wide-offset Phase Noise.”

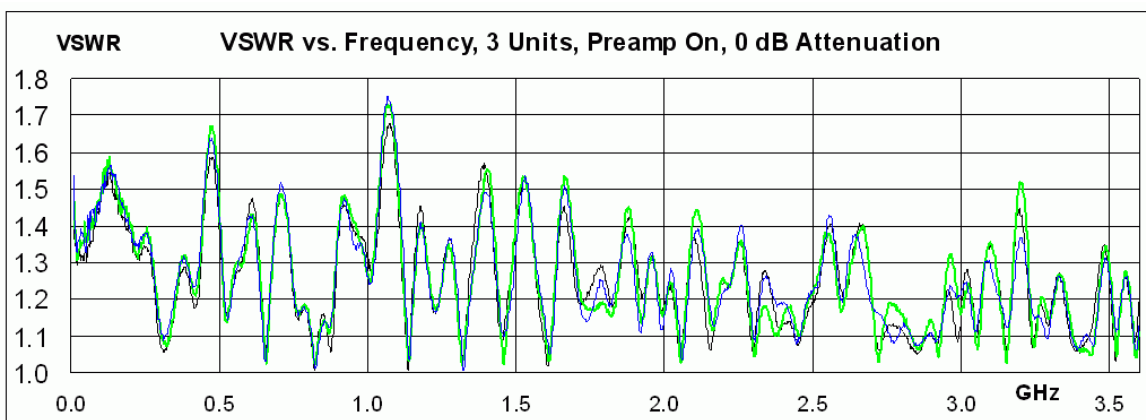
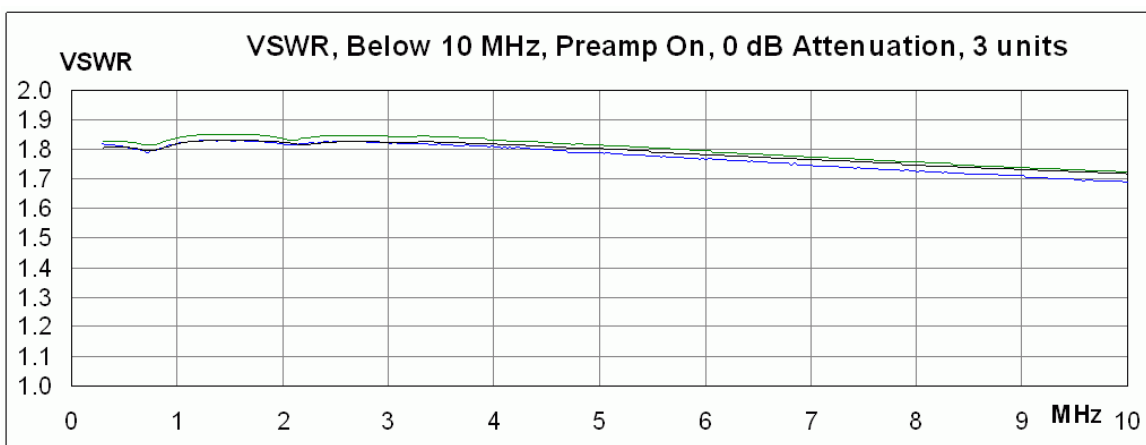
Description	Specifications	Supplemental Information
Frequency Response – Preamp On <i>(Options P03, P07, P13, P26, P32, P44)</i> (Maximum error relative to reference condition (50 MHz) Input attenuation 0 dB Swept operation ^{a)})		
100 kHz to 3.6 GHz ^{b)}		±0.28 dB (nominal)
3.5 to 8.4 GHz		±0.67 dB (nominal)
8.3 to 26.5 GHz		±0.8 dB (nominal)
26.5 to 44 GHz		±0.8 dB (nominal)

- For Sweep Type = FFT, add the RF flatness errors of this table to the IF Frequency Response errors. An additional error source, the error in switching between swept and FFT sweep types, is nominally ±0.01 dB and is included within the “Absolute Amplitude Error” specifications.
- Electronic attenuator (Option EA3) may not be used with preamp on.

Description	Specifications	Supplemental Information
<p>RF Input VSWR (at tuned frequency, Freq Option \leq 526)</p> <p>Band 0 (0.01 to 3.6 GHz) Band 1 (3.5 to 8.4 GHz) Band 2 (8.3 to 13.6 GHz) Band 3 (13.5 to 17.1 GHz) Band 4 (17.0 to 26.5 GHz) Nominal VSWR vs. Freq.</p>		<p>DC coupled, 0 dB atten</p> <p>95th Percentile^a</p> <p>1.52 1.68 1.69 1.66 1.66</p> <p>See plots following</p>

- a. X-Series analyzers have a reflection coefficient that is excellently modeled with a Rayleigh probability distribution. Agilent recommends using the methods outlined in Application Note 1449-3 and companion Average Power Sensor Measurement Uncertainty Calculator to compute mismatch uncertainty. Use this 95th percentile VSWR information and the Rayleigh model (Case C or E in the application note) with that process.

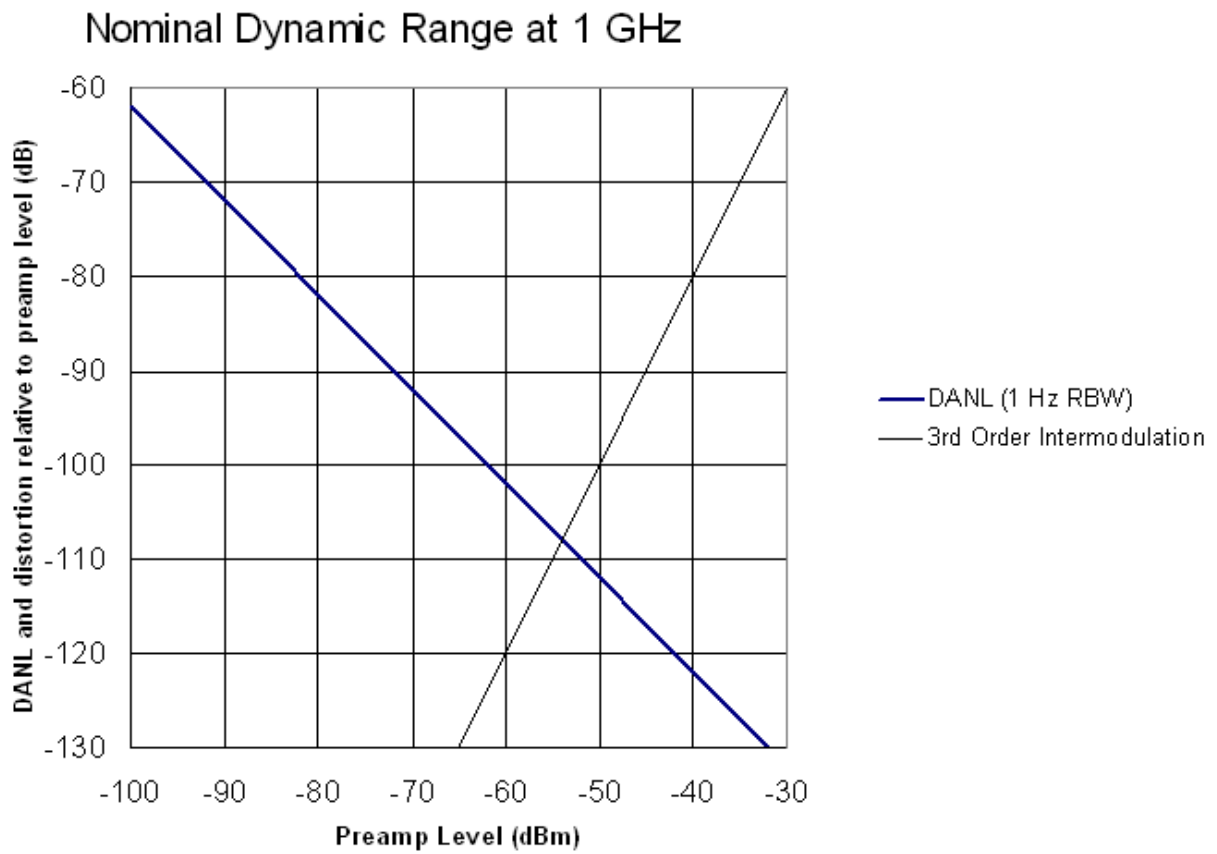
Nominal VSWR – Preamp On, Freq Option ≤ 526 [Plot]



Description	Specifications	Supplemental Information
Third Order Intermodulation Distortion (Tone separation 5 times IF Prefilter Bandwidth ^a Sweep type not set to FFT)		
30 MHz to 3.6 GHz		Preamp Level^b Distortion (nominal) TOI^c (nominal) -45 dBm -90 dBc 0 dBm
3.6 to 26.5 GHz		-50 dBm -64 dBc -18 dBm

- a. See the IF Prefilter Bandwidth table in the specifications for “Gain Compression” on page 41. When the tone separation condition is met, the effect on TOI of the setting of IF Gain is negligible.
- b. Preamp Level = Input Level – Input Attenuation.
- c. TOI = third order intercept. The TOI is given by the preamplifier input tone level (in dBm) minus (distortion/2) where distortion is the relative level of the distortion tones in dBc.

Nominal Dynamic Range at 1 GHz, Preamp On, Freq Option ≤ 526 [Plot]



Option P03, P07, P13, P26, P32 and P44 - Preamplifier
Other Preamp Specifications

Option PFR - Precision Frequency Reference

This chapter contains specifications for the *Option PFR*, Precision Frequency Reference.

Specifications Affected by Precision Frequency Reference

Specification Name	Information
Precision Frequency Reference	See “Precision Frequency Reference” on page 21 in the core specifications.

Option YAS - Y-Axis Screen Video Output

This chapter contains specifications for *Option YAS*, Y-Axis Screen Video Output.

Specifications Affected by Y-Axis Screen Video Output

No other analyzer specifications are affected by the presence or use of this option. New specifications are given in the following pages.

Other Y-Axis Screen Video Output Specifications

General Port Specifications

Description	Specifications	Supplemental Information
Connector	BNC female	Shared with other options
Impedance		<140Ω (nominal)

Screen Video

Description	Specifications	Supplemental Information
<p>Operating Conditions</p> <p>Display Scale Types</p> <p>Log Scales</p> <p>Modes</p> <p>FFT & Sweep</p> <p>Gating</p> <p>Output Signal</p> <p>Replication of the RF Input Signal envelope, as scaled by the display settings</p> <p>Differences between display effects and video output</p> <p>Detector = Peak, Negative, Sample, or Normal</p> <p>Average Detector</p> <p>EMI Detectors</p> <p>Trace Averaging</p>	<p>All (Log and Lin)</p> <p>All (0.1 to 20 dB/div)</p> <p>Spectrum Analyzer only</p> <p>Select sweep type = Swept.</p> <p>Gating must be off.</p> <p>The output signal represents the input envelope excluding display detection</p> <p>The effect of average detection in smoothing the displayed trace is approximated by the application of a low-pass filter</p> <p>The output will not be useful.</p> <p>Trace averaging affects the displayed signal but does not affect the video output</p>	<p>“Lin” is linear in voltage</p> <p>Nominal bandwidth:</p> $LPFBW = \frac{Npoints - 1}{SweepTime \cdot \pi}$

Option YAS - Y-Axis Screen Video Output
Other Y-Axis Screen Video Output Specifications

Description	Specifications	Supplemental Information
Amplitude Range		Range of represented signals
Minimum	Bottom of screen	
Maximum	Top of Screen + Overrange	
Overrange		Smaller of 2 dB or 1 division, (nominal)
Output Scaling^a	0 to 1.0 V open circuit, representing bottom to top of screen respectively	
Offset		±1% of full scale (nominal)
Gain accuracy		±1% of output voltage (nominal)
Delay		
RF Input to Analog Out		
Without <i>Option B40, DP2, or MPB</i>		$1.67 \mu\text{s} + 2.56/\text{RBW} + 0.159/\text{VBW}$ (nominal)
With <i>Option B40, DP2, or MPB</i>		$71.7 \mu\text{s} + 2.56/\text{RBW} + 0.159/\text{VBW}$ (nominal)

- a. The errors in the output can be described as offset and gain errors. An offset error is a constant error, expressed as a fraction of the full-scale output voltage. The gain error is proportional to the output voltage. Here's an example. The reference level is -10 dBm, the scale is log, and the scale is 5 dB/division. Therefore, the top of the display is -10 dBm, and the bottom is -60 dBm. Ideally, a -60 dBm signal gives 0 V at the output, and -10 dBm at the input gives 1 V at the output. The maximum error with a -60 dBm input signal is the offset error, ±1% of full scale, or ±10 mV; the gain accuracy does not apply because the output is nominally at 0 V. If the input signal is -20 dBm, the nominal output is 0.8 V. In this case, there is an offset error (±10 mV) plus a gain error (±1% of 0.8 V, or ±8 mV), for a total error of ±18 mV.

Continuity and Compatibility

Description	Specifications	Supplemental Information
Continuity and Compatibility		
Output Tracks Video Level		
During sweep	Yes	Except band breaks in swept spans
Between sweeps	See supplemental information	Before sweep interruption ^a Alignments ^b Auto Align = Partial ^{cd}
External trigger, no trigger ^d	Yes	
HP 8566/7/8 Compatibility ^e		Recorder output labeled “Video”
Continuous output		Alignment differences ^f
Output impedance		Two variants ^g
Gain calibration		LL and UR not supported ^h
RF Signal to Video Output Delay		See footnote ⁱ

- a. There is an interruption in the tracking of the video output before each sweep. During this interruption, the video output holds instead of tracks for a time period given by approximately $1.8/RBW$.
- b. There is an interruption in the tracking of the video output during alignments. During this interruption, the video output holds instead of tracking the envelope of the RF input signal. Alignments may be set to prevent their interrupting video output tracking by setting Auto Align to Off.
- c. Setting Auto Align to Off usually results in a warning message soon thereafter. Setting Auto Align to Partial results in many fewer and shorter alignment interruptions, and maintains alignments for a longer interval.
- d. If video output interruptions for Partial alignments are unacceptable, setting the analyzer to External Trigger without a trigger present can prevent these from occurring, but will prevent there being any on-screen updating. Video output is always active even if the analyzer is not sweeping.
- e. Compatibility with the HP/Agilent 8560 and 8590 families, and the ESA and PSA, is similar in most respects.
- f. This section of specifications shows compatibility of the Screen Video function with HP 8566-Series analyzers. Compatibility with ESA and PSA analyzers is similar in most respects.
- g. Early HP 8566-family spectrum analyzers had a 140Ω output impedance; later ones had 190Ω . The specification was $<475\Omega$. The Analog Out port has a 50Ω impedance if the analyzer has *Option B40*, *DP2*, or *MPB*. Otherwise, the Analog Out port impedance is nominally 140Ω .
- h. The HP 8566 family had LL (lower left) and UR (upper right) controls that could be used to calibrate the levels from the video output circuit. These controls are not available in this option.
- i. The delay between the RF input and video output shown in [Delay on page 154](#) is much higher than the delay in the HP 8566 family spectrum analyzers. The latter has a delay of approximately $0.554/RBW + 0.159/VBW$.

Option YAS - Y-Axis Screen Video Output
Other Y-Axis Screen Video Output Specifications

Analog Demodulation Measurement Application

This chapter contains specifications for the N9063A Analog Demodulation Measurement Application.

Pre-Demodulation

Description	Specifications	Supplemental Information
Carrier Frequency Maximum Frequency <i>Option 503</i> <i>Option 507</i> <i>Option 513</i> <i>Option 526</i> <i>Option 532</i> <i>Option 544</i> Minimum Frequency AC Coupled ^a DC Coupled	3.6 GHz 7 GHz 13.6 GHz 26.5 GHz 32 GHz 44 GHz 10 MHz 9 kHz	In practice, limited by the need to keep modulation sidebands from folding, and by the interference from LO feedthrough.
Demodulation Bandwidth	8 MHz	
Capture Memory <i>(sample rate * demod time)</i>	250 kSa	Each sample is an I/Q pair.

a. AC Coupled is only applicable to frequency *Options 503, 507, 513, and 526.*

Post-Demodulation

Description	Specifications	Supplemental Information
Maximum Audio Frequency Span		4 MHz
Filters		
Low Pass	300 Hz, 3 kHz, 15 kHz, 30 kHz, 80 kHz, 300 kHz	
High Pass	20 Hz, 50 Hz, 300 Hz	
Band Pass	CCITT	
De-emphasis	25 μ s, 50 μ s, 75 μ s, 750 μ s	FM only

Frequency Modulation - Level and Carrier Metrics

Description	Specifications	Supplemental Information
FM Deviation Accuracy^{abc} (Rate: 1 kHz to 1 MHz, Deviation: 1 to 100 kHz)		$\pm(1\% \text{ of (rate + deviation) + 20 Hz}$ (nominal)
FM Rate Accuracy^b (Rate: 1 kHz to 1 MHz ^d)		$\pm 0.2 \text{ Hz}$ (nominal)
Carrier Frequency Error^e		$\pm 0.5 \text{ Hz}$ (nominal) + tfa Assumes the signal is still visible in the channel BW with offset.
Carrier Power		Same as Absolute Amplitude Accuracy at all frequencies (nominal).

- This specification applies to the result labeled "(Pk-Pk)/2".
- For optimum measurement, ensure that the channel bandwidth is set wide enough to capture the significant RF energy. Setting the channel bandwidth too wide will result in measurement errors.
- Reading is a measured frequency peak deviation in Hz, and rate is a modulation rate in Hz.
- Rate accuracy at high channel bandwidths assumes that the deviation is sufficiently large to overcome channel noise.
- tfa = transmitter frequency \times frequency reference accuracy.

Frequency Modulation - Distortion

Description	Specifications	Supplemental Information
<p>Residual^a (Rate: 1 to 10 kHz, Deviation: 5 kHz)</p> <p>THD Distortion SINAD</p> <p>Absolute Accuracy (Rate: 1 to 10 kHz, Deviation: 5 kHz)</p> <p>THD Distortion SINAD</p> <p>AM Rejection (AF 100 Hz to 15 kHz, 50% Modulation Depth)</p> <p>Residual FM (RF 500 kHz to 10 GHz)</p> <p>Measurement Range (Rate: 1 to 10 kHz, Deviation: 5 kHz)</p> <p>THD^b Distortion SINAD</p>		<p>0.2% (nominal) 3% (nominal) 32 dB (nominal)</p> <p>$\pm (2\% \times \text{reading} + \text{residual})$ (nominal) Measured 2nd and 3rd harmonics</p> <p>$\pm(2\% \times \text{reading} + \text{residual})$ (nominal)</p> <p>$\pm 0.4 \text{ dB} + \text{effect of residual}$ (nominal) 150 Hz (nominal)</p> <p>150 Hz (nominal)</p> <p>Residual to 100% (nominal) Measured 2nd and 3rd harmonics</p> <p>Residual to 100% (nominal) 0 dB to residual (nominal)</p>

- a. For optimum measurement, ensure that the channel bandwidth is set wide enough to capture the significant RF energy. Setting the channel bandwidth too wide will result in measurement errors.
- b. The measurement includes at most 10 harmonics.

Amplitude Modulation - Level and Carrier Metrics

Description	Specifications	Supplemental Information
AM Depth Accuracy ^{abc} (Rate: 1 kHz to 1 MHz)		$\pm 0.2\% + 0.002 \times \text{measured value}$ (nominal)
AM Rate Accuracy ^b (Rate: 1 kHz to 1 MHz)		$\pm 0.05 \text{ Hz}$ (nominal)
Carrier Power		Same as Absolute Amplitude Accuracy at all frequencies (nominal).

- This specification applies to the result labeled "(Pk-Pk)/2".
- For optimum measurement, ensure that the channel bandwidth is set wide enough to capture the significant RF energy. Setting the channel bandwidth too wide will result in measurement errors.
- Reading is a measured modulation depth in %.

Amplitude Modulation - Distortion

Description	Specifications	Supplemental Information
Residual^a (Depth: 50%, Rate: 1 to 10 kHz) THD Distortion SINAD Absolute Accuracy (Depth: 50%, Rate: 1 to 10 kHz) THD Distortion SINAD FM Rejection (AF + deviation < 0.5 × channel BW, AF < 0.1 × channel BW) Residual AM (RF 500 kHz to 20 GHz) Measurement Range (Depth: 50% Rate: 1 to 10 kHz) THD ^b Distortion SINAD		0.16% (nominal) 0.3% (nominal) 50 dB (nominal) ± (1% × reading + residual) (nominal) Measured 2nd and 3rd harmonics ± (1% × reading + residual) (nominal) ±0.05 dB + residual (nominal) 0.5% (nominal) 0.2% (nominal) Residual to 100% (nominal) Measured 2nd and 3rd harmonics Residual to 100% (nominal) 0 dB to residual (nominal)

- a. For optimum measurement, ensure that the channel bandwidth is set wide enough to capture the significant RF energy. Setting the channel bandwidth too wide will result in measurement errors.
- b. The measurement includes at most 10 harmonics.

Phase Modulation - Level and Carrier Metrics

Description	Specifications	Supplemental Information
<p>PM Deviation Accuracy^{ab} (Rate: 1 to 20 kHz^c Deviation: 0.2 to 6 rad)</p> <p>PM Rate Accuracy^b (Rate: 1 to 10 kHz)</p> <p>Carrier Frequency Error^d</p> <p>Carrier Power</p>		<p>$\pm(1 \text{ rad} \times (0.005 + (\text{rate}/1 \text{ MHz})))$ (nominal)</p> <p>$\pm 0.2 \text{ Hz}$ (nominal)</p> <p>$\pm 0.02 \text{ Hz}$ (nominal) + tfa Assumes the signal is still visible in the channel BW with offset.</p> <p>Same as Absolute Amplitude Accuracy at all frequencies (nominal).</p>

- a. This specification applies to the result labeled "(Pk-Pk)/2".
- b. For optimum measurement, ensure that the channel bandwidth is set wide enough to capture the significant RF energy. Setting the channel bandwidth too wide will result in measurement errors.
- c. Rate is a modulation rate in Hz.
- d. tfa = transmitter frequency \times frequency reference accuracy.

Phase Modulation - Distortion

Description	Specifications	Supplemental Information
<p>Residual^a</p> <p>(Rate: 1 to 10 kHz, Deviation: 628 mrad)</p> <p>THD Distortion SINAD</p> <p>Absolute Accuracy</p> <p>(Rate: 1 to 10 kHz, Deviation: 628 mrad)</p> <p>THD Distortion SINAD</p> <p>AM Rejection</p> <p>(AF 1 kHz to 15 kHz, 50% Modulation Depth)</p> <p>Residual PM</p> <p>(RF = 1 GHz, highpass filter 300 Hz)</p> <p>Measurement Range</p> <p>(Rate: 1 to 10 kHz, Deviation: 628 mrad)</p> <p>THD^b Distortion SINAD</p>		<p>0.1% (nominal) 0.8% (nominal) 42 dB (nominal)</p> <p>$\pm(1\% \times \text{reading} + \text{residual})$ (nominal)</p> <p>$\pm(1\% \times \text{reading} + \text{residual})$ (nominal)</p> <p>$\pm(0.1 \text{ dB} + \text{residual})$ (nominal)</p> <p>4 mrad (nominal)</p> <p>4 mrad (nominal)</p> <p>Residual to 100% (nominal) Measured 2nd and 3rd harmonics</p> <p>Residual to 100% (nominal) 0 dB to residual (nominal)</p>

- a. For optimum measurement, ensure that the channel bandwidth is set wide enough to capture the significant RF energy. Setting the channel bandwidth too wide will result in measurement errors.
- b. The measurement includes at most 10 harmonics.

FM Stereo/Radio Data System (RDS) Measurements¹

Description	Specifications	Supplemental Information
FM Stereo Modulation Analysis Measurements		
MPX view	RF Spectrum, AF Spectrum, Demod Waveform, FM Deviation (Hz) (Peak +, Peak-, (Pk-Pk)/2, RMS), Carrier Power (dBm), Carrier Frequency Error (Hz), SINAD (dB), Distortion (% or dB)	MPX consists of FM signal multiplexing with the mono signal (L+R), stereo signal (L-R), pilot signal (at 19 kHz) and optional RDS signal (at 57 kHz). <ul style="list-style-type: none"> • SINAD MPX BW, default 53 kHz, range from 1 kHz to 58 kHz. • Reference Deviation, default 75 kHz, range from 15 kHz to 150 kHz.
Mono (L+R) / Stereo (L-R) view	Demod Waveform, AF Spectrum, Carrier Power (dBm), Carrier Frequency Error (Hz), Modulation Rate	Mono Signal is Left + Right Stereo Signal is Left – Right
Left / Right view	Demod Waveform, AF Spectrum, Carrier Power (dBm), Carrier Frequency Error (Hz), Modulation Rate, SINAD (dB), Distortion (% or dB), THD (% or dB)	Post-demod settings: <ul style="list-style-type: none"> • Highpass filter: 20, 50, or 300 Hz • Lowpass filter: 300 Hz, 3, 15, 80, or 300 kHz • Bandpass filter: A-Weighted, CCITT • De-Emphasis: 25, 50, 75 and 750 μs
RDS / RBDS Decoding Results view	BLER basic tuning and switching information, radio text, program item number and slow labeling codes, clock time and date	BLER Block Count default 1E+8, range from 1 to 1E+16

1. The N9063A-3FP option requires that the instrument also has the N9063A-2FP option installed and licensed.

Description	Specifications	Supplemental Information
Numeric Result view	MPX, Mono, Stereo, Left, Right, Pilot and RDS with FM Deviation result (Hz) of Peak+, (Pk-Pk/2, RMS, Modulation Rate (Hz), SINAD (% or dB), THD (% or dB), Left to Right (dB), Mono to Stereo (dB), RF Carrier Power (dBm), RF Carrier Frequency Error (Hz), 38 kHz Carrier Phase Error (deg)	

Description	Specifications	Supplemental Information
FM Stereo Modulation Analysis Measurements 20 to 30°C		FM Stereo with 67.5 kHz audio deviation at 1 kHz modulation rate plus 6.75 kHz pilot deviation.
SINAD (with A-Weighted filter)		61 dB (nominal)
SINAD (with CCITT filter)		68 dB (nominal)
Left to Right Ratio (with A-Weighted filter)		61 dB (nominal)
Left to Right Ratio (with CCITT filter)		69 dB (nominal)

Analog Demodulation Measurement Application
FM Stereo/Radio Data System (RDS) Measurements

This chapter contains specifications for the N9069A Noise Figure Measurement Application.

General Specifications

Description	Specifications		Supplemental Information
Noise Figure <200 kHz 10 MHz to internal preamplifier's frequency limit ^c			Uncertainty Calculator ^a See note ^b Using internal preamp (such as <i>Option P07</i>) and RBW = 4 MHz
Noise Source ENR 4 to 6.5 dB 12 to 17 dB 20 to 22 dB	Measurement Range 0 to 20 dB 0 to 30 dB 0 to 35 dB	Instrument Uncertainty^{de} ±0.02 dB ±0.025 dB ±0.03 dB	

- The figures given in the table are for the uncertainty added by the EXASignal Analyzer instrument only. To compute the total uncertainty for your noise figure measurement, you need to take into account other factors including: DUT NF, Gain and Match, Instrument NF, Gain Uncertainty and Match; Noise source ENR uncertainty and Match. The computations can be performed with the uncertainty calculator included with the Noise Figure Measurement Personality. Go to **Mode Setup** then select **Uncertainty Calculator**. Similar calculators are also available on the Agilent web site; go to <http://www.agilent.com/find/nfu>.
- Instrument Uncertainty is nominally the same in this frequency range as in the higher frequency range. However, total uncertainty is higher because the analyzer has poorer noise figure, leading to higher uncertainties as computed by the uncertainty calculator. Also, there is a paucity of available noise sources in this range.
- At the highest frequencies, especially above 40 GHz, the only Agilent Supra-26-GHz noise source, the 346CK01, often will not have enough ENR to allow for the calibration operation. For high gain DUTs, operation without calibration can still be highly accurate. The Noisecom NC5200 series does have adequate ENR for calibration.
- "Instrument Uncertainty" is defined for noise figure analysis as uncertainty due to relative amplitude uncertainties encountered in the analyzer when making the measurements required for a noise figure computation. The relative amplitude uncertainty depends on, but is not identical to, the relative display scale fidelity, also known as incremental log fidelity. The uncertainty of the analyzer is multiplied within the computation by an amount that depends on the Y factor to give the total uncertainty of the noise figure or gain measurement.
 See Agilent App Note 57-2, literature number 5952-3706E for details on the use of this specification. Jitter (amplitude variations) will also affect the accuracy of results. The standard deviation of the measured result decreases by a factor of the square root of the Resolution Bandwidth used and by the square root of the number of averages. This application uses the 4 MHz Resolution Bandwidth as default because this is the widest bandwidth with uncompromised accuracy.
- The instrument uncertainties shown are under best-case sweep time conditions, which is a sweep time near to the period of the power line, such as 20 ms for 50 Hz power sources. The behavior can be greatly degraded (uncertainty increased nominally by 0.12 dB) by setting the sweep time per point far from an integer multiple of the period of the line frequency.

Description	Specifications	Supplemental Information
Gain Instrument Uncertainty ^a <10 MHz 10 MHz to 3.6 GHz >3.6 GHz	± 0.15 dB	DUT Gain Range = -20 to +40 dB See note ^b ± 0.11 dB additional ^c 95 th percentile, 5 minutes after calibration

a. “Instrument Uncertainty” is defined for gain measurements as uncertainty due to relative amplitude uncertainties encountered in the analyzer when making the measurements required for the gain computation.

See Agilent App Note 57-2, literature number 5952-3706E for details on the use of this specification. Jitter (amplitude variations) will also affect the accuracy of results. The standard deviation of the measured result decreases by a factor of the square root of the Resolution Bandwidth used and by the square root of the number of averages. This application uses the 4 MHz Resolution Bandwidth as default since this is the widest bandwidth with uncompromised accuracy.

Under difficult conditions (low Y factors), the instrument uncertainty for gain in high band can dominate the NF uncertainty as well as causing errors in the measurement of gain. These effects can be predicted with the uncertainty calculator.

b. Uncertainty performance of the instrument is nominally the same in this frequency range as in the higher frequency range. However, performance is not warranted in this range. There is a paucity of available noise sources in this range, and the analyzer has poorer noise figure, leading to higher uncertainties as computed by the uncertainty calculator.

c. For frequencies above 3.6 GHz, the analyzer uses a YIG-tuned filter (YTF) as a preselector, which adds uncertainty to the gain. When the Y factor is small, such as with low gain DUTs, this uncertainty can be greatly multiplied and dominate the uncertainty in NF (as the user can compute with the Uncertainty Calculator), as well as impacting gain directly. When the Y factor is large, the effect of IU of Gain on the NF becomes negligible.

When the Y-factor is small, the non-YTF mechanism that causes Instrument Uncertainty for Gain is the same as the one that causes IU for NF with low ENR. Therefore, we would recommend the following practice: When using the Uncertainty Calculator for measurements above 3.6 GHz, fill in the IU for Gain parameter with the sum of the IU for NF for 4 – 6.5 dB ENR sources and the shown “additional” IU for gain for this frequency range. When estimating the IU for Gain for the purposes of a gain measurement for frequencies above 3.6 GHz, use the sum of IU for Gain in the 0.01 – 3.6 GHz range and the “additional” IU shown.

You will find, when using the Uncertainty Calculator, that the IU for Gain is only important when the input noise of the spectrum analyzer is significant compared to the output noise of the DUT. That means that the best devices, those with high enough gain, will have comparable uncertainties for frequencies below and above 3.6 GHz.

The additional uncertainty shown is that observed to be met in 95% of the frequency/instrument combinations tested with 95% confidence. It is not warranted.

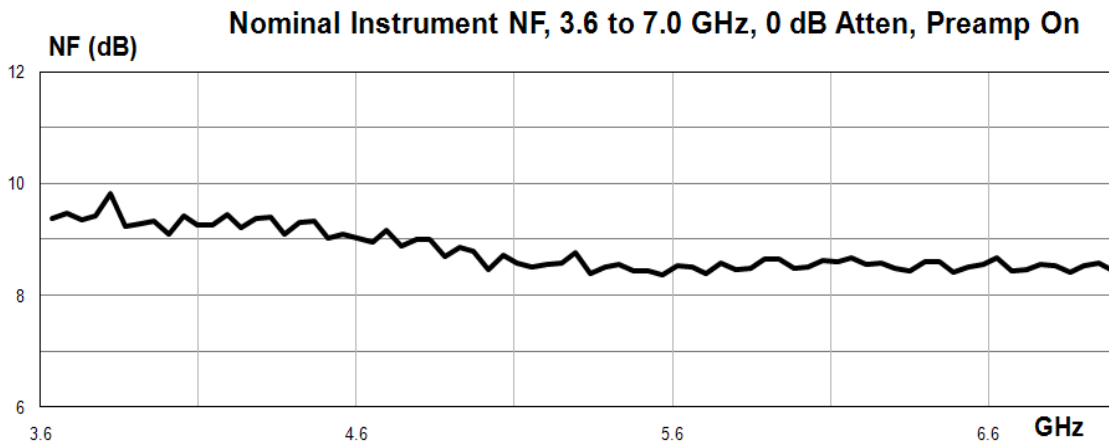
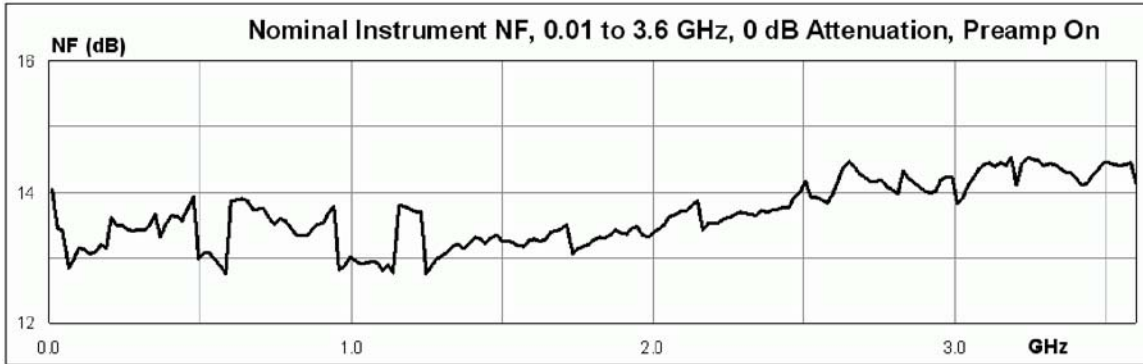
Noise Figure Measurement Application
General Specifications

Description	Specifications	Supplemental Information
Noise Figure Uncertainty Calculator^a		
Instrument Noise Figure Uncertainty	See the Noise Figure table earlier in this chapter	
Instrument Gain Uncertainty	See the Gain table earlier in this chapter	
Instrument Noise Figure		See graphs of “Nominal Instrument Noise Figure”; Noise Figure is DANL + 176.24 dB (nominal) ^b Note on DC coupling ^{cd}
Instrument Input Match		See graphs: Nominal VSWR Note on DC coupling ^c

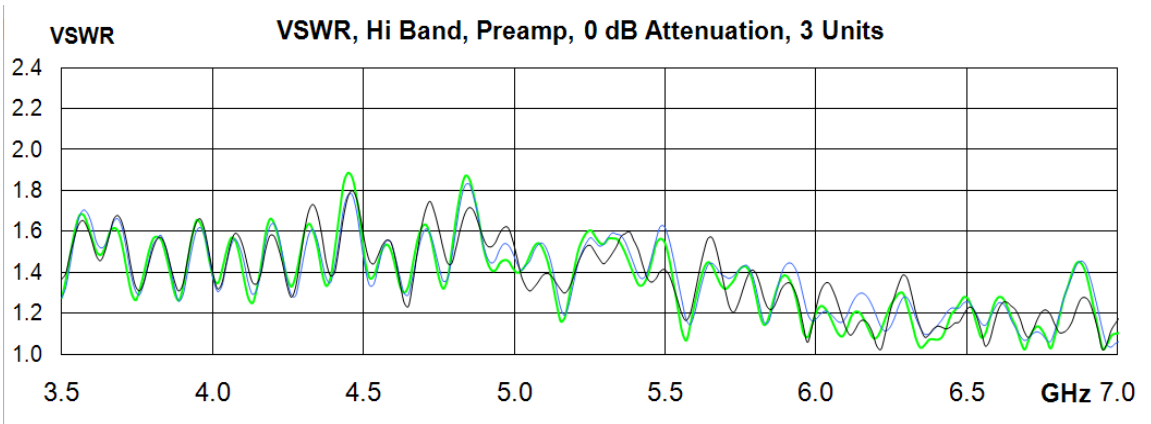
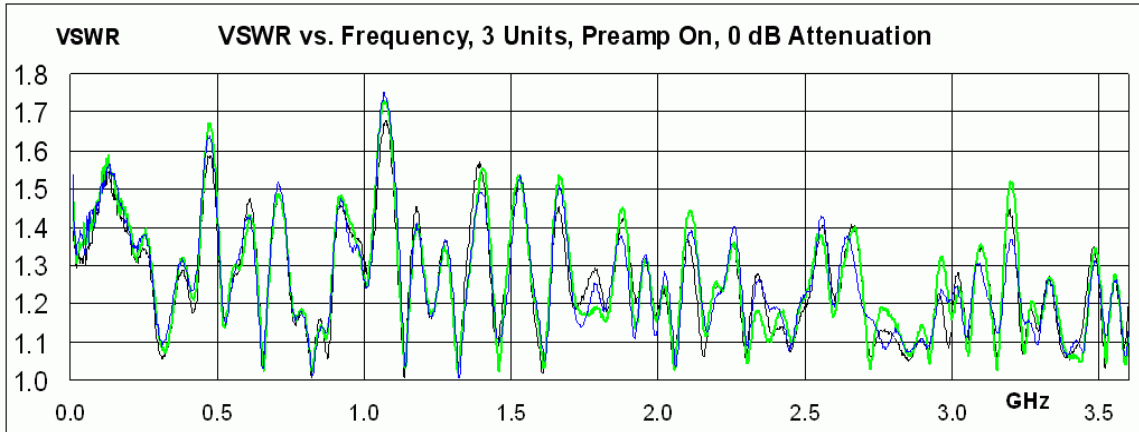
- a. The Noise Figure Uncertainty Calculator requires the parameters shown in order to calculate the total uncertainty of a Noise Figure measurement.
- b. Nominally, the noise figure of the spectrum analyzer is given by

$$NF = D - (K - L + N + B)$$
 where D is the DANL (displayed average noise level) specification,
 K is kTB (-173.98 dBm in a 1 Hz bandwidth at 290 K)
 L is 2.51 dB (the effect of log averaging used in DANL verifications)
 N is 0.24 dB (the ratio of the noise bandwidth of the RBW filter with which DANL is specified to an ideal noise bandwidth)
 B is ten times the base-10 logarithm of the RBW (in hertz) in which the DANL is specified. B is 0 dB for the 1 Hz RBW.
 The actual NF will vary from the nominal due to frequency response errors.
- c. The effect of AC coupling is negligible for frequencies above 40 MHz. Below 40 MHz, DC coupling is recommended for the best measurements.
- d. The instrument NF nominally degrades by 0.2 dB at 30 MHz and 1 dB at 10 MHz with AC coupling.

Nominal Instrument Noise Figure, Freq Option ≤ 526



Nominal Instrument Input VSWR, DC Coupled, Freq *Option* ≤ 526



This chapter contains specifications for the N9068A Phase Noise measurement application.

General Specifications

Description	Specifications	Supplemental Information
Maximum Carrier Frequency <i>Option 503</i> <i>Option 507</i> <i>Option 513</i> <i>Option 526</i> <i>Option 532</i> <i>Option 544</i>	3.6 GHz 7 GHz 13.6 GHz 26.5 GHz 32 GHz 44 GHz	

Description	Specifications	Supplemental Information
Measurement Characteristics Measurements	Log plot, RMS noise, RMS jitter, Residual FM, Spot frequency	

Description	Specifications	Supplemental Information
Measurement Accuracy Phase Noise Density Accuracy ^{ab} Offset < 1 MHz Offset ≥ 1 MHz Non-overdrive case ^c With Overdrive RMS Markers	 ±0.50 dB ±0.50 dB	 ±0.60 dB (nominal) See equation ^d

- a. This does not include the effect of system noise floor. This error is a function of the signal (phase noise of the DUT) to noise (analyzer noise floor due to phase noise and thermal noise) ratio, SN, in decibels. The function is: $error = 10 \times \log(1 + 10^{-SN/10})$
For example, if the phase noise being measured is 10 dB above the measurement floor, the error due to adding the analyzer's noise to the UUT is 0.41 dB.
- b. Offset frequency errors also add amplitude errors. See the Offset frequency section, below.
- c. The phase noise density accuracy for the non-overdrive case is derived from warranted analyzer specifications. It applies whenever there is no overdrive. Overdrive occurs only for offsets of 1 MHz and greater, with signal input power greater than -10 dBm, and controls set to allow overdrive. The controls allow overdrive if the electronic attenuator option is licensed, Enable Elect Atten is set to On, Pre-Adjust for Min Clip is set to either Elect Atten Only or Elect-Mech Atten, and the carrier frequency plus offset frequency is <3.6 GHz.
The controls also allow overdrive if (in the Meas Setup > Advanced menu) the Overdrive with Mech Atten is enabled. With the mechanical attenuator only, the overdrive feature can be used with carriers in the high band path (>3.6 GHz). To prevent overdrive in all cases, set the overdrive with Mech Atten to disabled and the Enable Elect Atten to Off.
- d. The accuracy of an RMS marker such as "RMS degrees" is a fraction of the readout. That fraction, in percent, depends on the phase noise accuracy, in dB, and is given by $100 \times (10^{PhaseNoiseDensityAccuracy/20} - 1)$. For example, with +0.30 dB phase noise accuracy, and with a marker reading out 10 degrees RMS, the accuracy of the marker would be +3.5% of 10 degrees, or +0.35 degrees.

Description	Specifications	Supplemental Information
Offset Frequency Range (Log Plot) Range (Spot Frequency) Accuracy Offset < 1 MHz Offset ≥ 1 MHz	1 Hz to $(f_{opt} - f_{CF})^a$ 10 Hz up to $(f_{opt} - f_{CF})$	f_{opt} : Maximum frequency determined by option ^b f_{CF} : Carrier frequency of signal under test Negligible error (nominal) ±(0.5% of offset + marker resolution) (nominal) 0.5% of offset is equivalent to 0.0072 octave ^c

- a. Option AFP required for 1 Hz offset.
- b. For example, f_{opt} is 3.6 GHz for *Option 503*.
- c. The frequency offset error in octaves causes an additional amplitude accuracy error proportional to the product of the frequency error and slope of the phase noise. For example, a 0.01 octave frequency error combined with an 18 dB/octave slope gives 0.18 dB additional amplitude error.

Phase Noise Measurement Application
General Specifications

Description	Specifications	Supplemental Information
Amplitude Repeatability (No Smoothing, all offsets, default settings, including averages = 10)		<1 dB (nominal) ^a

- a. Standard deviation. The repeatability can be improved with the use of smoothing and increasing the number of averages.

Nominal Phase Noise at Different Center Frequencies
See the plot of core spectrum analyzer Nominal Phase Noise on page 56 .

This chapter contains specifications for the N9076A 1xEV-DO measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

This application supports forward link radio configurations 1 to 5 and reverse link radio configurations 1-4. cdmaOne signals can be analyzed by using radio configuration 1 or 2.

Measurements

Description	Specifications	Supplemental Information
Channel Power (1.23 MHz Integration BW) Minimum power at RF input Absolute power accuracy ^a (20 to 30°C) Measurement floor	± 1.04 dB	Input signal must not be bursted -50 dBm (nominal) ± 0.27 dB (typical) -85.8 dBm (nominal)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Power Statistics CCDF Minimum power at RF Input Histogram Resolution	0.01 dB ^a	-40 dBm (nominal)

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Occupied Bandwidth Minimum carrier power at RF Input Frequency accuracy		Input signal must not be bursted -40 dBm (nominal) ± 2 kHz (nominal) RBW = 30 kHz, Number of Points = 1001, Span = 2 MHz

Description	Specifications	Supplemental Information
<p>Power vs. Time</p> <p>Minimum power at RF input</p> <p>Absolute power accuracy^a</p> <p>Measurement floor</p> <p>Relative power accuracy^b</p>		<p>–50 dBm (nominal)</p> <p>±0.27 dB (nominal)</p> <p>–85.8 dBm (nominal)</p> <p>±0.16 dB (nominal)</p>

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.
- b. The relative accuracy is the ratio of the accuracy of amplitude measurements of two different transmitter power levels. This specification is equivalent to the difference between two points on the scale fidelity curve shown in the EXA Specifications Guide. Because the error sources of scale fidelity are almost all monotonic with input level, the relative error between two levels is nearly (within 0.10 dB) identical to the “error relative to -35 dBm” specified in the Guide.

Description	Specifications	Supplemental Information
Spectrum Emission Mask and Adjacent Channel Power		
Minimum power at RF Input		-20 dBm (nominal)
Dynamic Range, relative ^a		
Offset Freq. Integ BW		
750 kHz 30 kHz	-74.4 dB	-81.5 dB (typical)
1980 kHz 30 kHz	-80.9 dB	-84.7 dB (typical)
Sensitivity, absolute		
Offset Freq. Integ BW		
750 kHz 30 kHz	-97.7 dB	-101.7 dB (typical)
1980 kHz 30 kHz	-97.7 dB	-101.7 dB (typical)
Accuracy, relative		RBW method ^b
Offset Freq. Integ BW		
750 kHz 30 kHz	±0.09 dB	
1980 kHz 30 kHz	±0.10 dB	

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. This specification is derived from other analyzer performance limitations such as third-order intermodulation, DANL and phase noise. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Mixer level is defined to be the input power minus the input attenuation.
- b. The RBW method measures the power in the adjacent channels within the defined resolution bandwidth. The noise bandwidth of the RBW filter is nominally 1.055 times the 3.01 dB bandwidth. Therefore, the RBW method will nominally read 0.23 dB higher adjacent channel power than would a measurement using the integration bandwidth method, because the noise bandwidth of the integration bandwidth measurement is equal to that integration bandwidth. For 1xEVDO ACPR measurements using the RBW method, the main channel is measured in a 3 MHz RBW, which does not respond to all the power in the carrier. Therefore, the carrier power is compensated by the expected under-response of the filter to a full width signal, of 0.15 dB. But the adjacent channel power is not compensated for the noise bandwidth effect. The reason the adjacent channel is not compensated is subtle. The RBW method of measuring ACPR is very similar to the preferred method of making measurements for compliance with FCC requirements, the source of the specifications for the 1xEVDO Spur Close specifications. ACPR is a spot measurement of Spur Close, and thus is best done with the RBW method, even though the results will disagree by 0.23 dB from the measurement made with a rectangular passband.

Description	Specifications	Supplemental Information
Spurious Emissions		
Dynamic Range ^a , relative (RBW=1 MHz)	76.9 dB	77.4 dB (typical)
Sensitivity ^b , absolute (RBW=1 MHz)	-82.5 dBm	-86.5 dBm (typical)
Accuracy, absolute		
20 Hz to 3.6 GHz		±0.38 dB (95th percentile)
3.5 to 8.4 GHz		±1.22 dB (95th percentile)
8.3 to 13.6 GHz		±1.59 dB (95th percentile)

- The dynamic range is specified at 12.5 MHz offset from center frequency with mixer level of 1 dB compression point, which will degrade accuracy by 1 dB.
- The sensitivity is specified at far offset from carrier, where phase noise does not contribute. You can derive the dynamic range at far offset from 1 dB compression mixer level and sensitivity.

Description	Specifications	Supplemental Information
QPSK EVM		
(-25 dBm ≤ ML ^a ≤ -15 dBm 20 to 30°C)		Set the attenuation to meet the Mixer Level requirement
EVM		
Operating range	0 to 25%	
Floor	1.5%	
Accuracy ^b	±1.0%	
I/Q origin offset		
DUT Maximum Offset		-10 dBc (nominal)
Analyzer Noise Floor		-50 dBc (nominal)
Frequency Error		
Range		±30 kHz (nominal)
Accuracy	±5 Hz + tfa ^c	

- ML (mixer level) is RF input power minus attenuation
- The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: $\text{error} = \sqrt{\text{EVMUUT}^2 + \text{EVMsa}^2} - \text{EVMUUT}$, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent.
- tfa = transmitter frequency × frequency reference accuracy.

1xEV-DO Measurement Application
Measurements

Description	Specifications	Supplemental Information
Code Domain (BTS Measurements $-25 \text{ dBm} \leq \text{ML}^a \leq -15 \text{ dBm}$ 20 to 30°C) Absolute power accuracy	±0.15 dB	For pilot, 2 MAC channels, and 16 channels of QPSK data. RF input power and attenuation are set to meet the Mixer Level range

a. ML (mixer level) is RF input power minus attenuation.

Description	Specifications	Supplemental Information
Modulation Accuracy (Composite Rho) ($-25 \text{ dBm} \leq \text{ML}^a \leq -15 \text{ dBm}$ 20 to 30°C) Composite EVM Operating Range Floor Accuracy ^b Composite Rho Range Floor Accuracy I/Q Origin Offset DUT Maximum Offset Analyzer Noise Floor Frequency Error Range Accuracy	 1.5% ±1.0 0.99978 ±0.0010 dB ±0.0045 dB	For pilot, 2 MAC channels, and 16 channels of QPSK data 0 to 25% (nominal) 0.94118 to 1.0 (nominal) At Rho 0.99751 (EVM 5%) At Rho 0.94118 (EVM 25%) -10 dBc (nominal) -50 dBc (nominal) pilot, MAC, QPSK Data, 8PSK Data ±400 Hz (nominal) ±10 Hz + tfa ^c

a. ML (mixer level) is RF input power minus attenuation.

b. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: $\text{floorerror} = \sqrt{\text{EVMUUT}^2 + \text{EVMsa}^2} - \text{EVMUUT}$, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent. For example, if the EVM of the UUT is 7%, and the floor is 2.5%, the error due to the floor is 0.43%.

c. tfa = transmitter frequency × frequency reference accuracy.

In-Band Frequency Range

Description	Specifications	Supplemental Information
In-Band Frequency Range (Access Network Only)		
Band Class 0	869 to 894 MHz	North American and Korean Cellular Bands
Band Class 1	1930 to 1990 MHz	North American PCS Band
Band Class 2	917 to 960 MHz	TACS Band
Band Class 3	832 to 869 MHz	JTACS Band
Band Class 4	1840 to 1870 MHz	Korean PCS Band
Band Class 6	2110 to 2170 MHz	IMT-2000 Band
Band Class 8	1805 to 1880 MHz	1800-MHz Band
Band Class 9	925 to 960 MHz	900-MHz Band

Description	Specifications	Supplemental Information
Alternative Frequency Ranges (Access Network Only)		
Band Class 5	421 to 430 MHz 460 to 470 MHz 480 to 494 MHz	NMT-450 Band
Band Class 7	746 to 764 MHz	North American 700-MHz Cellular Band

1xEV-DO Measurement Application
In-Band Frequency Range

802.16 OFDMA Measurement Application

This chapter contains specifications for the N9075A 802.16 OFDMA measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Information bandwidth is assumed to be 5 or 10 MHz unless otherwise explicitly stated.

Measurements

Description	Specifications	Supplemental Information
Channel Power Minimum power at RF Input Absolute power accuracy ^a (20 to 30°C, Atten = 10 dB) Measurement floor	±1.04 dB	-35 dBm (nominal) ±0.27 dB (95th percentile) -76.7 dBm (nominal) at 10 MHz BW

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Power Statistics CCDF Histogram Resolution	0.01 dB ^a	

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of the histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Occupied Bandwidth Minimum power at RF Input Frequency Accuracy		-30 dBm (nominal) ±20 kHz (nominal) at 10 MHz BW

Description			Specifications	Supplemental Information
Adjacent Channel Power				
Minimum power at RF Input				-36 dBm (nominal)
ACPR Accuracy				
Radio	BW	Offset		
MS	5 MHz	5 MHz	±0.10 dB	At ACPR -24 dBc with optimum mixer level ^a
MS	5 MHz	10 MHz	±0.32 dB	At ACPR -47 dBc with optimum mixer level ^b
MS	10 MHz	10 MHz	±0.16 dB	At ACPR -24 dBc with optimum mixer level ^c
MS	10 MHz	20 MHz	±0.58 dB	At ACPR -47 dBc with optimum mixer level ^b
BS	5 MHz	5 MHz	±0.66 dB	At ACPR -45 dBc with optimum mixer level ^d
BS	5 MHz	10 MHz	±0.47 dB	At ACPR -50 dBc with optimum mixer level ^b
BS	10 MHz	10 MHz	±0.96 dB	At ACPR -45 dBc with optimum mixer level ^e
BS	10 MHz	20 MHz	±0.86 dB	At ACPR -50 dBc with optimum mixer level ^b

- To meet this specified accuracy when measuring mobile station (MS) at -24 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -25 dBm, so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -9 dBm, set the attenuation to 16 dB. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- ACPR accuracy for this case is warranted when the input attenuator is set to give an average mixer level of -14 dBm.
- To meet this specified accuracy when measuring mobile station (MS) at -24 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -24 dBm, so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -4 dBm, set the attenuation to 20 dB. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- To meet this specified accuracy when measuring base station (BS) at -45 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -20 dBm, so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -4 dBm, set the attenuation to 16 dB. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- To meet this specified accuracy when measuring base station (BS) at -45 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -18 dBm, so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -2 dBm, set the attenuation to 16 dB. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

Description	Specifications	Supplemental Information
Spectrum Emission Mask		
Dynamic Range, relative (5.05 MHz offset, 10 MHz BW ^{ab})	74.5 dB	79.6 dB (typical)
Sensitivity, absolute (5.05 MHz offset, 10 MHz BW ^c)	-92.5 dBm	-96.5 dBm (typical)
Accuracy (5.05 MHz offset, 10 MHz BW)		
Relative ^d	±0.11 dB	
Absolute ^e (20 to 30°C)	±1.15 dB	±0.31 dB (95th percentile)

- The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- This dynamic range specification applies for the optimum mixer level, which is about -16 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified with 100 kHz RBW, at a center frequency of 2 GHz.
- The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- The absolute accuracy of SEM measurement is the same as the absolute accuracy of the spectrum analyzer. The numbers shown are for 0 to 3.6 GHz, with attenuation set to 10 dB.

Description	Specifications	Supplemental Information
Spurious Emissions		
Accuracy (Attenuation = 10 dB)		
Frequency Range		
9 kHz to 3.6 GHz		±0.38 dB (95th percentile)
3.5 to 8.4 GHz		±1.22 dB (95th percentile)
8.3 to 13.6 GHz		±1.59 dB (95th percentile)

Description	Specifications	Supplemental Information
<p>Modulation Analysis</p> <p>Frequency Error: Accuracy RCE (EVM)^c floor</p> <p>Early analyzers (SN prefix <MY\SG\US5340)</p> <p>RF Input Freq CF ≤ 3 GHz 3.0 GHz < CF < 3.5 GHz</p> <p>Analyzers with -EP3 (SN prefix ≥MY\SG\US5340, ship standard with N9010A-EP3)</p> <p>CF ≤ 3 GHz 3.0 GHz < CF < 3.5 GHz</p>	<p>$\pm 1 \text{ Hz}^a + \text{tfa}^b$</p> <p>–38 dB</p> <p>–43 dB</p>	<p>Input range within 5 dB of full scale, 20 to 30°C</p> <p>–38 dB (nominal)</p> <p>–43 dB (nominal)</p>

- a. This term includes an error due to the software algorithm. It is verified using a reference signal whose center frequency is intentionally shifted. This specification applies when the center frequency offset is within 5 kHz.
- b. $\text{tfa} = \text{transmitter frequency} \times \text{frequency reference accuracy}$.
- c. RCE(EVM) specification applies when 10 MHz downlink reference signal including QPSK/16QAM/64QAM is tested. This requires that Equalizer Training is set to “Preamble, Data & Pilots” and Pilot Tracking is set to Phase/Timing on state. It also requires that Phase Noise optimization mode is set to "Best close-in [offset < 20 kHz]".

In-Band Frequency Range for Warranted Specifications

Band Class	Spectrum Range
1	2.300 to 2.400 GHz
2	2.305 to 2.320 GHz 2.345 to 2.360 GHz
3	2.496 to 2.690 GHz
4	3.300 to 3.400 GHz
6	1.710 to 2.170 GHz
7	0.698 to 0.862 GHz
8	1.710 to 2.170 GHz

This chapter contains specifications for N9081A-2FP Bluetooth measurement application. Three standards, Bluetooth 2.1-basic rate, Bluetooth 2.1-EDR and Bluetooth 2.1-low energy are supported.

Three power classes, class 1, class 2 and class 3 are supported. Specifications for the three standards above are provided separately.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations. The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Basic Rate Measurements

Description	Specifications	Supplemental Information
Output Power Packet Type Payload Synchronization Trigger Supported measurements Range ^a Absolute Power Accuracy ^b (20 to 30°C, Atten = 10 dB) Measurement floor		This measurement is a Transmit Analysis measurement and supports average and peak power in conformance with Bluetooth RF test specification 2.1.E.0.5.1.3. DH1, DH3, DH5, HV3 PRBS9, BS00, BSFF, BS0F, BS55 RF Burst or Preamble External, RF Burst, Periodic Timer, Free Run, Video Average power, peak power +30 dBm to -70 dBm ±0.29 dB (95th percentile) -70 dBm (nominal)

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
<p>Modulation Characteristics</p> <p>Packet Type</p> <p>Payload</p> <p>Synchronization</p> <p>Trigger</p> <p>Supported measurements</p> <p>RF input level range^a</p> <p>Deviation range</p> <p>Deviation resolution</p> <p>Measurement Accuracy^b</p>		<p>This measurement is a Transmit Analysis measurement and supports average and peak power in conformance with Bluetooth RF test specification 2.1.E.0.5.1.9.</p> <p>DH1, DH3, DH5, HV3</p> <p>BS0F, BS55</p> <p>Preamble</p> <p>External, RF Burst, Periodic Timer, Free Run, Video</p> <p>Min/max Δf_{1avg} min Δf_{2max} (kHz) total $\Delta f_{2max} > \Delta f_{2max}$ lower limit (%) min of min Δf_{2avg} / max Δf_{1avg} pseudo frequency deviation (Δf_1 and Δf_2)</p> <p>+30 dBm to -70 dBm</p> <p>± 250 kHz (nominal)</p> <p>100 Hz (nominal)</p> <p>± 100 Hz + tfa^c (nominal)</p>

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Example, using 1 ppm as frequency reference accuracy of the analyzer, at frequency of 2.402 GHz, frequency accuracy would be in the range of $\pm(2.402 \text{ GHz} \times 1 \text{ ppm}) \text{ Hz} \pm 100 \text{ Hz} = \pm 2402 \text{ Hz} \pm 100 \text{ Hz} = \pm 2502 \text{ Hz}$.
- c. tfa = transmitter frequency \times frequency reference accuracy.

Bluetooth Measurement Application
Basic Rate Measurements

Description	Specifications	Supplemental Information
Initial Carrier Frequency Tolerance Packet Type Payload Synchronization Trigger RF input level range ^a Measurement range Measurement Accuracy ^b		This measurement is a Transmit Analysis measurement and supports average and peak power in conformance with Bluetooth RF test specification 2.1.E.0.5.1.10. DH1, DH3, DH5, HV3 PRBS9, BS00, BSFF, BS0F, BS55 Preamble External, RF Burst, Periodic Timer, Free Run, Video +30 dBm to -70 dBm Nominal channel freq ± 100 kHz (nominal) ± 100 Hz + tfa ^c (nominal)

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Example, using 1 ppm as frequency reference accuracy of the analyzer, at frequency of 2.402 GHz, frequency accuracy would be in the range of $\pm(2.402 \text{ GHz} \times 1 \text{ ppm}) \text{ Hz} \pm 100 \text{ Hz} = \pm 2402 \text{ Hz} \pm 100 \text{ Hz} = \pm 2502 \text{ Hz}$.
- c. tfa = transmitter frequency \times frequency reference accuracy.

Description	Specifications	Supplemental Information
Carrier Frequency Drift Packet Type Payload Synchronization Trigger RF input level range ^a Measurement range Measurement Accuracy ^b		This measurement is a Transmit Analysis measurement and supports average and peak power in conformance with Bluetooth RF test specification 2.1.E.0.5.1.11. DH1, DH3, DH5, HV3 PRBS9, BS00, BSFF, BS0F, BS55 Preamble External, RF Burst, Periodic Timer, Free Run, Video +30 dBm to -70 dBm ±100 kHz (nominal) ±100 Hz + tfa ^c (nominal)

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Example, using 1 ppm as frequency reference accuracy of the analyzer, at frequency of 2.402 GHz, frequency accuracy would be in the range of $\pm(2.402 \text{ GHz} \times 1 \text{ ppm}) \text{ Hz} \pm 100 \text{ Hz} = \pm 2402 \text{ Hz} \pm 100 \text{ Hz} = \pm 2502 \text{ Hz}$.
- c. tfa = transmitter frequency \times frequency reference accuracy.

Description	Specifications	Supplemental Information
Adjacent Channel Power Packet Type Payload Synchronization Trigger Measurement Accuracy ^a		This measurement is an Adjacent Channel Power measurement and is in conformance with Bluetooth RF test specification 2.1.E.0.5.1.8. DH1, DH3, DH5, HV3 PRBS9, BS00, BSFF, BS0F, BS55 None External, RF Burst, Periodic Timer, Free Run, Video Dominated by the variance of measurements ^b

- a. The accuracy is for absolute power measured at 2.0 MHz offset and other offsets (offset = K MHz, K = 3, ..., 78).
- b. The measurement at these offsets is usually the measurement of noise-like signals and therefore has considerable variance. For example, with 100 ms sweeping time, the standard deviation of the measurement is about 0.5 dB. In comparison, the computed uncertainties of the measurement for the case with CW interference is only $\pm 0.29 \text{ dB}$.

Low Energy Measurements

Description	Specifications	Supplemental Information
Output Power Packet Type Payload Synchronization Trigger Supported measurements Range ^a Absolute Power Accuracy ^b (20 to 30°C, Atten = 10 dB) Measurement floor		This measurement is a Transmit Analysis measurement and supports average and peak power in conformance with Bluetooth RF test specification LE.RF-PHY.TS/0.7d2.6.2.1. Reference type PRBS9, BS00, BSFF, BS0F, BS55 RF Burst or Preamble External, RF Burst, Periodic Timer, Free Run, Video Average Power, Peak Power +30 dBm to -70 dBm ±0.29 dB (95th percentile) -70 dBm (nominal)

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
<p>Modulation Characteristics</p> <p>Packet Type</p> <p>Payload</p> <p>Synchronization</p> <p>Trigger</p> <p>Supported measurements</p> <p>RF input level range^a</p> <p>Deviation range</p> <p>Deviation resolution</p> <p>Measurement Accuracy^b</p>		<p>This measurement is a Transmit Analysis measurement and is in conformance with Bluetooth RF test specification LE.RF-PHY.TS/0.7d2.6.2.3.</p> <p>Reference type</p> <p>BS0F, BS55</p> <p>Preamble</p> <p>External, RF Burst, Periodic Timer, Free Run, Video</p> <p>Min/max Δf_{1avg}</p> <p>min Δf_{2max} (kHz)</p> <p>total $\Delta f_{2max} > \Delta f_{2max}$ lower limit (%)</p> <p>min of min Δf_{2avg} / max Δf_{1avg}</p> <p>pseudo frequency deviation (Δf_1 and Δf_2)</p> <p>+30 dBm to -70 dBm</p> <p>± 250 kHz (nominal)</p> <p>100 Hz (nominal)</p> <p>± 100 Hz + tfa^c (nominal)</p>

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Example, using 1 ppm as frequency reference accuracy of the analyzer, at frequency of 2.402 GHz, frequency accuracy would be in the range of $\pm(2.402 \text{ GHz} \times 1 \text{ ppm}) \text{ Hz} \pm 100 \text{ Hz} = \pm 2402 \text{ Hz} \pm 100 \text{ Hz} = \pm 2502 \text{ Hz}$.
- c. tfa = transmitter frequency \times frequency reference accuracy.

Bluetooth Measurement Application
Low Energy Measurements

Description	Specifications	Supplemental Information
<p>Initial Carrier Frequency Tolerance</p> <p>Packet Type</p> <p>Payload</p> <p>Synchronization</p> <p>Trigger</p> <p>RF input level range^a</p> <p>Measurement range</p> <p>Measurement Accuracy^b</p>		<p>This measurement is a Transmit Analysis measurement and is in conformance with Bluetooth RF test specification LE.RF-PHY.TS/0.7d2.6.2.4.</p> <p>Reference type</p> <p>PRBS9, BS00, BSFF, BS0F, BS55</p> <p>Preamble</p> <p>External, RF Burst, Periodic Timer, Free Run, Video</p> <p>+30 dBm to -70 dBm</p> <p>Nominal channel freq ± 100 kHz (nominal)</p> <p>±100 Hz + tfa^c (nominal)</p>

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Example, using 1 ppm as frequency reference accuracy of the analyzer, at frequency of 2.402 GHz, frequency accuracy would be in the range of $\pm(2.402 \text{ GHz} \times 1 \text{ ppm}) \text{ Hz} \pm 100 \text{ Hz} = \pm 2402 \text{ Hz} \pm 100 \text{ Hz} = \pm 2502 \text{ Hz}$.
- c. tfa = transmitter frequency × frequency reference accuracy.

Description	Specifications	Supplemental Information
Carrier Frequency Drift Packet Type Payload Synchronization Trigger RF input level range ^a Measurement range Measurement Accuracy ^b		This measurement is a Transmit Analysis measurement and is in conformance with Bluetooth RF test specification LE.RF-PHY.TS/0.7d2.6.2.4. Reference type PRBS9, BS00, BSFF, BS0F, BS55 Preamble External, RF Burst, Periodic Timer, Free Run, Video +30 dBm to -70 dBm ±100 kHz (nominal) ±100 Hz + tfa ^c (nominal)

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Example, using 1 ppm as frequency reference accuracy of the analyzer, at frequency of 2.402 GHz, frequency accuracy would be in the range of $\pm(2.402 \text{ GHz} \times 1 \text{ ppm}) \text{ Hz} \pm 100 \text{ Hz} = \pm 2402 \text{ Hz} \pm 100 \text{ Hz} = \pm 2502 \text{ Hz}$.
- c. tfa = transmitter frequency \times frequency reference accuracy.

Description	Specifications	Supplemental Information
LE In-band Emission Packet Type Payload Synchronization Trigger Measurement Accuracy ^a		This measurement is an LE in-band emission measurement and is in conformance with Bluetooth RF test specification LE.RF-PHY.TS/0.7d2.6.2.2. Reference type PRBS9, BS00, BSFF, BS0F, BS55 None External, RF Burst, Periodic Timer, Free Run, Video Dominated by the variance of measurements ^b

- a. The accuracy is for absolute power measured at 2.0 MHz offset and other offsets (offset = 2 MHz \times K, K = 2, ..., 29).
- b. The measurement at these offsets is usually the measurement of noise-like signals and therefore has considerable variance. For example, with 100 ms sweeping time, the standard deviation of the measurement is about 0.5 dB. In comparison, the computed uncertainties of the measurement for the case with CW interference is only $\pm 0.29 \text{ dB}$.

Enhanced Data Rate (EDR) Measurements

Description	Specifications	Supplemental Information
EDR Relative Transmit Power		This measurement is a Transmit Analysis measurement and supports average and peak power in conformance with Bluetooth RF test specification 2.1.E.0.5.1.12.
Packet Type		2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5
Payload		PRBS9, BS00, BSFF, BS55
Synchronization		DPSK synchronization sequence
Trigger		External, RF Burst, Periodic Timer, Free Run, Video
Supported measurements		Power in GFSK header, power in PSK payload, relative power between GFSK header and PSK payload
Range ^a		+30 dBm to -70 dBm
Absolute Power Accuracy ^b (20 to 30°C, Atten = 10 dB)		±0.29 dB (95th percentile)
Measurement floor		-70 dBm (nominal)

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
EDR Modulation Accuracy		This measurement is a Transmit Analysis measurement and is in conformance with Bluetooth RF test specification 2.1.E.0.5.1.13
Packet Type		2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5
Payload		PRBS9, BS00, BSFF, BS55
Synchronization		DPSK synchronization sequence
Trigger		External, RF Burst, Periodic Timer, Free Run, Video
Supported measurements		rms DEVM peak DEVM, 99% DEVM
RF input level range ^a		+30 dBm to -70 dBm
RMS DEVM		
Range	0 to 12%	
Floor	1.5%	
Accuracy ^b	1.2%	

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows:

$$\text{error} = \sqrt{\text{EVM}_{\text{UUT}}^2 + \text{EVM}_{\text{sa}}^2} - \text{EVM}_{\text{UUT}}$$
 where EVM_{UUT} is the EVM of the UUT in percent, and EVM_{sa} is the EVM floor of the analyzer in percent

Bluetooth Measurement Application
Enhanced Data Rate (EDR) Measurements

Description	Specifications	Supplemental Information
EDR Carrier Frequency Stability Packet Type Payload Synchronization Trigger Supported measurements RF input level range ^a Carrier Frequency Stability and Frequency Error ^b		This measurement is a Transmit Analysis measurement and is in conformance with Bluetooth RF test specification 2.1.E.0.5.1.13 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5 PRBS9, BS00, BSFF, BS55 DPSK synchronization sequence External, RF Burst, Periodic Timer, Free Run, Video Worst case initial frequency error(ω_i) for all packets (carrier frequency stability), worst case frequency error for all blocks (ω_o), ($\omega_o + \omega_i$) for all blocks +30 dBm to -70 dBm $\pm 100 \text{ Hz} + tfa^c$ (nominal)

- a. When the input signal level is lower than -40 dBm, the analyzer's preamp should be turned on and the attenuator set to 0 dB.
- b. Example, using 1 ppm as frequency reference accuracy of the analyzer, at frequency of 2.402 GHz, frequency accuracy would be in the range of $\pm(2.402 \text{ GHz} \times 1 \text{ ppm}) \text{ Hz} \pm 100 \text{ Hz} = \pm 2402 \text{ Hz} \pm 100 \text{ Hz} = \pm 2502 \text{ Hz}$.
- c. $tfa = \text{transmitter frequency} \times \text{frequency reference accuracy}$.

Description	Specifications	Supplemental Information
<p>EDR In-band Spurious Emissions</p> <p>Packet Type</p> <p>Payload</p> <p>Synchronization</p> <p>Trigger</p> <p>Measurement Accuracy^a</p> <p style="padding-left: 20px;">Offset Freq = 1 MHz to 1.5 MHz</p> <p style="padding-left: 20px;">Offset Freq = other offsets (2 MHz to 78 MHz)</p>		<p>This measurement is an EDR in-band spur emissions and is in conformance with Bluetooth RF test specification 2.1.E.0.5.1.15.</p> <p>2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5</p> <p>PRBS9, BS00, BSFF, BS55</p> <p>DPSK synchronization sequence</p> <p>External, RF Burst, Periodic Timer, Free Run, Video</p> <p>Dominated by ambiguity of the measurement standards^b</p> <p>Dominated by the variance of measurements^c</p>

- a. For offsets from 1 MHz to 1.5 MHz, the accuracy is the relative accuracy which is the adjacent channel power (1 MHz to 1.5 MHz offset) relative to the reference channel power (main channel). For other offsets (offset = K MHz, K= 2,...,78), the accuracy is the power accuracy of the absolute alternative channel power.
- b. The measurement standards call for averaging the signal across 3.5 μs apertures and reporting the highest result. For common impulsive power at these offsets, this gives a variation of result with the time location of that interference that is 0.8 dB peak-to-peak and changes with a scallop shape with a 3.5 μs period. Uncertainties in the accuracy of measuring CW-like relative power at these offsets are nominally only ±0.09 dB, but observed variations of the measurement algorithm used with impulsive interference are similar to the scalloping error.
- c. The measurement at these offsets is usually the measurement of noise-like signals and therefore has considerable variance. For example, with a 1.5 ms packet length, the standard deviation of the measurement of the peak of ten bursts is about 0.6 dB. In comparison, the computed uncertainties of the measurement for the case with CW interference is only ±0.29 dB.

In-Band Frequency Range

Description	Specifications	Supplemental Information
Bluetooth Basic Rate and Enhanced Data Rate (EDR) System	2.400 to 2.4835 GHz (ISM radio band)	$f = 2402 + k$ MHz, $k = 0, \dots, 78$ (RF channels used by Bluetooth)
Bluetooth Low Energy System	2.400 to 2.4835 GHz (ISM radio band)	$f = 2402 + k \times 2$ MHz, $k = 0, \dots, 39$ (RF channels used by Bluetooth)

This chapter contains specifications for the N9072A, cdma2000 measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

This application supports forward link radio configurations 1 to 5 and reverse link radio configurations 1-4. cdmaOne signals can be analyzed by using radio configuration 1 or 2.

Measurements

Description	Specifications	Supplemental Information
Channel Power (1.23 MHz Integration BW) Minimum power at RF input Absolute power accuracy ^a (20 to 30°C, Atten = 10 dB) 95th Percentile Absolute power accuracy (20 to 30°C, Atten = 10 dB) Measurement floor	± 1.04 dB	-50 dBm (nominal) ± 0.27 dB -85.8 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Adjacent Channel Power^a		
Minimum power at RF input		-36 dBm (nominal)
Dynamic range		Referenced to average power of carrier in 1.23 MHz bandwidth
Offset Freq	Integ BW	
750 kHz	30 kHz	-74.3 dBc
1980 kHz	30 kHz	-80.9 dBc
ACPR Relative Accuracy		RBW method ^b
Offsets ≤ 750 kHz	±0.09 dB	
Offsets ≥ 1.98 MHz	±0.10 dB	
Absolute Accuracy	±1.15 dB	±0.31 dB (at 95th percentile confidence)
Sensitivity	-97.7 dBm	-101.7 dBm (typical)

- a. ACP test items compliance the limits of conducted spurious emission specification defined in 3GPP2 standards
- b. The RBW method measures the power in the adjacent channels within the defined resolution bandwidth. The noise bandwidth of the RBW filter is nominally 1.055 times the 3.01 dB bandwidth. Therefore, the RBW method will nominally read 0.23 dB higher adjacent channel power than would a measurement using the integration bandwidth method, because the noise bandwidth of the integration bandwidth measurement is equal to that integration bandwidth. For cdma2000 ACP measurements using the RBW method, the main channel is measured in a 3 MHz RBW, which does not respond to all the power in the carrier. Therefore, the carrier power is compensated by the expected under-response of the filter to a full width signal, of 0.15 dB. But the adjacent channel power is not compensated for the noise bandwidth effect.

The reason the adjacent channel is not compensated is subtle. The RBW method of measuring ACP is very similar to the preferred method of making measurements for compliance with FCC requirements, the source of the specifications for the cdma2000 Spur Close specifications. ACP is a spot measurement of Spur Close, and thus is best done with the RBW method, even though the results will disagree by 0.23 dB from the measurement made with a rectangular passband.

Description	Specification	Supplemental Information
Power Statistics CCDF		
Histogram Resolution ^a	0.01 dB	

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specification	Supplemental Information
Occupied Bandwidth Minimum carrier power at RF Input Frequency accuracy		–30 dBm (nominal) ±2 kHz (nominal) RBW = 30 kHz, Number of Points = 1001, Span = 2 MHz

Description	Specifications	Supplemental Information
Spectrum Emission Mask^a Dynamic Range, relative 750 kHz offset 1980 kHz offset Sensitivity, absolute ^b 750 kHz offset 1980 kHz offset Accuracy 750 kHz offset Relative ^c Absolute ^d 20 to 30°C 1980 kHz offset Relative ^c Absolute ^d 20 to 30°C	 74.3 dB 80.9 dB –97.7 dBm –97.7 dBm ±0.09 dB ±1.15 dB ±0.10 dB ±1.15 dB	 81.4 dB (typical) 84.7 dB (typical) –101.7 dBm (typical) –101.0 dBm (typical) ±0.31 dB (at 95th percentile) ±0.31 dB (at 95th percentile)

- a. SEM test items compliance the limits of conducted spurious emission specification defined in 3GPP2 standards.
- b. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified for the default 30 kHz RBW, at a center frequency of 2 GHz.
- c. The relative accuracy is a measure of the ration of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are near the regulatory limits of –25 dBc at 750 kHz offset and –60 dBc at 1980 kHz offset.
- d. The absolute accuracy of SEM measurement is the same as the absolute accuracy of the spectrum analyzer. See Absolute Amplitude Accuracy for more information. The numbers shown are for 0 to 3.6 GHz, with attenuation set to 10 dB.

Description	Specifications	Supplemental Information
QPSK EVM (–25 dBm ≤ ML ^a ≤ –15 dBm 20 to 30°C) EVM Range Floor Accuracy ^b I/Q origin offset DUT Maximum Offset Analyzer Noise Floor Frequency Error Range Accuracy	 0 to 25% 1.6% ±1.0% ±5 Hz + tfa ^c	RF input power and attenuation are set to meet the Mixer Level range –10 dBc (nominal) –50 dBc (nominal) ±30 kHz (nominal)

- a. ML (mixer level) is RF input power minus attenuation.
- b. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: $\text{error} = \sqrt{\text{EVM}_{\text{UUT}}^2 + \text{EVM}_{\text{sa}}^2} - \text{EVM}_{\text{UUT}}$, where EVM_{UUT} is the EVM of the UUT in percent, and EVM_{sa} is the EVM floor of the analyzer in percent.
- c. tfa = transmitter frequency × frequency reference accuracy

Description	Specifications	Supplemental Information
Modulation Accuracy (Composite Rho) (BTS Measurements $-25 \text{ dBm} \leq \text{ML}^a \leq -15 \text{ dBm}$ 20 to 30°C) Composite EVM Range Floor Accuracy ^b Composite Rho Range Floor Accuracy Pilot time offset Range Accuracy Resolution Code domain timing Range Accuracy Resolution Code domain phase Range Accuracy Resolution Peak code domain error Accuracy I/Q origin offset DUT Maximum Offset Analyzer Noise Floor Frequency error Range Accuracy	 0 to 25% 1.6% $\pm 1.0\%$ $\pm 0.5\%$ 0.94118 to 1.0 0.99974 ± 0.0010 ± 0.0030 -13.33 to $+13.33$ ms ± 300 ns 10 ns ± 200 ns ± 1.25 ns 0.1 ns ± 200 mrad ± 10 mrad 0.1 mrad ± 10 Hz $\pm 10 \text{ Hz} + \text{tfa}^c$	Set the attenuation to meet the Mixer Level requirement. Specifications apply to BTS for 9 active channels as defined in 3GPP2 RF input power and attenuation are set to meet the Mixer Level range At EVM measurement in the range of 12.5% to 22.5% at Rho 0.99751 (EVM 5%) at Rho 0.94118 (EVM 25%) From even second signal to start of PN sequence Pilot to code channel time tolerance Pilot to code channel phase tolerance ± 1.0 dB (nominal) Range from -10 dB to -55 dB -10 dBc (nominal) -50 dBc (nominal)

a. ML (mixer level) is RF input power minus attenuation.

- b. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: $\text{floorerror} = \sqrt{\text{EVMUUT}^2 + \text{EVMsa}^2} - \text{EVMUUT}$, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent. For example, if the EVM of the UUT is 7%, and the floor is 2.5%, the error due to the floor is 0.43%.
- c. $\text{tfa} = \text{transmitter frequency} \times \text{frequency reference accuracy}$

In-Band Frequency Range

Band	Frequencies
Band Class 0 (North American Cellular)	869 to 894 MHz 824 to 849 MHz
Band Class 1 (North American PCS)	1930 to 1990 MHz 1850 to 1910 MHz
Band Class 2 (TACS)	917 to 960 MHz 872 to 915 MHz
Band Class 3 (JTACS)	832 to 870 MHz 887 to 925 MHz
Band Class 4 (Korean PCS)	1840 to 1870 MHz 1750 to 1780 MHz
Band Class 6 (IMT-2000)	2110 to 2170 MHz 1920 to 1980 MHz

This chapter contains specifications for the N6158A, CMMB measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

The specifications apply to carrier frequencies below 2 GHz.

Measurements

Description	Specifications	Supplemental Information
Channel Power (8 MHz Integration BW) Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor	±1.04 dB	Input signal must not be bursted -50 dBm (nominal) ±0.27 dB (95th percentile) -78.7 dBm

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Channel Power with Shoulder Attenuation View (7.512 MHz Integration BW, ML = -16 dBm, Shoulder Offset = 4.2 MHz) Dynamic Range, relative ^a	88.2 dB	Input signal must not be bursted 93.7 dB (typical)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset and region specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. This specification is derived from other analyzer performance limitations such as third-order intermodulation, DANL and phase noise. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Mixer level is defined to be the input power minus the input attenuation.

Description	Specifications	Supplemental Information
Power Statistics CCDF Minimum power at RF Input Histogram Resolution	0.01 dB ^a	-50 dBm (nominal)

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Adjacent Channel Power Minimum power at RF Input ACPR Accuracy ^a (7.512 MHz noise bandwidth method = IBW Offset Freq = 8 MHz)	± 0.77 dB	-36 dBm (nominal) At ACPR -45 dBc with optimum mixer level ^b

- a. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately $-37 \text{ dBm} - (\text{ACPR}/3)$, where the ACPR is given in (negative) decibels.
- b. To meet the specified accuracy when measuring transmitter at -45 dB ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -20 dBm, so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -4 dBm, set the attenuation to 16 dB. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

Description	Specifications	Supplemental Information
Spectrum Emission Mask (7.512 MHz Transmission BW RBW = 3.9 kHz) 4.2 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C) 10 MHz offset Dynamic Range, relative ^e Sensitivity, absolute Accuracy Relative Absolute (20 to 30°C)	88.2 dB -107.5 dBm ±0.18 dB ±1.15 dB 90.6 dB -107.5 dBm ±0.22 dB ±1.15 dB	93.7 dB (typical) -111.5 dBm (typical) ±0.26 dB (95th percentile) 95.7 dB (typical) -111.5 dBm (typical) ±0.26 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 3.9 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -16 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 3.9 kHz RBW, at a center frequency of 666 MHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- e. This dynamic range specification applies for the optimum mixer level, which is about -13 dBm. Mixer level is defined to be the average input power minus the input attenuation.

Description	Specifications	Supplemental Information
Modulation Analysis Settings		
Device Type	Transmitter or Exciter	
Trigger	FreeRun, External 1, External 2 or Periodic Timer	<ul style="list-style-type: none"> • External Trigger is used with 1 PPS input from GPS, (this trigger method is recommended for SFN mode) • Periodic Timer Trigger is used usually used for MFN mode or SFN mode without 1 PPS input • FreeRun can be used when all of the timeslots use the same Mod Format (this trigger mode is recommended for Exciter under Test Mode)
Sync Frame Now		Immediate Action to synchronize CMMB signals when using Periodic Timer or External Trigger
Meas Type	PLCH, Timeslot or Frame	
PLCH Settings	CLCH or SLCH (0-38)	Enabled when Meas Type is PLCH
Timeslot Settings	Start Timeslot Meas Interval	Enabled when Meas Type is Timeslot
	Modulation Format: BPSK, QPSK or 16 QAM	
MER Limit	38 dB as default	Auto or Manual
Spectrum	Normal or Invert	
Clock Rate	10.0 MHz	Auto or Manual
Demod Symbols Per Slot	4 to 53	
Out of Band Filtering	On or Off	
Data Equalization	On or Off	

Description	Specifications	Supplemental Information
Modulation Analysis Measurement I/Q Measured Polar Graph I/Q Error (Quad View)	Constellation (–1538 to 1538 subcarriers) EVM, MER, Mag Error, Phase Error RMS, Peak (Subcarrier position), Freq Error MER vs. Subcarriers (–1538 to 1538 subcarriers) Logical Channel Information Constellation EVM, MER, Mag Error, Phase Error RMS, Peak (Subcarrier position) Quadrature Error Amplitude Imbalance Timing Skew	Logical Channel Information (LCH, Range, Modulation Format, Reed Solomon Codes, LDPC Rate, Interleaving Mode, Scrambling Mode) LCH: CLCH, SLCH(0 to N) $N \leq 38$ Range: 0 (CLCH), M~N (SLCHx), $1 \leq M < N \leq 39$ Mod Format: BPSK, QPSK, 16QAM Reed Solomon Codes: (240, 240), (240,224), (240,192), (240,176) LDPC: 1/2, 3/4 Interleaving Mode: Mode 1/2/3 Scrambling: Mode 0~7
Channel Frequency Response	Amplitude vs. Subcarriers (–1538 to 1538 subcarriers) Phase vs. Subcarriers (–1538 to 1538 subcarriers) Group Delay vs. Subcarriers (–1538 to 1537 subcarriers)	

Description	Specifications	Supplemental Information
CMMB Modulation Analysis Specification (ML ^a = -20 dBm 20 to 30°C)		CLCH+SLCH0 CLCH: Timeslot 0, LDPC 1/2, Reed Solomon Code (240,240), Interleaving Mode1, Mod Type BPSK SLCH0: Timeslot 1-39, LDPC 1/2, Reed Solomon Code (240,240), Interleaving Mode1, Mod Type 16QAM EQ Off
EVM Operating range Floor Accuracy from 0.7% to 1.0% from 1.0% to 2.0% from 2.0% to 16.0%	0 to 16% 0.70% ±0.30% ±0.30% ±0.40%	
MER Operating range Floor Accuracy from 39 to 43 dB from 34 to 39 dB from 16 to 34 dB	≥16 dB 43 dB ±2.93 dB ±1.41 dB ±0.52 dB	EQ Off
Frequency Error^b Range Accuracy	±1 Hz + tfa ^c	-20 kHz to 20 kHz
Quad Error Range		-5 to +5°
Amplitude Imbalance Range		-1 to +1 dB

- a. ML (mixer level) is RF input power minus attenuation
- b. The accuracy specification applies at the EVM = 1%.
- c. tfa = transmitter frequency × frequency reference accuracy.

Digital Cable TV Measurement Application

This chapter contains specifications for the N6152A, Digital Cable TV measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

The specifications apply to carrier frequencies below 1 GHz.

Measurements

Description	Specifications	Supplemental Information
Channel Power (8.0 MHz Integration BW) Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor	±1.04 dB	Input signal must not be bursted -50 dBm (nominal) ±0.27 dB (95th percentile) -78.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Power Statistics CCDF Minimum power at RF Input Histogram Resolution	0.01 dB	-50 dBm (nominal)

Description	Specifications	Supplemental Information
Adjacent Channel Power Minimum power at RF Input ACPR Accuracy ^a Offset Freq 8 MHz	±0.81 dB	-36 dBm (nominal) 8.0 MHz noise bandwidth method = IBW At ACPR -45 dBc with optimum mixer level ^b

- a. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately $-37 \text{ dBm} - (\text{ACPR}/3)$, where the ACPR is given in (negative) decibels.
- b. To meet this specified accuracy when measuring transmitter at -45 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -20 dBm, so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -4 dBm, set the attenuation to 16 dB. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

Description	Specifications	Supplemental Information
Spectrum Emission Mask (6.9 MHz Integration BW, RBW = 3.9 kHz) 4.2 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C) 10 MHz offset Dynamic Range, relative ^e Sensitivity, absolute Accuracy Relative Absolute (20 to 30°C)	88.1 dB -107.5 dBm ±0.18 dB ±1.15 dB 92.0 dB -107.5 dBm ±0.22 dB ±1.15 dB	93.6 dB (typical) -111.5 dBm (typical) ±0.26 dB (95th percentile) 96.9 dB (typical) -111.5 dBm (typical) ±0.26 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 3.9 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -16 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 3.9 kHz RBW, at a center frequency of 474 MHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- e. This dynamic range specification applies for the optimum mixer level, which is about -12 dBm. Mixer level is defined to be the average input power minus the input attenuation.

Digital Cable TV Measurement Application
Measurements

Description	Specifications	Supplemental Information
DVB-C 64QAM EVM (ML ^a = -20 dBm 20 to 30°C, CF ≤1 GHz)		Modulation Rate = 64 QAM Symbol Rate = 6.9 MHz
EVM (Smax)		
Operating range		0 to 5%
Floor	0.59%	Adaptive EQ Off
MER		
Operating range		≥22 dB
Floor	41 dB	Adaptive EQ Off
Frequency Error ^b		
Range		-150 kHz to 150 kHz
Accuracy		±10 Hz + tfa ^c
Quad Error		
Range		-5° to +5°
Gain Imbalance		
Range		-1 to +1 dB
BER Before Reed-Solomon		For DVB-C (J.83 Annex A/C) only
Range		0 to 1.0×10 ⁻³
Packet Error Ratio		For DVB-C (J.83 Annex A/C) only
Range		0 to 1.0×10 ⁻¹

- a. ML (mixer level) is RF input power minus attenuation
- b. The accuracy specification applies at the EVM =1%.
- c. tfa = transmitter frequency × frequency reference accuracy.

This chapter contains specifications for the N6156A, DTMB measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

The specifications apply to carrier frequencies below 2 GHz.

Measurements

Description	Specifications	Supplemental Information
Channel Power (8 MHz Integration BW) Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor	± 1.04 dB	Input signal must not be bursted -50 dBm (nominal) ± 0.27 dB (95th percentile) -78.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Channel Power with Shoulder Attenuation View (7.56 MHz Integration BW, Shoulder Offset = 4.2 MHz) Dynamic Range, relative ^a	88.2 dB	Input signal must not be bursted ML = -16 dBm (nominal) 93.7 dB (typical)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset and region specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. This specification is derived from other analyzer performance limitations such as third-order intermodulation, DANL and phase noise. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Mixer level is defined to be the input power minus the input attenuation.

Description	Specifications	Supplemental Information
Power Statistics CCDF Minimum power at RF Input Histogram Resolution	0.01 dB ^a	-50 dBm (nominal)

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Adjacent Channel Power Minimum power at RF Input ACPR Accuracy ^a	± 0.77 dB	-36 dBm (nominal) RRC weighted, 7.56 MHz noise bandwidth method = IBW, Offset Freq = 8 MHz, At ACPR -45 dBc with optimum mixer level ^b

- a. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately $-37 \text{ dBm} - (\text{ACPR}/3)$, where the ACPR is given in (negative) decibels.
- b. To meet this specified accuracy when measuring transmitter at -45 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -20 dBm , so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -4 dBm , set the attenuation to 16 dB . Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

Description	Specifications	Supplemental Information
Spectrum Emission Mask (7.56 MHz transmission BW RBW = 3.9 kHz)		
4.2 MHz offset		
Dynamic Range, relative ^{ab}	88.2 dB	93.7 dB (typical)
Sensitivity, absolute ^c	-107.5 dBm	-111.5 dBm (typical)
Accuracy		
Relative ^d	±0.18 dB	
Absolute (20 to 30°C)	±1.15 dB	±0.26 dB (95th percentile)
10 MHz offset		
Dynamic Range, relative ^e	90.3 dB	95.7 dB (typical)
Sensitivity, absolute	-107.5 dBm	-111.5 dBm (typical)
Accuracy		
Relative	±0.22 dB	
Absolute (20 to 30°C)	±1.15 dB	±0.26 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 3.9 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -16 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 3.9 kHz RBW, at a center frequency of 474 MHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- e. This dynamic range specification applies for the optimum mixer level, which is about -13 dBm. Mixer level is defined to be the average input power minus the input attenuation.

Description	Specifications	Supplemental Information
<p>16QAM EVM (ML^a = -20 dBm 20 to 30°C)</p> <p>EVM</p> <p>Operating range</p> <p>Floor</p> <p>Accuracy</p> <p> from 0.6% to 1.4%</p> <p> from 1.4% to 2.0%</p> <p> from 2.0% to 7.0%</p> <p>MER</p> <p>Operating range</p> <p>Floor</p> <p>Accuracy</p> <p> from 37 to 44 dB</p> <p> from 34 to 37 dB</p> <p> from 23 to 34 dB</p>	<p>0 to 7%</p> <p>0.60%</p> <p>±0.30%</p> <p>±0.30%</p> <p>±0.70%</p> <p>≥ 23 dB</p> <p>45 dB</p> <p>±2.96 dB</p> <p>±1.09 dB</p> <p>±0.89 dB</p>	<p>Sub-carrier Number: 3780</p> <p>Code Rate: 0.8</p> <p>Interleaver Type: B=52, M=720</p> <p>Frame Header: PN420</p> <p>PN Phase Change: True</p>

a. ML (mixer level) is RF input power minus attenuation

DTMB Measurement Application
Measurements

Description	Specifications	Supplemental Information
16QAM EVM (ML ^a = -20 dBm 20 to 30°C)		Sub-carrier Number: 1 Code Rate: 0.8 Interleaver Type: B=52, M=720 Frame Header: PN595 PN Phase Change: True Insert Pilot: False
EVM Operating range Floor Accuracy from 1.4% to 2.0% from 2.0% to 8.0%	0 to 8% 1.36% ±0.60% ±0.50%	
MER Operating range Floor Accuracy from 34 to 37 dB from 22 to 34 dB	≥22 dB 38 dB ±2.81 dB ±1.62 dB	

a. ML (mixer level) is RF input power minus attenuation

DVB-T/H with T2 Measurement Application

This chapter contains specifications for the N6153A, DVB-T/H with T2 measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

The specifications apply to carrier frequencies below 2 GHz.

Measurements

Description	Specifications	Supplemental Information
Channel Power (7.61 MHz Integration BW) Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor	± 1.04 dB	Input signal must not be bursted -50 dBm (nominal) ± 0.27 dB (95th percentile) -78.9 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Channel Power with Shoulder Attenuation View 7.61 MHz Integration BW Dynamic Range, relative ^a Shoulder Offset ^b = 4.305 MHz	88.2 dB	Input signal must not be bursted ML = -16 dBm (nominal) 93.7 dB (typical)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset and region specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. This specification is derived from other analyzer performance limitations such as third-order intermodulation, DANL and phase noise. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Mixer level is defined to be the input power minus the input attenuation.
- b. Shoulder offset is the midpoint of the Shoulder Offset Start and Shoulder Offset Stop settings. The specification applies with the default difference between these two of 400 kHz.

Description	Specifications	Supplemental Information
Power Statistics CCDF Minimum power at RF Input Histogram Resolution	0.01 dB	-50 dBm (nominal)

Description	Specifications	Supplemental Information
Adjacent Channel Power Minimum power at RF Input ACPR Accuracy ^a (Offset Freq = 8 MHz)	±0.78 dB	-36 dBm (nominal) 7.61 MHz noise bandwidth, method = IBW, At ACPR -45 dBc with optimum mixer level ^b

- a. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately $-37 \text{ dBm} - (\text{ACPR}/3)$, where the ACPR is given in (negative) decibels.
- b. To meet this specified accuracy when measuring transmitter at -45 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -19 dBm, so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -3 dBm, set the attenuation to 16 dB. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

Description	Specifications	Supplemental Information
Spectrum Emission Mask (7.61 MHz transmission BW, RBW = 3.9 kHz)		
4.2 MHz offset		
Dynamic Range, relative ^{ab}	88.2 dB	93.7 dB (typical)
Sensitivity, absolute ^c	-107.5 dBm	-111.5 dBm (typical)
Accuracy		
Relative ^d	±0.18 dB	
Absolute (20 to 30°C)	±1.15 dB	±0.26 dB (95th percentile)
10 MHz offset		
Dynamic Range, relative ^e	90.5 dB	95.6 dB (typical)
Sensitivity, absolute	-107.5 dBm	-111.5 dBm (typical)
Accuracy		
Relative	±0.22 dB	
Absolute (20 to 30°C)	±1.15 dB	±0.26 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 3.9 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -16 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 3.9 kHz RBW, at a center frequency of 474 MHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- e. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.

Description	Specifications	Supplemental Information
Spurious Emission (ML = 3 dBm)		
Dynamic Range ^a , relative		
RBW = 3.9 kHz	101.1 dB	101.5 dB (typical)
RBW = 100 kHz	87.0 dB	87.5 dB (typical)
Sensitivity, ^b absolute		
RBW = 3.9 kHz	-107.3 dBm	-111.3 dBm (typical)
RBW = 100 kHz	-93.2 dBm	-99.2 dBm (typical)
Accuracy, absolute		
20 Hz to 3.6 GHz		±0.38 dB (95th percentile)
3.5 GHz to 8.4 GHz		±1.22 dB (95th percentile)
8.3 GHz to 13.6 GHz		±1.59 dB (95th percentile)

- a. The dynamic range is specified at 12.5 MHz offset from center frequency with mixer level of 1 dB compression point, which will degrade accuracy by 1 dB.
- b. The sensitivity is specified at far offset from carrier, where phase noise does not contribute. You can derive the dynamic range at far offset from 1 dB compression mixer level and sensitivity.

DVB-T/H with T2 Measurement Application
Measurements

Description	Specifications	Supplemental Information
DVB-T 64QAM EVM (ML ^a = -20 dBm 20 to 30°C)		FFT Size = 2048 Guard Interval = 1/32, alpha = 1
EVM		
Operating range	0 to 8%	
Floor		
EQ On	0.64%	
EQ Off	0.73%	
Accuracy		
from 0.7% to 1.2%	±0.30%	
from 1.2% to 2.0%	±0.20%	
from 2.0% to 8.0%	±0.20%	
MER		
Operating range	≥22 dB	
Floor		
EQ On	44 dB	
EQ Off	43 dB	
Accuracy		
from 38 to 43 dB	±2.62 dB	
from 34 to 38 dB	±1.02 dB	
from 22 to 34 dB	±0.48 dB	
Frequency Error^b		
Range		-100 kHz to 100 kHz
Accuracy	±1 Hz + tfa ^c	
Phase Jitter		
Range		0 to 0.0349 rad
Resolution	0.0001 rad	
Quad Error		
Range		-4° to +5°
Accuracy	±0.090°	
Amplitude Imbalance		
Range		-5% to +5%
Accuracy	±0.50%	
BER Before Viterbi		
Range		0 to 1.0×10 ⁻¹
BER Before Reed-Solomon		
Range		0 to 1.0×10 ⁻³
BER After Reed-Solomon		
Range		0 to infinity

- a. ML (mixer level) is RF input power minus attenuation
- b. The accuracy specification applies at the EVM = 1%.
- c. tfa = transmitter frequency \times frequency reference accuracy.

Description	Specifications	Supplemental Information
DVB-T2 256QAM EVM (ML ^a = -20 dBm 20 to 30°C, CF ≤ 1 GHz)		Single PLP, V & V001 FFT Size = 32K, Guard Interval = 1/128, Bandwidth Extension = Yes, Data Symbols = 59, Pilot = PP7, L1 Modulation = 64QAM, Rotation = Yes, Code Rate = 3/5, FEC = 64 K, FEC Block = 202, Interleaving Type = 0, Interleaving Length = 3
EVM		
Operating range		0 to 6%
Floor	0.72%	EQ Off
MER		
Operating range		≥ 24 dB
Floor	42.8 dB	EQ Off
Frequency Error		
Range		-380 kHz to 380 kHz
Accuracy		± 1 Hz + tfa^b
Clock Error		
Range		-20 Hz to 20 Hz
Accuracy		± 1 Hz + tfa^b
Quad Error		
Range		-5° to +5°
Amplitude Imbalance		
Range		-1 to +1 dB

- a. ML (mixer level) is RF input power minus attenuation
- b. tfa = transmitter frequency \times frequency reference accuracy.

This chapter contains specifications for the N9071A GSM/EDGE/EDGE Evolution Measurement Application. For EDGE Evolution (EGPRS2) including Normal Burst (16QAM/32QAM) and High Symbol Rate (HSR) Burst, option 3FP is required.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Description	Specifications	Supplemental Information
Power vs. Time <i>and</i> EDGE Power vs. Time Minimum carrier power at RF Input for GSM and EDGE Absolute power accuracy for in-band signal (excluding mismatch error) ^a Power Ramp Relative Accuracy Accuracy Measurement floor	 ± 0.16 dB -89 dBm	GMSK modulation (GSM) $3\pi/8$ shifted 8PSK modulation, $3\pi/4$ shifted QPSK, $\pi/4$ shifted 16QAM, $-\pi/4$ shifted 32QAM modulation in NSR/HSR (EDGE) Measures mean transmitted RF carrier power during the useful part of the burst (GSM method) and the power vs. time ramping. 510 kHz RBW -35 dBm (nominal) -0.11 ± 0.27 dB (95th percentile) Referenced to mean transmitted power

- a. The power versus time measurement uses a resolution bandwidth of about 510 kHz. This is not wide enough to pass all the transmitter power unattenuated, leading the consistent error shown in addition to the uncertainty. A wider RBW would allow smaller errors in the carrier measurement, but would allow more noise to reduce the dynamic range of the low-level measurements. The measurement floor will change by $10 \times \log(\text{RBW}/510 \text{ kHz})$. The average amplitude error will be about $-0.11 \text{ dB} \times ((510 \text{ kHz}/\text{RBW})^2)$. Therefore, the consistent part of the amplitude error can be eliminated by using a wider RBW.

Description	Specifications	Supplemental Information
Phase and Frequency Error Carrier power range at RF Input Phase error ^a , rms Floor Accuracy Frequency error ^a Initial frequency error range Accuracy I/Q Origin Offset DUT Maximum Offset Analyzer Noise Floor Trigger to T0 time offset (Relative accuracy) ^d	 0.6° $\pm 0.3^\circ$ $\pm 5 \text{ Hz}^b + \text{tfa}^c$	GMSK modulation (GSM) Specifications based on 3GPP essential conformance requirements, and 200 bursts $+27$ to -45 dBm (nominal) Phase error range 1° to 6° ± 80 kHz (nominal) -15 dBc (nominal) -50 dBc (nominal) ± 5.0 ns (nominal)

- a. Phase error and frequency error specifications apply when the Burst Sync is set to Training Sequence.
- b. This term includes an error due to the software algorithm. The accuracy specification applies when RMS phase error is less than 1° .
- c. tfa = transmitter frequency \times frequency reference accuracy
- d. The accuracy specification applies when the Burst Sync is set to Training Sequence, and Trigger is set to External Trigger.

Description	Specifications	Supplemental Information
<p>Output RF Spectrum (ORFS) <i>and</i> EDGE Output RF Spectrum</p> <p>Minimum carrier power at RF Input</p> <p>ORFS Relative RF Power Uncertainty^b</p> <p style="padding-left: 20px;">Due to modulation</p> <p style="padding-left: 40px;">Offsets \leq 1.2 MHz</p> <p style="padding-left: 40px;">Offsets \geq 1.8 MHz</p> <p style="padding-left: 20px;">Due to switching^c</p> <p>ORFS Absolute RF Power Accuracy^d</p>	<p>± 0.26 dB</p> <p>± 0.27 dB</p>	<p>GMSK modulation (GSM) $3\pi/8$ shifted 8PSK modulation, $3\pi/4$ shifted QPSK, $\pi/4$ shifted 16QAM, $-\pi/4$ shifted 32QAM modulation in NSR/HSR (EDGE)</p> <p>-20 dBm (nominal)^a</p> <p>± 0.17 dB (nominal)</p> <p>± 0.27 dB (95th percentile)</p>

- a. For maximum dynamic range, the recommended minimum power is -10 dBm.
- b. The uncertainty in the RF power ratio reported by ORFS has many components. This specification does not include the effects of added power in the measurements due to dynamic range limitations, but does include the following errors: detection linearity, RF and IF flatness, uncertainty in the bandwidth of the RBW filter, and compression due to high drive levels in the front end.
- c. The worst-case modeled and computed errors in ORFS due to switching are shown, but there are two further considerations in evaluating the accuracy of the measurement: First, Agilent has been unable to create a signal of known ORFS due to switching, so we have been unable to verify the accuracy of our models. This performance value is therefore shown as nominal instead of guaranteed. Second, the standards for ORFS allow the use of any RBW of at least 300 kHz for the reference measurement against which the ORFS due to switching is ratioed. Changing the RBW can make the measured ratio change by up to about 0.24 dB, making the standards ambiguous to this level. The user may choose the RBW for the reference; the default 300 kHz RBW has good dynamic range and speed, and agrees with past practices. Using wider RBWs would allow for results that depend less on the RBW, and give larger ratios of the reference to the ORFS due to switching by up to about 0.24 dB.
- d. The absolute power accuracy depends on the setting of the input attenuator as well as the signal-to-noise ratio. For high input levels, the use of the electronic attenuator and “Adjust Atten for Min Clip” will result in high signal-to-noise ratios and Electronic Input Atten > 2 dB, for which the absolute power accuracy is best. At moderate levels, manually setting the Input Atten can give better accuracy than the automatic setting. For GSM and EDGE, “high levels” would nominally be levels above $+1.7$ dBm and -1.3 dBm, respectively.

Description	Specifications			Supplemental Information			
<p>ORFS and EDGE ORFS (continued)</p> <p>Dynamic Range, Spectrum due to modulation^a</p> <p>Early analyzers (SN prefix <MY/SG/US5340)</p>				5-pole sync-tuned filters ^b Methods: Direct Time ^c and FFT ^d			
		GSM (GMSK)	EDGE (NSR 8PSK & Narrow QPSK)	EDGE (others)^e	GSM (GMSK) (typical)	EDGE (NSR 8PSK & Narrow QPSK) (typical)	EDGE (others)^e (typical)
	Offset Frequency						
	100 kHz ^f	60.7 dB	60.7 dB	60.6 dB			
	200 kHz ^f	66.1 dB	66.0 dB	65.7 dB			
	250 kHz ^f	67.8 dB	67.6 dB	67.3 dB			
	400 kHz ^f	71.3 dB	70.9 dB	70.2 dB			
	600 kHz	74.1 dB	73.5 dB	72.3 dB	78.4 dB	77.7 dB	76.3 dB
	1.2 MHz	78.2 dB	76.7 dB	74.6 dB	82.2 dB	80.5 dB	78.1 dB
						EDGE (NSR 8PSK & Narrow QPSK) (nominal)	EDGE (others) (nominal)
	1.8 MHz ^g	77.1 dB	76.7 dB	75.9 dB	83.8 dB	83.0 dB	81.5 dB
	6.0 MHz ^g	80.7 dB	79.8 dB	78.2 dB	85.7 dB	84.5 dB	82.5 dB
	<p>Analyzers with -EP3 (SN prefix ≥MY/SG/US5340, ship standard with N9010A-EP3)^h</p>				5-pole sync-tuned filters ^b Methods: Direct Time ^c and FFT ^d		
		GSM (GMSK)	EDGE (NSR 8PSK & Narrow QPSK)	EDGE (others)^e	GSM (GMSK) (typical)	EDGE (NSR 8PSK & Narrow QPSK) (typical)	EDGE (others)^e (typical)
Offset Frequency							
100 kHz		63.7 dB	63.9 dB	63.5 dB			
200 kHz		69.5 dB	69.3 dB	68.8 dB			
250 kHz		71.4 dB	71.0 dB	70.3 dB			
400 kHz		75.0 dB	74.2 dB	72.9 dB			
600 kHz	77.6 dB	76.4 dB	74.3 dB	80.7 dB	79.5 dB	77.5 dB	

Description	Specifications			Supplemental Information		
1.2 MHz	80.7 dB	78.4 dB	75.5 dB	83.7 dB	81.5 dB	78.7 dB
				EDGE (NSR 8PSK & GSM (GMSK) (nominal)	Narrow QPSK) (nominal)	EDGE (others) (nominal)
1.8 MHz	81.3 dB	80.3 dB	78.6 dB	84.7 dB	83.7 dB	82.1 dB
6.0 MHz	84.1 dB	82.3 dB	79.8 dB	88.1 dB	86.2 dB	83.6 dB
Dynamic Range, Spectrum due to switching ^a Early analyzers (SN prefix <MY/SG/US5340) ^h				5-pole sync-tuned filters ⁱ		
Offset Frequency	GSM (GMSK)	EDGE (NSR 8PSK & Narrow QPSK)	EDGE (others)^e			
400 kHz		69.2 dB	68.8 dB			
600 kHz		71.7 dB	71.2 dB			
1.2 MHz		75.0 dB	73.9 dB			
1.8 MHz		80.2 dB	79.8 dB			
Analyzers with -EP3 (SN prefix ≥MY/SG/US5340, ship standard with N9010A-EP3) ^h						
Offset Frequency	GSM (GMSK)	EDGE (NSR 8PSK & Narrow QPSK)	EDGE (others)^e			
400 kHz		72.5 dB	71.8 dB			
600 kHz		74.6 dB	73.6 dB			
1.2 MHz		76.6 dB	75.1 dB			
1.8 MHz		83.7 dB	82.9 dB			

- a. Maximum dynamic range requires RF input power above -2 dBm for offsets of 1.2 MHz and below for GSM, and above -5 dBm for EDGE. For offsets of 1.8 MHz and above, the required RF input power for maximum dynamic range is $+8$ dBm for GSM signals and $+5$ dBm for EDGE signals.
- b. ORFS standards call for the use of a 5-pole, sync-tuned filter; this and the following footnotes review the instrument's conformance to that standard. Offset frequencies can be measured by using either the FFT method or the direct time method. By default, the FFT method is used for offsets of 400 kHz and below, and the direct time method is used for offsets above 400 kHz. The FFT method is faster, but has lower dynamic range than the direct time method.

- c. The direct time method uses digital Gaussian RBW filters whose noise bandwidth (the measure of importance to “spectrum due to modulation”) is within $\pm 0.5\%$ of the noise bandwidth of an ideal 5-pole sync-tuned filter. However, the Gaussian filters do not match the 5-pole standard behavior at offsets of 400 kHz and below, because they have *lower* leakage of the carrier into the filter. The lower leakage of the Gaussian filters provides a superior measurement because the leakage of the carrier masks the ORFS due to the UUT, so that less masking lets the test be more sensitive to variations in the UUT spectral splatter. But this superior measurement gives a result that does not conform with ORFS standards. Therefore, the default method for offsets of 400 kHz and below is the FFT method.
- d. The FFT method uses an exact 5-pole sync-tuned RBW filter, implemented in software.
- e. EDGE (others) means NSR 16/32QAM and HSR all formats (QPSK/16QAM/32QAM).
- f. The dynamic range for offsets at and below 400 kHz is not directly observable because the signal spectrum obscures the result. These dynamic range specifications are computed from phase noise observations.
- g. Offsets of 1.8 MHz and higher use 100 kHz analysis bandwidths.
- h. Phase Noise optimization is set to Best Wide offset (offset >100 kHz).
- i. The impulse bandwidth (the measure of importance to “spectrum due to switching transients”) of the filter used in the direct time method is 0.8% less than the impulse bandwidth of an ideal 5-pole sync-tuned filter, with a tolerance of $\pm 0.5\%$. Unlike the case with spectrum due to modulation, the shape of the filter response (Gaussian vs. sync-tuned) does not affect the results due to carrier leakage, so the only parameter of the filter that matters to the results is the impulse bandwidth. There is a mean error of -0.07 dB due to the impulse bandwidth of the filter, which is compensated in the measurement of ORFS due to switching. By comparison, an analog RBW filter with a $\pm 10\%$ width tolerance would cause a maximum amplitude uncertainty of 0.9 dB.

Frequency Ranges

Description	Uplink	Downlink
In-Band Frequency Ranges		
P-GSM 900	890 to 915 MHz	935 to 960 MHz
E-GSM 900	880 to 915 MHz	925 to 960 MHz
R-GSM 900	876 to 915 MHz	921 to 960 MHz
DCS1800	1710 to 1785 MHz	1805 to 1880 MHz
PCS1900	1850 to 1910 MHz	1930 to 1990 MHz
GSM850	824 to 849 MHz	869 to 894 MHz
GSM450	450.4 to 457.6 MHz	460.4 to 467.6 MHz
GSM480	478.8 to 486 MHz	488.8 to 496 MHz
GSM700	777 to 792 MHz	747 to 762 MHz
T-GSM810	806 to 821 MHz	851 to 866 MHz

This chapter contains specifications for the N6149A, iDEN/WiDEN/MotoTalk Measurement Application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Frequency and Time

Description	Specifications	Supplemental Information
Frequency and Time-related Specifications		Please refer to “Frequency and Time” on page 19

Amplitude Accuracy and Range

Description	Specifications	Supplemental Information
Amplitude and Range-related Specifications		Please refer to “Amplitude Accuracy and Range” on page 31.

Dynamic Range

Description	Specifications	Supplemental Information
Dynamic Range-related Specifications		Please refer to “Dynamic Range” on page 41.

Application Specifications

Description	Specifications	Supplemental Information
Measurements		
iDEN Power	ACP (adjacent channel power) Occupied Bandwidth	Includes Carrier Power on summary data screen
iDEN Demod	PvT (power versus time) Modulation analysis BER (bit error rate) SER Sub-channel analysis Slot power results	
MotoTalk Demod	EVM (error vector magnitude) Slot power results	
Vector Analysis	IQ waveform BER (bit error rate)	

Description	Specifications	Supplemental Information
Parameter Setups		
Radio Device Radio Standard		BS (outbound) and MS (inbound) iDEN version R02.00.06 and Motorola TalkAround: RF Interface, TalkAround Protocol (8/19/2002) developed by Motorola Inc.
Bandwidths	25/50/75/100/50-Outer kHz	
Modulation	4QAM/16QAM/64QAM	

Description	Specifications	Supplemental Information
iDEN Power		
Supported Formats	iDEN single carrier TDMA WiDEN- multiple carrier TDMA	
Pass/Fail Tests	Occupied Bandwidth (OBW) Adjacent Channel Power (ACP)	
Carrier Configuration	25 kHz WiDEN 50 kHz WiDEN 75 kHz WiDEN 100 kHz WiDEN 50 kHz Outer WiDEN	

Description	Specifications	Supplemental Information
iDEN Signal Demod		
Supported Formats	iDEN single carrier TDMA WiDEN multiple carrier TDMA	
iDEN Composite EVM Floor ^a		2.4% (nominal)
Carrier Configuration	25 kHz WiDEN 50 kHz WiDEN 75 kHz WiDEN 100 kHz WiDEN 50 kHz Outer WiDEN	
Provided Tests	Bit Error Rate (BER) Error Vector Magnitude (EVM) Power Versus Time (PvT)	

a. The EVM floor is derived for signal power –20 dBm at mixer. The signal is iDEN Inbound Full Reserved.

Description	Specifications	Supplemental Information
MotoTalk Signal Demod		
Supported Slot Formats	Traffic Burst Slot Format	
Composite EVM Floor ^a		1.4% (nominal)
Measurement Parameters	Search Length Normalize	IQ and FSK waveforms
Measurement Parameters (advanced)	Gaussian BT Symbol Rate Burst Search on/off	Bandwidth Time product
Result Displays	Slot Error Vector Time Slot Error Summary Table	

a. The EVM floor is derived for signal power –20 dBm at mixer.

This chapter contains specifications for N6155A, ISDB-T measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

The specifications apply to carrier frequencies below 2 GHz.

Measurements

Description	Specifications	Supplemental Information
Channel Power (5.6 MHz Integration BW) Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor	±1.04 dB	Input signal must not be bursted –50 dBm (nominal) ±0.27 dB (95th percentile) –80.2 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Channel Power with Shoulder Attenuation View (5.60 MHz Integration BW, ML = –16 dBm, Shoulder Offset ^a = 3.40 MHz) Dynamic Range, relative ^b	83.7 dB	Input signal must not be bursted 89.3 dB (typical)

- a. Shoulder offset is the midpoint of the Shoulder Offset Start and Shoulder Offset Stop settings. The specification applies with the default difference between these two of 200 kHz.
- b. The dynamic range specification is the ratio of the channel power to the power in the offset and region specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. This specification is derived from other analyzer performance limitations such as third-order intermodulation, DANL and phase noise. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Mixer level is defined to be the input power minus the input attenuation.

Description	Specifications	Supplemental Information
Power Statistics CCDF Minimum power at RF Input Histogram Resolution	0.01 dB ^a	–50 dBm (nominal)

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Adjacent Channel Power Minimum power at RF Input ACPR Accuracy ^a (5.60 MHz noise bandwidth method = IBW, Offset Freq = 6 MHz)	± 0.67 dB	-36 dBm (nominal) At ACPR -45 dBc with optimum mixer level ^b

- a. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately $-37 \text{ dBm} - (\text{ACPR}/3)$, where the ACPR is given in (negative) decibels.
- b. To meet this specified accuracy when measuring transmitter at -45 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -21 dBm, so the input attenuation must be set as close as possible to the average input power. For example, if the average input power is -5 dBm, set the attenuation to 16 dB. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

Description	Specifications	Supplemental Information
Spectrum Emission Mask (5.60 MHz Integration BW RBW = 10.0 kHz)		Limit Type <ul style="list-style-type: none"> • Manual • JEITA (ARIB-B31) according to $P \leq 0.025 \text{ W}$; $0.025 \text{ W} < P \leq 0.25 \text{ W}$; $0.25 \text{ W} < P \leq 2.5 \text{ W}$; $P > 2.5 \text{ W}$ (P is the channel power) • ABNT Non-Critical • ABNT Sub-Critical • ABNT Critical • ISDB-T_{SB}
3.0 MHz Offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	83.6 dB -103.5 dBm ±0.16 dB ±1.15 dB	89.1 dB (typical) -107.5 dBm (typical) ±0.26 dB (95th percentile)
4.36 MHz Offset Dynamic Range, relative ^e Sensitivity, absolute Accuracy Relative Absolute (20 to 30°C)	84.1 dB -103.5 dBm ±0.18 dB ±1.15 dB	89.6 dB (typical) -107.5 dBm (typical) ±0.26 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 10.0 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -16 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 10.0 kHz RBW, at a center frequency of 713.142857 MHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- e. This dynamic range specification applies for the optimum mixer level, which is about -16 dBm. Mixer level is defined to be the average input power minus the input attenuation.

Description	Specifications	Supplemental Information
Modulation Analysis Settings		
Radio Standard	ISDB-T or ISDB-T _{SB}	
Segment Number	13 Segments for ISDB-T	
	1 or 3 Segments for ISDB-T _{SB}	
FFT Size	2K, 4K, or 8K	Auto-Detection or Manual Input
Guard Interval	1/4, 1/8, 1/16 or 1/32	Auto-Detection or Manual Input
Partial Reception	On or Off	Auto-Detection or Manual Input
Layer A	Segment Count =1 (Partial Reception=On) or number maximum to 13 (ISDB-T)	Auto-Detection or Manual Input
	Segment Count =1 (ISDB-T _{SB})	
	Modulation Format: QPSK/16QAM/64QAM	
Layer B	Segment Count = number maximum to 13-LayerA Segments (ISDB-T)	Auto-Detection or Manual Input
	Segment Count = 2 (ISDB-T _{SB})	
	Modulation Format: QPSK/16QAM/64QAM	
Layer C	Segment Count = number maximum to 13-LayerA Segments-LayerB Segments	Auto-Detection or Manual Input
	Modulation Format: QPSK/16QAM/64QAM	
Spectrum	Normal or Invert	
Clock Rate	8.126984 MHz	Auto or Manual
Demod Symbols	4 to 50	
Out of Band Filtering	On or Off	
Data Equalization	On or Off	

ISDB-T Measurement Application
Measurements

Description	Specifications	Supplemental Information
Modulation Analysis Measurements		
I/Q Measured Polar Graph	Constellation (subcarriers 0 to 5616 configurable for 8K FFT) MER (dB), EVM (%),Mag Error (%), Phase Error (deg) RMS, Peak results (Peak Position) Freq Error (Hz)	Start and Stop subcarriers can be manually configured
I/Q Error (Quad View)	MER vs Subcarriers Constellation: Layer A/B/C, Segment (0-12 for ISDB-T) or All Segments MER (dB), EVM (%), Amp Error (%), Phase Error(deg) RMS, Peak results Quadrature Error (deg) Amplitude Imbalance (dB)	In this View, you can measure: MER vs Subcarriers MER by Segment MER by Layer Constellation by Segment Constellation by Layer
Channel Frequency Response	Amplitude vs Subcarriers Phase vs Subcarriers Group Delay vs Subcarriers	
Channel Impulse Response Spectrum Flatness	Amax-Ac (Limit: +0.5) Amin-Ac (Limit: -0.5) Amax: max amplitude value Amin: min amplitude value Ac: center frequency amp value	

ISDB-T Measurement Application
Measurements

Description	Specifications	Supplemental Information
ISDB-T Modulation Analysis (ML ^a = -20 dBm, 20 to 30°C, CF ≤1 GHz)		Segments=13 Mode3 Guard Interval=1/8 Partial Reception=Off Layer A-C Segment=13 Code Rate=3/4 Time Interleaving I=2 Modulation=64QAM EQ OFF
EVM Operating range Floor Accuracy from 0.8% to 1.2% from 1.2% to 2.0% from 2.0% to 8.0%	0 to 8% 0.80% ±0.40% ±0.30% ±0.70%	EQ OFF
MER Operating range Floor Accuracy from 38 to 42 dB from 34 to 38 dB from 22 to 34 dB	≥ 22 dB 42 dB ±3.00 dB ±1.52 dB ±0.85 dB	EQ OFF
Frequency Error^b Range Accuracy		-170 kHz to 170 kHz ±1 Hz + tfa ^c
Clock Error Range Accuracy		-100 Hz to 100 Hz (nominal) ±1 Hz + tfa ^c
Quad Error Range		-5 to +5°
Amplitude Imbalance Range		-1 to +1 dB

- a. ML (mixer level) is RF input power minus input attenuation
- b. The accuracy specification applies at the EVM = 1%.
- c. tfa = transmitter frequency × frequency reference accuracy.

Description	Specifications	Supplemental Information
ISDB-Tmm Modulation Analysis (ML ^a = -20 dBm, 20 to 30°C)		Segments=33 Mode3 Guard Interval=1/4 Super Segment #0 ISDB-T: Layer A: QPSK Layer B: 16QAM SuperSegment #1 Seven 1-segment: Layer A: QPSK SuperSegment #2 ISDB-T: Layer A: QPSK Layer B: 16QAM
EVM Operating range Floor Accuracy	0.68% (EQ Off)	EQ OFF 0 to 25%
MER Operating range Floor Accuracy	43.4 dB (EQ Off)	EQ OFF ≥ 12 dB
Frequency Error^b Range Accuracy		-170 kHz to 170 kHz ±1 Hz + tfa ^c
Clock Error Range Accuracy		-100 Hz to 100 Hz ±1 Hz + tfa ^c
Quad Error Range		-5° to +5°
Amplitude Imbalance Range		-1 to +1 dB

- a. ML (mixer level) is RF input power minus input attenuation
- b. The accuracy specification applies at the EVM = 1%.
- c. tfa = transmitter frequency × frequency reference accuracy.

This chapter contains specifications for the N9080A LTE measurement application and for the N9082A measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Supported Air Interface Features

Description	Specifications	Supplemental Information
3GPP Standards Supported	36.211 V9.1.0 (March 2010) 36.212 V9.4.0 (September 2011) 36.213 V9.3.0 (September 2010) 36.214 V9.2.0 (June 2010) 36.141 V9.10.0 (July 2012) 36.521-1 V9.8.0 (March 2012)	
Signal Structure	FDD Frame Structure Type 1 TDD Frame Structure Type 2 Special subframe configurations 0-8	N9080A only N9082A only N9082A only
Signal Direction	Uplink and Downlink UL/DL configurations 0-6	N9082A only
Signal Bandwidth	1.4 MHz (6 RB), 3 MHz (15 RB), 5 MHz (25 RB), 10 MHz (50 RB), 15 MHz (75 RB), 20 MHz (100 RB)	
Modulation Formats and Sequences	BPSK; BPSK with I & Q CDM; QPSK; 16QAM; 64QAM; PRS; CAZAC (Zadoff-Chu)	
Physical Channels		
Downlink	PBCH, PCFICH, PHICH, PDCCH, PDSCH, PMCH	
Uplink	PUCCH, PUSCH, PRACH	
Physical Signals		
Downlink	P-SS, S-SS, RS, P-PS (positioning), MBSFN-RS	
Uplink	PUCCH-DMRS, PUSCH-DMRS, S-RS (sounding)	

Measurements

Description	Specifications	Supplemental Information
Channel Power Minimum power at RF input Absolute power accuracy ^a (20 to 30°C, Atten = 10 dB) 95th Percentile Absolute power accuracy (20 to 30°C, Atten = 10 dB) Measurement floor	±1.04 dB	-50 dBm (nominal) ±0.27 dB -76.7 dBm (nominal) in a 10 MHz bandwidth

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Transmit On/Off Power Burst Type Transmit power Dynamic Range ^a Average type Measurement time Trigger source		This table applies only to the N9082A measurement application. Traffic, DwPTS, UpPTS, SRS, PRACH Min, Max, Mean, Off 122.5 dB (nominal) Off, RMS, Log Up to 20 slots External 1, External 2, Periodic, RF Burst, IF Envelope

- a. This dynamic range expression is for the case of Information BW = 5 MHz; for other Info BW, the dynamic range can be derived. The equation is:

$$\text{Dynamic Range} = \text{Dynamic Range for 5 MHz} - 10 \cdot \log_{10}(\text{Info BW}/5.0\text{e6})$$

Description	Specifications	Supplemental Information
Adjacent Channel Power		Single Carrier
Minimum power at RF input		–36 dBm (nominal)
Accuracy	Channel Bandwidth	
Radio	Offset	5 MHz
		10 MHz
		20 MHz
		ACPR Range for Specification
MS	Adjacent ^a	±0.16 dB
		±0.24 dB
		±0.41 dB
BTS	Adjacent ^c	±1.03 dB
		±1.29. dB
		±2.04 dB
BTS	Alternate ^c	±0.24 dB
		±0.39 dB
		±0.74 dB
Dynamic Range E-UTRA		–33 to –27 dBc with opt ML ^b
		–48 to –42 dBc with opt ML ^d
		–48 to –42 dBc with opt ML ^e
		Test conditions ^f
		Dynamic Range
		(nominal)
		Optimum Mixer Level
		(nominal)
Offset	Channel BW	
Adjacent	5 MHz	70.0 dB
Adjacent	10 MHz	69.3 dB
Adjacent	20 MHz	68.4 dB
Alternate	5 MHz	75.8 dB
Alternate	10 MHz	73.2 dB
Alternate	20 MHz	70.3 dB
Dynamic Range UTRA		–16.5 dBm
		–16.5 dBm
		–16.3dBm
		–16.6 dBm
		–16.4 dBm
		–16.3 dBm
		Test conditions ^f
		Dynamic Range
		(nominal)
		Optimum Mixer Level
		(nominal)
Offset	Channel BW	
2.5 MHz	5 MHz	70.5 dB
2.5 MHz	10 MHz	70.5 dB
2.5 MHz	20 MHz	71.4 dB
7.5 MHz	5 MHz	76.5 dB
7.5 MHz	10 MHz	76.5 dB
7.5 MHz	20 MHz	75.7 dB
		–16.6 dBm
		–16.4 dBm
		–16.3 dBm
		–16.6 dBm
		–16.4 dBm
		–16.3 dBm

- Measurement bandwidths for mobile stations are 4.5, 9.0 and 18.0 MHz for channel bandwidths of 5, 10 and 20 MHz respectively.
- The optimum mixer levels (ML) are –22, –23 and –19 dBm for channel bandwidths of 5, 10 and 20 MHz respectively.
- Measurement bandwidths for base transceiver stations are 4.515, 9.015 and 18.015 MHz for channel bandwidths of 5, 10 and 20 MHz respectively.
- The optimum mixer levels (ML) are –18, –18 and –15 dBm for channel bandwidths of 5, 10 and 20 MHz respectively.
- The optimum mixer level (ML) is –8 dBm.
- E-TM1.1 and E-TM1.2 used for test. Noise Correction set to On.

Description	Specification	Supplemental Information
Occupied Bandwidth Minimum carrier power at RF Input Frequency accuracy	± 10 kHz	-30 dBm (nominal) RBW = 30 kHz, Number of Points = 1001, Span = 10 MHz

Description	Specifications	Supplemental Information
Spectrum Emission Mask		Offset from CF = (channel bandwidth + measurement bandwidth) / 2; measurement bandwidth = 100 kHz
Dynamic Range		
Channel Bandwidth		
5 MHz	72.6 dB	79.4 dB (typical)
10 MHz	73.5 dB	80.3 dB (typical)
20 MHz	73.4 dB	80.6 dB (typical)
Sensitivity	-92.5 dBm	-96.5 dBm (typical)
Accuracy		
Relative	± 0.13 dB	
Absolute, 20 to 30°C	± 1.15 dB	± 0.31 dB (95th percentile)

Description	Specifications	Supplemental Information
Spurious Emissions		Table-driven spurious signals; search across regions
Dynamic Range ^a , relative (RBW = 1 MHz)	76.9 dB	77.4 dB (typical)
Sensitivity ^b , absolute (RBW=1 MHz)	-82.5 dBm	-86.5 dBm (typical)
Accuracy		
Attenuation = 10 dB		
Frequency Range		
9 k Hz to 3.6 GHz		± 0.38 dB (95th percentile)
3.5 to 7.0 GHz		± 1.22 dB (95th percentile)
6.9 to 13.6 GHz		± 1.59 dB (95th percentile)

- a. The dynamic range is specified at 12.5 MHz offset from center frequency with mixer level of 1 dB compression point, which will degrade accuracy by 1 dB.
- b. The sensitivity is specified at far offset from carrier, where phase noise does not contribute. You can derive the dynamic range at far offset from 1 dB compression mixer level and sensitivity.

Description	Specifications	Supplemental Information
Modulation Analysis (Signal level within one range step of overload)		% and dB expressions ^a
OSTP/RSTP Absolute accuracy ^b		±0.30 dB (nominal)
EVM Floor for Downlink (OFDMA) Early analyzers ^c (SN prefix <MY/SG/US5340)		
Signal Bandwidth		
5 MHz	1.35% (–37.3 dB)	0.56% (–45 dB) (nominal)
10 MHz	1.35% (–37.3 dB)	0.63% (–44 dB) (nominal)
20 MHz ^d	1.35% (–37.3 dB)	0.63% (–44 dB) (nominal)
Analizers with -EP3 (SN prefix ≥MY/SG/US5340, ship standard with N9010A-EP3)		
Signal Bandwidth		
5 MHz	0.68% (–43.3 dB)	
10 MHz	0.68% (–43.3 dB)	
20 MHz ^f	0.72% (–42.8 dB)	
EVM Accuracy for Downlink (OFDMA) (EVM range: 0 to 8%) ^e		±0.3% (nominal)
EVM for Uplink (SC-FDMA) Floor Early analyzers ^c (SN prefix <MY/SG/US5340)		
Signal Bandwidth		
5 MHz	1.35% (–37.3 dB)	0.56% (–45 dB) (nominal)
10 MHz	1.35% (–37.3 dB)	0.56% (–45 dB) (nominal)
20 MHz ^d	1.35% (–37.3 dB)	0.56% (–45 dB) (nominal)
Analizers with -EP3 (SN prefix ≥MY/SG/US5340, ship standard with N9010A-EP3)		
Signal Bandwidth		
5 MHz	0.66% (–43.6 dB)	
10 MHz	0.66% (–43.6 dB)	
20 MHz ^d	0.70% (–43.0 dB)	

Description	Specifications	Supplemental Information
Frequency Error		
Lock range		$\pm 2.5 \times$ subcarrier spacing = 37.5 kHz for default 15 kHz subcarrier spacing (nominal)
Accuracy		± 1 Hz + tfa ^f (nominal)
Time Offset ^g		
Absolute frame offset accuracy	± 20 ns	
Relative frame offset accuracy		± 5 ns (nominal)
MIMO RS timing accuracy		± 5 ns (nominal)

- a. In these specifications, those values with % units are the specifications, while those with decibel units, in parentheses, are conversions from the percentage units to decibels for reader convenience.
- b. The accuracy specification applies when EVM is less than 1% and no boost applies for the reference signal.
- c. Overall EVM and Data EVM using 3GPP standard-defined calculation. Phase Noise Optimization set to Best Close-in (<20 kHz).
- d. Requires *Option B25* above 10 MHz to 25 MHz.
- e. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows:

$$\text{error} = [\text{sqrt}(\text{EVM}_{\text{UUT}}^2 + \text{EVM}_{\text{sa}}^2)] - \text{EVM}_{\text{UUT}}$$
 where EVM_{UUT} is the EVM of the UUT in percent, and EVM_{sa} is the EVM floor of the analyzer in percent.
- f. tfa = transmitter frequency \times frequency reference accuracy.
- g. The accuracy specification applies when EVM is less than 1% and no boost applies for resource elements

In-Band Frequency Range

Operating Band, FDD	Uplink	Downlink
1	1920 to 1980 MHz	2110 to 2170 MHz
2	1850 to 1910 MHz	1930 to 1990 MHz
3	1710 to 1785 MHz	1805 to 1880 MHz
4	1710 to 1755 MHz	2110 to 2155 MHz
5	824 to 849 MHz	869 to 894 MHz
6	830 to 840 MHz	875 to 885 MHz
7	2500 to 2570 MHz	2620 to 2690 MHz
8	880 to 915 MHz	925 to 960 MHz
9	1749.9 to 1784.9 MHz	1844.9 to 1879.9 MHz
10	1710 to 1770 MHz	2110 to 2170 MHz
11	1427.9 to 1452.9 MHz	1475.9 to 1500.9 MHz
12	698 to 716 MHz	728 to 746 MHz
13	777 to 787 MHz	746 to 756 MHz
14	788 to 798 MHz	758 to 768 MHz
17	704 to 716 MHz	734 to 746 MHz

Operating Band, TDD	Uplink/Downlink
33	1900 to 1920 MHz
34	2010 to 2025 MHz
35	1850 to 1910 MHz
36	1930 to 1990 MHz
37	1910 to 1930 MHz
38	2570 to 2620 MHz
39	1880 to 1920 MHz
40	2300 to 2400 MHz

Multi-Standard Radio Measurement Application

This chapter contains specifications for the N9083A Multi-Standard Radio (MSR) measurement application. The measurements for GSM/EDGE, W-CDMA and LTE FDD also require N9071A-2FP, N9073A-1FP, and N9080A-1FP respectively.

Additional Definitions and Requirements

The specifications apply in the frequency range documented in In-Band Frequency Range of each application.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Measurements

Description	Specifications	Supplemental Information
Channel Power Minimum power at RF Input 95th percentile Absolute power accuracy (20 to 30°C, Atten = 10 dB)		-50 dBm (nominal) ±0.27 dB

Description	Specifications	Supplemental Information
Power Statistics CCDF Histogram Resolution	0.01 dB ^a	

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of the histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Occupied Bandwidth Minimum power at RF Input Frequency Accuracy		-30 dBm (nominal) ± (Span / 1000) (nominal)

Description	Specifications	Supplemental Information
<p>Spurious Emissions</p> <p>Accuracy (Attenuation = 10 dB)</p> <p>Frequency Range</p> <p>20 Hz to 3.6 GHz</p> <p>3.5 to 7.0 GHz</p> <p>6.9 to 13.6 GHz</p>		<p>Table-driven spurious signals; search across regions</p> <p>± 0.38 dB (95th percentile)</p> <p>± 1.22 dB (95th percentile)</p> <p>± 1.59 dB (95th percentile)</p>

Description	Specifications	Supplemental Information
Conformance EVM^a GSM/EDGE^b EVM, rms - floor (EDGE) Phase error, rms - floor (GSM)		0.7% (nominal) 0.6° (nominal)
W-CDMA^c Composite EVM floor		1.6% (nominal)
LTE FDD^d EVM floor for downlink (OFDMA)		% and dB expression ^e
Early analyzers (SN prefix <MY\SG\US5340)		
Signal bandwidths		
5 MHz		0.66% (–43.6 dB) (nominal)
10 MHz		0.66% (–43.6 dB) (nominal)
20 MHz		0.65% (–43.7 dB) (nominal)
Analyzers with -EP3 (SN prefix ≥MY\SG\US5340, ship standard with N9010A-EP3)		
Signal bandwidths		
5 MHz		0.56% (–45.0 dB) (nominal)
10 MHz		0.48% (–46.3 dB) (nominal)
20 MHz		0.52% (–45.6 dB) (nominal)

- a. The signal level is within one range step of overload. The specification for floor do not include signal-to-noise impact which may decrease by increasing the number of carriers. The noise floor can be estimated by $DANL + 2.51 + 10 \times \log_{10}(\text{MeasBW})$, where DANL is the Display Averaged Noise Level specification in dBm and MeasBW is the measurement bandwidth at the receiver in Hz.
- b. Specifications apply when the carrier spacing is 600 kHz and the carrier power of each adjacent channel does not exceed the carrier power of the channel tested for EVM.
- c. Specifications apply when the carrier spacing is 5 MHz and the carrier power of each adjacent channel does not exceed the carrier power of the channel tested for EVM.
- d. Specifications apply when the carrier spacing is the same as the signal bandwidth and the carrier power of each adjacent channel does not exceed the carrier power of the channel tested for EVM.
- e. In LTE FDD specifications, those values with % units are the specifications, while those with decibel units, in parentheses, are conversion from the percentage units to decibels for reader convenience.

In-Band Frequency Range

Refer to the tables of In-Band Frequency Range in GSM/EDGE on [page 250](#), W-CDMA on [page 301](#), and LTE on [page 274](#).

Multi-Standard Radio Measurement Application
In-Band Frequency Range

This chapter contains specifications for two measurement applications. One of those is the N9079A-1FP or N9079A-1TP TD-SCDMA measurement application. Modulation specifications rows and columns labeled with DPCH apply to TD-SCDMA only. The other application is the N9079A-2FP or N9079A-2TP HSPA/8PSK measurement application. Modulation specifications rows and columns labeled with HS-PDSCH apply to HSPA/8PSK only.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Measurements

Description	Specification	Supplemental Information
Power vs. Time Burst Type Measurement results type Dynamic range Averaging type Measurement time Trigger type Measurement floor		Traffic, UpPTS and DwPTS Min, Max, Mean 128.3 dB (nominal) Off, RMS, Log Up to 9 slots External1, External2, RF Burst -98.3 dBm (nominal)

Description	Specification	Supplemental Information
Transmit Power Burst Type Measurement results type Averaging type Average mode Measurement time Power Accuracy Measurement floor		Traffic, UpPTS, and DwPTS Min, Max, Mean Off, RMS, Log Exponential, Repeat Up to 18 slots ±0.29 dB (95th percentile) -84.3 dBm (nominal)

Description		Specification	Supplemental Information
Adjacent Channel Power Single Carrier			
Minimum Power at RF Input			-36 dBm (nominal)
ACPR Accuracy ^a			RRC weighted, 1.28 MHz noise bandwidth, method = IBW
Radio	Offset Freq		
MS (UE)	1.6 MHz	±0.12 dB	At ACPR range of -30 to -36 dBc with optimum mixer level ^b
MS (UE)	3.2 MHz	±0.13 dB	At ACPR range of -40 to -46 dBc with optimum mixer level ^c
BTS	1.6 MHz	±0.25 dB	At ACPR range of -37 to -43 dBc with optimum mixer level ^d
BTS	3.2 MHz	±0.15 dB	At ACPR range of -42 to -48 dBc with optimum mixer level ^e
BTS	1.6 MHz	±0.13 dB	At -43 dBc non-coherent ACPR ^d

- a. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately $-37 \text{ dBm} - (\text{ACPR}/3)$, where the ACPR is given in (negative) decibels.
- b. To meet this specified accuracy when measuring mobile station (MS) or user equipment (UE) within 3 dB of the required -33 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -25 dBm, so the input attenuation must be set as close as possible to the average input power - (-25 dBm). For example, if the average input power is -6 dBm, set the attenuation to 19 dB. This specification applies for the normal 3.5 dB peak-to-average ratio of a single code. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- c. ACPR accuracy at 3.2 MHz offset is warranted when the input attenuator is set to give an average mixer level of -13 dBm.
- d. In order to meet this specified accuracy, the mixer level must be optimized for accuracy when measuring node B Base Transmission Station (BTS) within 3 dB of the required -40 dBc ACPR. This optimum mixer level is -23 dBm, so the input attenuation must be set as close as possible to the average input power - (-23 dBm). For example, if the average input power is -5 dBm, set the attenuation to 18 dB. This specification applies for the normal 10 dB peak-to-average ratio (at 0.01% probability) for Test Model 1. Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- e. ACPR accuracy at 3.2 MHz offset is warranted when the input attenuator is set to give an average mixer level of -12 dBm.

Description	Specification	Supplemental Information
Power Statistics CCDF		
Histogram Resolution	0.01 dB ^a	

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of the histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specification	Supplemental Information
Occupied Bandwidth		
Minimum power at RF Input		-30 dBm (nominal)
Frequency Accuracy	±4.8 kHz	RBW = 30 kHz, Number of Points = 1001, Span = 4.8 MHz

Description	Specification	Supplemental Information
Spectrum Emission Mask		
Dynamic Range, relative (815 kHz offset ^{ab})	75.3 dB	81.8 dB (typical)
Sensitivity, absolute (815 kHz offset ^c)	-97.7 dBm	-101.7 dBm (typical)
Accuracy (815 kHz offset)		
Relative ^d	±0.11 dB	
Absolute ^e , 20 to 30°C	±1.15 dB	±0.31 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 30 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -17 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 30 kHz RBW, at a center frequency of 2 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- e. The absolute accuracy of SEM measurement is the same as the absolute accuracy of the spectrum analyzer.

Description	Specification	Supplemental Information
Spurious Emissions		
Dynamic Range ^a , relative (RBW=1 MHz)	76.9 dB	77.4 dB (typical)
Sensitivity ^b , absolute (RBW=1 MHz)	-82.5 dBm	-86.5 dBm (typical)
Accuracy (Attenuation = 10 dB)		
Frequency Range		
9 kHz to 3.6 GHz		±0.38 dB (95th percentile)
3.5 to 7.0 GHz		±1.22 dB (95th percentile)
6.9 to 13.6 GHz		±1.59 dB (95th percentile)

- a. The dynamic range is specified at 12.5 MHz offset from center frequency with mixer level of 1 dB compression point, which will degrade accuracy by 1 dB.
- b. The sensitivity is specified at far offset from carrier, where phase noise does not contribute. You can derive the dynamic range at far offset from 1 dB compression mixer level and sensitivity.

Description	Specification	Supplemental Information
Code Domain		
(BTS Measurements -25 dBm ≤ ML ^a ≤ -15 dBm 20 to 30°C)		Set the attenuation to meet the Mixer Level requirement
Code Domain Power		
Absolute Accuracy		
-10 dBc DPCH, Atten = 10 dB ^b		±0.32 dB (95th percentile)
-10 dBc HS-PDSCH, Atten = 10 dB ^b		±0.33 dB (95th percentile)
Relative Accuracy		
Code domain power range ^c	DPCH HS-PDSCH	
0 to -10 dBc	±0.02 dB ±0.03 dB	
-10 to -20 dBc	±0.06 dB ±0.11 dB	
-20 to -30 dBc	±0.19 dB ±0.32 dB	
Symbol Power vs Time ^b		
Relative Accuracy		
Code domain power range	DPCH HS-PDSCH	
0 to -10 dBc	±0.02 dB ±0.03 dB	
-10 to -20 dBc	±0.06 dB ±0.11 dB	
-20 to -30 dBc	±0.19 dB ±0.32 dB	

TD-SCDMA Measurement Application
Measurements

Description	Specification	Supplemental Information
Symbol error vector magnitude Accuracy DPCH Channel (0 to -25 dBc) HS-PDSCH Channel (0 to -25 dBc)		±1.1% (nominal) ±1.2% (nominal)

- a. ML (mixer level) is RF input power minus attenuation.
- b. Code Domain Power Absolute accuracy is calculated as sum of 95th percentile Absolute Amplitude Accuracy and Code Domain relative accuracy at Code Power Level.
- c. This is tested for signal with 2 DPCH or 2 HS-PDSCH in TS0.

Description	Specification	Supplemental Information
<p>Modulation Accuracy (Composite EVM)</p> <p>(BTS Measurements $-25 \text{ dBm} \leq \text{ML}^a \leq -15 \text{ dBm}$ 20 to 30°C)</p> <p>Composite EVM</p> <p>Range</p> <p>Test signal with TS0 active and one DPCH in TS0</p> <p>Test signal with TS0 active and one HS-PDSCH in TS0</p> <p>Floor^b</p> <p>Accuracy</p> <p>Test signal with TS0 active and one DPCH in TS0</p> <p>EVM $\leq 9\%$</p> <p>EVM $9\% < \text{EVM} \leq 18\%$</p> <p>Test signal with TS0 active and one HS-PDSCH in TS0</p> <p>Peak Code Domain Error</p> <p>Accuracy</p> <p>Test signal with TS0 active and one DPCH in TS0</p> <p>Test signal with TS0 active and one HS-PDSCH in TS0</p> <p>I/Q Origin Offset</p> <p>DUT Maximum Offset</p> <p>Analyzer Noise Floor</p> <p>Frequency Error</p> <p>Range</p> <p>Accuracy</p> <p>Test signal with TS0 active and one DPCH in TS0</p> <p>Test signal with TS0 active and one HS-PDSCH in TS0</p>	<p>0 to 18%</p> <p>1.5%</p> <p>$\pm 0.7\%$^{cd}</p> <p>$\pm 1.1\%$</p> <p>$\pm 0.3 \text{ dB}$</p> <p>$\pm 1.0 \text{ dB}$</p>	<p>Set the attenuation to meet the Mixer Level requirement</p> <p>0 to 17% (nominal)</p> <p>$\pm 1.1\%$ (nominal)</p> <p>-20 dBc (nominal)</p> <p>-50 dBc (nominal)</p> <p>$\pm 7 \text{ kHz}$ (nominal)^e</p> <p>$\pm 6 \text{ Hz} + \text{tfa}^f$ (nominal)</p>

a. ML (mixer level) is RF input power minus attenuation.

b. The EVM floor is derived for signal power -20 dBm . The signal has only 1 DPCH or HS-PDSCH in TS0.

TD-SCDMA Measurement Application
Measurements

- c. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: $\text{error} = [\text{sqrt}(\text{EVMUUT}^2 + \text{EVMsa}^2)] - \text{EVMUUT}$, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent. For example, if the EVM of the UUT is 7%, and the floor is 2.5%, the error due to the floor is 0.43%.
- d. The accuracy is derived in the EVM range 0 to 18%. We choose the maximum EVM variance in the results as the accuracy.
- e. This specifies a synchronization range with Midamble.
- f. $\text{tfa} = \text{transmitter frequency} \times \text{frequency reference accuracy}$.

In-Band Frequency Range

Operating Band	Frequencies
I	1900 to 1920 MHz 2010 to 2025 MHz
II	1850 to 1910 MHz 1930 to 1990 MHz
III	1910 to 1930 MHz

This chapter contains specifications for the N9073A W-CDMA/HSPA/HSPA⁺ measurement application. It contains N9073A-1FP W-CDMA, N9073A-2FP HSPA and N9073A-3FP HSPA⁺ measurement applications.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove those variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

The specifications for this chapter apply only to instruments with Frequency *Option 503, 507, 513* or *526*. For Instruments with higher frequency options, the performance is nominal only and not subject to any warranted specifications.

Measurements

Description	Specifications	Supplemental Information
Channel Power Minimum power at RF Input Absolute power accuracy ^a (20 to 30°C, Atten = 10 dB) 95th percentile Absolute power accuracy (20 to 30°C, Atten = 10 dB) Measurement floor	± 1.04 dB	-50 dBm (nominal) ± 0.27 dB -80.8 dBm (nominal)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Adjacent Channel Power		
(ACPR; ACLR)		
Single Carrier		
Minimum power at RF Input		-36 dBm (nominal)
ACPR Accuracy ^{ab}		RRC weighted, 3.84 MHz noise bandwidth, method = IBW or Fast ^c
Radio	Offset Freq	
MS (UE)	5 MHz	±0.18 dB
MS (UE)	10 MHz	±0.26 dB
BTS	5 MHz	±0.79 dB
BTS	10 MHz	±0.62 dB
BTS	5 MHz	±0.34 dB
Dynamic Range		
Noise Correction	Offset Freq	Method
off	5 MHz	Filtered IBW
off	5 MHz	Fast
off	10 MHz	Filtered IBW
on	5 MHz	Filtered IBW
on	10 MHz	Filtered IBW
RRC Weighting Accuracy ⁱ		
White noise in Adjacent Channel		0.00 dB (nominal)
TOI-induced spectrum		0.001 dB (nominal)
rms CW error		0.012 dB (nominal)

- The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately $-37 \text{ dBm} - (\text{ACPR}/3)$, where the ACPR is given in (negative) decibels.
- Accuracy is specified without NC. NC will make the accuracy even better.
- The Fast method has a slight decrease in accuracy in only one case: for BTS measurements at 5 MHz offset, the accuracy degrades by $\pm 0.01 \text{ dB}$ relative to the accuracy shown in this table.

- d. To meet this specified accuracy when measuring mobile station (MS) or user equipment (UE) within 3 dB of the required -33 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is -22 dBm, so the input attenuation must be set as close as possible to the average input power $-(-22$ dBm). For example, if the average input power is -6 dBm, set the attenuation to 16 dB. This specification applies for the normal 3.5 dB peak-to-average ratio of a single code. Note that if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- e. ACPR accuracy at 10 MHz offset is warranted when the input attenuator is set to give an average mixer level of -14 dBm.
- f. In order to meet this specified accuracy, the mixer level must be optimized for accuracy when measuring node B Base Transmission Station (BTS) within 3 dB of the required -45 dBc ACPR. This optimum mixer level is -19 dBm, -18 dBm, so the input attenuation must be set as close as possible to the average input power $-(-19$ dBm). For example, if the average input power is -5 dBm, set the attenuation to 14 dB. This specification applies for the normal 10 dB peak-to-average ratio (at 0.01% probability) for Test Model 1. Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
- g. Accuracy can be excellent even at low ACPR levels assuming that the user sets the mixer level to optimize the dynamic range, and assuming that the analyzer and UUT distortions are incoherent. When the errors from the UUT and the analyzer are incoherent, optimizing dynamic range is equivalent to minimizing the contribution of analyzer noise and distortion to accuracy, though the higher mixer level increases the display scale fidelity errors. This incoherent addition case is commonly used in the industry and can be useful for comparison of analysis equipment, but this incoherent addition model is rarely justified. This derived accuracy specification is based on a mixer level of -14 dBm.
- h. Agilent measures 100% of the signal analyzers for dynamic range in the factory production process. This measurement requires a near-ideal signal, which is impractical for field and customer use. Because field verification is impractical, Agilent only gives a typical result. More than 80% of prototype instruments met this “typical” specification; the factory test line limit is set commensurate with an on-going 80% yield to this typical.

The ACPR dynamic range is verified only at 2 GHz, where Agilent has the near-perfect signal available. The dynamic range is specified for the optimum mixer drive level, which is different in different instruments and different conditions. The test signal is a 1 DPCH signal.

The ACPR dynamic range is the observed range. This typical specification includes no measurement uncertainty.
- i. 3GPP requires the use of a root-raised-cosine filter in evaluating the ACLR of a device. The accuracy of the passband shape of the filter is not specified in standards, nor is any method of evaluating that accuracy. This footnote discusses the performance of the filter in this instrument. The effect of the RRC filter and the effect of the RBW used in the measurement interact. The analyzer compensates the shape of the RRC filter to accommodate the RBW filter. The effectiveness of this compensation is summarized in three ways:
 - White noise in Adj Ch: The compensated RRC filter nominally has no errors if the adjacent channel has a spectrum that is flat across its width.
 - TOI-induced spectrum: If the spectrum is due to third-order intermodulation, it has a distinctive shape. The computed errors of the compensated filter are -0.004 dB for the 470 kHz RBW used for UE testing with the IBW method and also used for all testing with the Fast method, and 0.000 dB for the 30 kHz RBW filter used for BTS testing with the IBW method. The worst error for RBWs between these extremes is 0.05 dB for a 330 kHz RBW filter.
 - rms CW error: This error is a measure of the error in measuring a CW-like spurious component. It is evaluated by computing the root of the mean of the square of the power error across all frequencies within the adjacent channel. The computed rms error of the compensated filter is 0.023 dB for the 470 kHz RBW used for UE testing with the IBW method and also used for all testing with the Fast method, and 0.000 dB for the 30 kHz RBW filter used for BTS testing. The worst error for RBWs between these extremes is 0.057 dB for a 430 kHz RBW filter.

Description	Specifications	Supplemental Information
Power Statistics CCDF Histogram Resolution	0.01 dB ^a	

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of the histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Occupied Bandwidth Minimum power at RF Input Frequency Accuracy	± 10 kHz	-30 dBm (nominal) RBW = 30 kHz, Number of Points = 1001, span = 10 MHz

Description	Specifications	Supplemental Information
Spectrum Emission Mask Dynamic Range, relative (2.515 MHz offset ^{ab}) Sensitivity, absolute (2.515 MHz offset ^c) Accuracy (2.515 MHz offset) Relative ^d Absolute ^e (20 to 30°C)	78.5 dB -97.7 dBm ± 0.11 dB ± 1.15 dB	84.2 dB (typical) -101.7 dBm (typical) ± 0.31 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 30 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -16 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 30 kHz RBW, at a center frequency of 2 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.
- e. The absolute accuracy of SEM measurement is the same as the absolute accuracy of the spectrum analyzer. See “[Absolute Amplitude Accuracy](#)” on page 36 for more information. The numbers shown are for 0 to 3.6 GHz, with attenuation set to 10 dB.

W-CDMA Measurement Application
Measurements

Description	Specifications	Supplemental Information
Spurious Emissions Dynamic Range ^a , relative (RBW=1 MHz) Sensitivity ^b , absolute (RBW=1 MHz) Accuracy (Attenuation = 10 dB) Frequency Range 9 kHz to 3.6 GHz 3.5 to 7.0 GHz 7.0 to 13.6 GHz	76.9 dB -82.5 dBm	Table-driven spurious signals; search across regions 77.4 dB (typical) -86.5 dBm (typical) ±0.38 dB (95th percentile) ±1.22 dB (95th percentile) ±1.59 dB (95th percentile)

- a. The dynamic range is specified at 12.5 MHz offset from center frequency with mixer level of 1 dB compression point, which will degrade accuracy by 1 dB.
- b. The sensitivity is specified at far offset from carrier, where phase noise does not contribute. You can derive the dynamic range at far offset from 1 dB compression mixer level and sensitivity.

Description	Specifications	Supplemental Information
<p>Code Domain (BTS Measurements –25 dBm ≤ ML^a ≤ –15 dBm 20 to 30°C)</p> <p>Code domain power Absolute accuracy^b (–10 dBc CPICH, Atten = 10 dB)</p> <p>Relative accuracy</p> <p>Code domain power range</p> <p>0 to –10 dBc</p> <p>–10 to –30 dBc</p> <p>–30 to –40 dBc</p> <p>Power Control Steps</p> <p>Accuracy</p> <p>0 to –10 dBc</p> <p>–10 to –30 dBc</p> <p>Power Dynamic Range</p> <p>Accuracy (0 to –40 dBc)</p> <p>Symbol power vs. time</p> <p>Relative accuracy</p> <p>Code domain power range</p> <p>0 to –10 dBc</p> <p>–10 to –30 dBc</p> <p>–30 to –40 dBc</p> <p>Symbol error vector magnitude</p> <p>Accuracy (0 to –25 dBc)</p>	<p>±0.015 dB</p> <p>±0.06 dB</p> <p>±0.07 dB</p> <p>±0.03 dB</p> <p>±0.12 dB</p> <p>±0.14 dB</p> <p>±0.015 dB</p> <p>±0.06 dB</p> <p>±0.07 dB</p>	<p>RF input power and attenuation are set to meet the Mixer Level range.</p> <p>±0.29 dB (95th percentile)</p> <p>±1.0% (nominal)</p>

- a. ML (mixer level) is RF input power minus attenuation.
- b. Code Domain Power Absolute accuracy is calculated as sum of 95% Confidence Absolute Amplitude Accuracy and Code Domain relative accuracy at Code Power level.

W-CDMA Measurement Application
Measurements

Description	Specifications	Supplemental Information
Power Control Absolute power measurement Accuracy 0 to -20 dBm -20 to -60 dBm Relative power measurement Accuracy Step range ± 1.5 dB Step range ± 3.0 dB Step range ± 4.5 dB Step range ± 26.0 dB		Using 5 MHz resolution bandwidth ± 0.7 dB (nominal) ± 1.0 dB (nominal) ± 0.1 dB (nominal) ± 0.15 dB (nominal) ± 0.2 dB (nominal) ± 0.3 dB (nominal)

In-Band Frequency Range

Operating Band	UL Frequencies UE transmit, Node B receive	DL Frequencies UE receive, Node B transmit
I	1920 to 1980 MHz	2110 to 2170 MHz
II	1850 to 1910 MHz	1930 to 1990 MHz
III	1710 to 1785 MHz	1805 to 1880 MHz
IV	1710 to 1755 MHz	2110 to 2155 MHz
V	824 to 849 MHz	869 to 894 MHz
VI	830 to 840 MHz	875 to 885 MHz
VII	2500 to 2570 MHz	2620 to 2690 MHz
VIII	880 to 915 MHz	925 to 960 MHz
IX	1749.9 to 1784.9 MHz	1844.9 to 1879.9 MHz
X	1710 to 1770 MHz	2110 to 2170 MHz
XI	1427.9 to 1452.9 MHz	1475.9 to 1500.9 MHz
XII	698 to 716 MHz	728 to 746 MHz
XIII	777 to 787 MHz	746 to 756 MHz
XIV	788 to 798 MHz	758 to 768 MHz

W-CDMA Measurement Application
In-Band Frequency Range

Single Acquisition Combined Fixed WiMAX Measurement Application

This chapter contains specifications for the N9074A, Combined Fixed WiMAX measurement application.¹

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications for dynamic range and sensitivity in this chapter include the highest variations in the noise commonly encountered. The specifications for accuracy apply only with adequate (external to the application) averaging to remove the variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

1. Currently, the *Option B40, B85, B1A, B1X, DP2, or MPB* hardware does not support single acquisition combined measurement applications.

Measurements

Description	Specifications	Supplemental Information
Transmit Power (10 MHz Integration BW) Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C)	±1.46 dB	Input signal must not be bursted –50 dBm (nominal) ±0.42 dB (95th percentile)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Tx Output Spectrum (10 MHz Transmission BW RBW = 100 kHz 5.05 MHz offset) Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	±0.63 dB ±1.55 dB	Tx Output Spectrum measurement is the same as a Spectrum Emission Mask measurement 63.6 dB (nominal) –80.7 dBm (nominal)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about –13.91 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 2 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications	Supplemental Information
64QAM EVM (ML ^a = -10 dBm 20 to 30°C) EVM Operating range Floor Accuracy ^b from 0.5% to 2.0% from 2.0% to 8.0% I/Q Origin Offset UUT Maximum Offset Analyzer Noise Floor Frequency Range Accuracy		10 MHz bandwidth profile. Code Rate: 3/4 EQ Seq Track Phase On Track Amp Off Track Timing Off 0.1 to 8% (nominal) -45.0 dB (0.57%) (nominal) ±0.30% (nominal) ±0.10% (nominal) -10 dBc (nominal) -50 dBc (nominal) ±100 kHz (nominal) ±10 Hz+tfa ^c

- a. ML (mixer level) is RF input power minus attenuation
- b. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: $\text{error} = \sqrt{\text{EVMUUT}^2 + \text{EVMsa}^2} - \text{EVMUUT}$, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent.
- c. tfa = transmitter frequency × frequency reference accuracy.

In-Band Frequency Range for Warranted Specifications

Band Class	Spectrum Range
1	2.305 to 2.320 GHz 2.345 to 2.360 GHz
2	2.150 to 2.162 GHz 2.500 to 2.690 GHz (USA)
3	2.150 to 2.162 GHz 2.500 to 2.596 GHz 2.686 to 2.688 GHz (Canada)
4	2.400 to 2.4835 GHz

The following band class can be measured but is not subject to warranted specifications.

Band Class	Spectrum Range
5	3.410 to 4.200 GHz 3.400 to 3.700 GHz 3.650 to 3.700 GHz 4.940 to 4.990 GHz

This chapter contains specifications for the N9077A WLAN measurement application.

Additional Definitions and Requirements

Because digital communications signals are noise-like, all measurements will have variations. The specifications apply only with adequate averaging to remove the variations.

The specifications apply in the frequency range documented in In-Band Frequency Range.

Different IEEE radio standard requires relative minimum hardware bandwidth for OFDM analysis:

802.11a/b/g/p, or 11n(20 MHz), or 11ac(20 MHz) requires N9010A-B25 or above.

802.11n (40 MHz), or 11ac (40 MHz) requires N9010A-B40 or above.

The List sequence measurements requires N9010A-B40.

Measurements

Description	Specifications	Supplemental Information
Channel Power 20 MHz Integration BW		Radio standards are: 802.11a/g/j/p (OFDM) or 802.11g (DSSS-OFDM) or 802.11n (20 MHz) or 802.11ac (20 MHz), 5 GHz band
Minimum power at RF Input		–50 dBm (nominal)
	Center Freq	Center Freq
	2.4 GHz 5.0 GHz	2.4 GHz 5.0 GHz
Absolute Power Accuracy ^a (20 to 30°C)	±1.04 dB ±2.44 dB	±0.27 dB (95th percentile) ±0.50 dB (95th percentile)
Measurement floor		–73.7 dBm (typical) –73.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Channel Power 40 MHz Integration BW		Radio standard is: 802.11n (40 MHz) or 802.11ac (40 MHz), 5 GHz band
Minimum power at RF Input		–50 dBm (nominal)
	Center Freq	Center Freq
	2.4 GHz 5.0 GHz	2.4 GHz 5.0 GHz
Absolute Power Accuracy ^a (20 to 30°C)	±1.04 dB ±2.44 dB	±0.27 dB (95th percentile) ±0.50 dB (95th percentile)
Measurement floor		–70.7 dBm (typical) –70.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Channel Power 22 MHz Integration BW Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor	± 1.04 dB	Radio standard is: 802.11b/g (DSSS/CCK/PBCC) Center Frequency in 2.4 GHz Band -50 dBm (nominal) ± 0.27 dB (95th percentile) -73.2 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Channel Power 80 MHz Integration BW Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor	± 2.44 dB	Radio standard is: 802.11ac (80 MHz) Center Frequency in 5.0 GHz Band -50 dBm (nominal) ± 0.50 dB (95th percentile) -67.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Channel Power 160 MHz Integration BW Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor	± 2.44 dB	Radio standard is: 802.11ac (160 MHz) Center Frequency in 5.0 GHz Band -50 dBm (nominal) ± 0.50 dB (95th percentile) -64.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Power Statistics CCDF		Radio standards are: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11b/g (DSSS/CCK/PBCC), 802.11n (20 MHz), 802.11n (40 MHz), 802.11ac (20 MHz), 802.11ac (40 MHz)or
Minimum power at RF Input		Center Frequency in 2.4 GHz Band or 5.0 GHz Band -50 dBm (nominal)
Histogram Resolution	0.01 dB ^a	

- a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Description	Specifications	Supplemental Information
Occupied Bandwidth		Radio standards are: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11b/g (DSSS/CCK/PBCC), 802.11n (20 MHz), 802.11n (40 MHz), 802.11ac (20 MHz), 802.11ac (40 MHz), 802.11ac (80 MHz) or 802.11ac (160 MHz)
Minimum power at RF Input		Center Frequency in 2.4 GHz Band or 5.0 GHz Band -30 dBm (nominal)
Frequency accuracy	±25 kHz	RBW = 100 kHz Number of Points = 1001 Span = 25 MHz

Description	Specifications	Supplemental Information
Power vs. Time Measurement results type Average Type Measurement Time Dynamic Range	0.01 dB	Radio standard is: 802.11/b/g (DSSS/CCK/PBCC) Center Frequency in 2.4 GHz Band Min, Max, Mean Off, RMS, Log Up to 88 ms 59.0 dB (nominal)

Description	Specifications	Supplemental Information
Spectrum Emission Mask 18 MHz Transmission BW RBW = 100 kHz 11.0 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	75.1 dB -92.5 dBm ±0.12 dB ±1.15 dB	Radio standards are: 802.11a/g/j/p (OFDM) 802.11g (DSSS-OFDM) or 802.11n (20 MHz) Center Frequency in 2.4 GHz Band 80.6 dB (typical) -96.5 dBm (typical) ±0.31 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 2.412 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications	Supplemental Information
Spectrum Emission Mask 18 MHz Transmission BW RBW = 100 kHz 11.0 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	75.4 dB -92.5 dBm ±0.12 dB ±2.55 dB	Radio standards are: 802.11a/g (OFDM), 802.11n (20 MHz) or 802.11ac (20 MHz) Center Frequency in 5.0 GHz Band 80.6 dB (typical) -96.5 dBm (typical) ±0.54 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 5.18 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications		Supplemental Information	
Spectrum Emission Mask (38 MHz Transmission BW RBW = 100 kHz 21.0 MHz offset)			Radio standard is: 802.11n (40 MHz) or 802.11ac (40 MHz) 5.0 GHz Band	
	Center Freq		Center Freq	
	2.4 GHz	5.0 GHz	2.4 GHz	5.0 GHz
Dynamic Range, relative ^{ab}	76.5 dB	76.5 dB	80.9 dB (typical)	80.9 dB (typical)
Sensitivity, absolute ^c	-92.5 dBm	-92.5 dBm	-96.5 dBm (typical)	-96.5 dBm (typical)
Accuracy				
Relative ^d	±0.12 dB	±0.12 dB		
Absolute (20 to 30°C)	±1.15 dB	±2.55 dB	±0.31 dB (95th percentile)	±0.54 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 2.412 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications	Supplemental Information
Spectrum Emission Mask 22 MHz Transmission BW RBW = 100 kHz 11.0 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	75.5 dB -92.5 dBm ±0.12 dB ±1.15 dB	Radio standard is: 802.11b/g (DSSS/CCK/PBCC) Center Frequency in 2.4 GHz Band 80.7 dB (typical) -96.5 dBm (typical) ±0.31 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 2.412 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications	Supplemental Information
Spectrum Emission Mask 78 MHz Transmission BW RBW = 100 kHz 41.0 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	77.1 dB -92.5 dBm ±0.12 dB ±2.55 dB	Radio standard is: 802.11ac (80 MHz) Center Frequency in 5.0 GHz Band 81.1 dB (typical) -96.5 dBm (typical) ±0.54 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 2.412 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications	Supplemental Information
Spectrum Emission Mask 158 MHz Transmission BW RBW = 100 kHz 81.0 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	77.5 dB -92.5 dBm ±0.12 dB ±2.55 dB	Radio standard is: 802.11ac (160 MHz) Center Frequency in 5.0 GHz Band 81.2 dB (typical) -96.5 dBm (typical) ±0.54 dB (95th percentile)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 2.412 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications		Supplemental Information	
Spurious Emission ML = 3 dBm, 0 to 55° C RBW = 100 kHz			Radio standards are: 802.11a/g/j/p (OFDM), 802.11b/g (DSSS/CCK/PBCC), 802.11g (DSSS-OFDM), 802.11n (20 MHz), 802.11n (40 MHz), 802.11ac (20 MHz) 5.0 GHz Band, 802.11ac (40 MHz) 5.0 GHz Band, 802.11ac (80 MHz) 5.0 GHz Band or 802.11ac (160 MHz) 5.0 GHz Band	
	Center Freq		Center Freq	
	2.4 GHz	5.0 GHz	2.4 GHz	5.0 GHz
Dynamic Range ^a , relative (RBW= 1 MHz)	76.9 dB	76.3 dB	77.4 dB (typical)	77.1 dB (typical)
Sensitivity ^b , absolute (RBW= 1 MHz)	-82.5 dBm	-82.5 dBm	-86.5 dBm (typical)	-86.5 dBm (typical)
Accuracy, absolute			(95th percentile)	(95th percentile)
20 Hz to 3.6 GHz			±0.38 dB	±0.38 dB
3.5 to 8.4 GHz			±1.22 dB	±1.22 dB
8.3 to 13.6 GHz			±1.59 dB	±1.59 dB

- a. The dynamic range is specified at 12.5 MHz offset from center frequency with mixer level of 1 dB compression point, which will degrade accuracy 1 dB.
- b. The sensitivity is specified at far offset from carrier, where phase noise does not contribute. You can derive the dynamic range at far offset from 1 dB compression mixer level and sensitivity.

WLAN Measurement Application
Measurements

Description	Specifications		Supplemental Information	
64QAM EVM , 2.4 GHz band RF Input Level = -10 dBm, Attenuation = 10 dB, 20 to 30°C			Radio standards ^a are: 802.11 a/g/j/p (OFDM), 802.11 g (DSSS-OFDM), 802.11 n (20 MHz) 802.11 n (40 MHz) Code Rate: 3/4 EQ Training: Channel Est Seq Only Track Phase On Track Amp Off Track Timing Off	
EVM floor	20 MHz	40 MHz^b	20 MHz (nominal)	40 MHz^b (nominal)
Early analyzers ^c (SN prefix <MY/SG/US5340)	-43.0 dB (0.70%) ^d	-42.0 dB (0.79%)	-49.0 dB (0.36%)	-46.0 dB (0.50%)
Analyzers with -EP3 ^e (SN prefix ≥MY/SG/US5340, ship standard with N9010A-EP3)	-46.0 dB (0.50%)	-44.0 dB (0.63%)	-51.0 dB (0.28%)	-48.0 dB (0.40%)
Accuracy (EVM Range:0 to 8.0%)			±0.30%	
Frequency Error				
Range			±100 kHz	
Accuracy			±10 Hz + tfa ^f	

- a. The specifications for these radio standards can apply to WLAN List Sequence measurements
- b. Requires *Option B40*.
- c. Phase Noise Optimization left at its default setting (Best Wide-offset ϕ Noise, >30 kHz)
- d. In these specifications, those values with dB units are the specifications, while those with % units, in parentheses, are conversions from the dB units to % for reader convenience.
- e. Phase Noise Optimization left at its default setting (Fast Tuning)
- f. tfa = transmitter frequency × frequency reference accuracy.

Description	Specifications	Supplemental Information												
64QAM EVM , 5.0 GHz band RF Input Level = -10 dBm, Attenuation = 10 dB, 20 to 30°C EVM floor Early analyzers ^{cd} (SN prefix <MY/SG/US5340) Analyzers with -EP3 ^{df} (SN prefix ≥MY/SG/US5340, ship standard with N9010A-EP3) Accuracy (EVM Range:0 to 8.0%) Frequency Error Range Accuracy		Radio standards ^a are: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11n (20 MHz) 802.11n (40 MHz) Code Rate: 3/4 EQ Training: Channel Est Seq Only Track Phase On Track Amp Off Track Timing Off <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">20 MHz</td> <td style="text-align: center;">40 MHz^b</td> </tr> <tr> <td style="text-align: center;">(nominal)</td> <td style="text-align: center;">(nominal)</td> </tr> <tr> <td style="text-align: center;">-47.0 dB</td> <td style="text-align: center;">-45.0 dB</td> </tr> <tr> <td style="text-align: center;">(0.45%)^e</td> <td style="text-align: center;">(0.56%)</td> </tr> <tr> <td style="text-align: center;">-48.0 dB</td> <td style="text-align: center;">-46.0 dB</td> </tr> <tr> <td style="text-align: center;">(0.40%)</td> <td style="text-align: center;">(0.50%)</td> </tr> </table> ±0.30% ±100 kHz ±10 Hz + tfa ^g	20 MHz	40 MHz^b	(nominal)	(nominal)	-47.0 dB	-45.0 dB	(0.45%) ^e	(0.56%)	-48.0 dB	-46.0 dB	(0.40%)	(0.50%)
20 MHz	40 MHz^b													
(nominal)	(nominal)													
-47.0 dB	-45.0 dB													
(0.45%) ^e	(0.56%)													
-48.0 dB	-46.0 dB													
(0.40%)	(0.50%)													

- a. The specifications for these radio standards can apply to WLAN List Sequence measurements
- b. Requires *Option B40*.
- c. Phase Noise Optimization left at its default setting (Best Wide-offset ϕ Noise,>30 kHz)
- d. The EVM Floor specification applies when the signal path is set to μ W Preselector Bypass (Option MPB enabled) for center frequencies above 3.6 GHz.
- e. In these specifications, those values with dB units are the specifications, while those with % units, in parentheses, are conversions from the dB units to % for reader convenience.
- f. Phase Noise Optimization left at its default setting (Fast Tuning)
- g. tfa = transmitter frequency \times frequency reference accuracy.

WLAN Measurement Application
Measurements

Description	Specifications	Supplemental Information
CCK 11Mbps (RF Input Level = -10 dBm, Attenuation = 10 dB) 20 to 30°C EVM Floor ^{ab} (EQ Off) Floor(EQ On) Accuracy (EVM Range: 0 to 2.0%) (EVM Range: 2 to 20.0%) Frequency Error Range Accuracy	-36.2 dB (1.55%)	Radio standard is: 802.11/b/g (DSSS/CCK/PBCC) Center Frequency in 2.4 GHz Band Reference Filter: Gaussian -39.7 dB (1.03%) (nominal) -46.0 dB (0.50%) (nominal) ±0.90% (nominal) ±0.40% (nominal) ±100 kHz (nominal) ±10 Hz + tfa ^c (nominal)

- a. In these specifications, those values with dB units are the specifications, while those with % units, in parentheses, are conversions from the dB units to % for reader convenience.
- b. The EVM Floor specification applies when Phase Noise Optimization is set to Wide-offset (>30 kHz)
- c. tfa = transmitter frequency × frequency reference accuracy.

List Sequence Measurements¹

Description	Specifications	Supplemental Information
Transmit Power 20 MHz Integration BW Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor		Radio standard is: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11n (20 MHz) or 802.11ac (20 MHz) Center Frequency in 2.4 GHz Band –35 dBm (nominal) ±0.49 dB (nominal) –73.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Transmit Power 20 MHz Integration BW Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor		Radio standard is: 802.11a/g/j/p (OFDM), 802.11n (20 MHz) or 802.11ac (20 MHz) Center Frequency in 5.0 GHz Band –35 dBm (nominal) ±0.93 dB (nominal) –73.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

1. Requires *Option N9077A-5FP* be installed and licensed.

WLAN Measurement Application
List Sequence Measurements

Description	Specifications	Supplemental Information
Transmit Power 40 MHz Integration BW Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor		Radio standard is: 802.11n (40 MHz) or 802.11ac (40 MHz) Center Frequency in 2.4 GHz Band –35 dBm (nominal) ±0.49 dB (nominal) –70.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Transmit Power 40 MHz Integration BW Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor		Radio standard is: 802.11n (40 MHz) or 802.11ac (40 MHz) Center Frequency in 5.0 GHz Band –35 dBm (nominal) ±0.93 dB (nominal) –70.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
Transmit Power 22 MHz Integration BW Minimum power at RF Input Absolute Power Accuracy ^a (20 to 30°C) Measurement floor		Radio standard is: 802.11b/g (DSSS/CCK/PBCC) Center Frequency in 2.4 GHz Band –35 dBm (nominal) ±0.49 dB (nominal) –73.7 dBm (typical)

- a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that the measurement floor contribution is negligible.

Description	Specifications	Supplemental Information
<p>Transmit Output Spectrum</p> <p>18 MHz Transmission BW RBW = 100 kHz 11.0 MHz offset</p> <p>Dynamic Range, relative^{ab}</p> <p>Sensitivity, absolute^c</p> <p>Accuracy Relative^d</p> <p>Absolute (20 to 30°C)</p>	<p>75.4 dB</p> <p>-92.5 dBm</p> <p>±0.21 dB</p>	<p>Radio standards are: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11n (20 MHz) or 802.11ac (20 MHz)</p> <p>Center Frequency in 2.4 GHz Band</p> <p>80.6 dB (typical)</p> <p>-96.5 dBm (typical)</p> <p>±0.50 dB (nominal)</p>

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 2.412 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

WLAN Measurement Application
List Sequence Measurements

Description	Specifications	Supplemental Information
Transmit Output Spectrum 18 MHz Transmission BW RBW = 100 kHz 11.0 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	 75.4 dB -92.5 dBm ±0.52 dB	Radio standards are: 802.11a/g (OFDM), 802.11n (20 MHz) or 802.11ac (20 MHz) Center Frequency in 5.0 GHz Band 80.6 dB (typical) -96.5 dBm (typical) ±0.94 dB (nominal)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 5.18 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications	Supplemental Information
<p>Transmit Output Spectrum</p> <p>38 MHz Transmission BW RBW = 100 kHz 21.0 MHz offset</p> <p>Dynamic Range, relative^{ab} Sensitivity, absolute^c Accuracy Relative^d Absolute (20 to 30°C)</p>	<p>76.5 dB -92.5 dBm ±0.23 dB</p>	<p>Radio standards are: 802.11n (40 MHz) or 802.11ac (40 MHz)</p> <p>Center Frequency in 2.4 GHz Band</p> <p>80.9 dB (typical) -96.5 dBm (typical) ±0.50 dB (nominal)</p>

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 5.18 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

WLAN Measurement Application
List Sequence Measurements

Description	Specifications	Supplemental Information
Transmit Output Spectrum 38 MHz Transmission BW RBW = 100 kHz 21.0 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	 76.5 dB -92.5 dBm ±0.63 dB	Radio standards are: 802.11n (40 MHz) or 802.11ac (40 MHz) Center Frequency in 5.0 GHz Band 80.9 dB (typical) -96.5 dBm (typical) ±0.94 dB (nominal)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 5.18 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Description	Specifications	Supplemental Information
Transmit Output Spectrum 22 MHz Transmission BW RBW = 100 kHz 11.0 MHz offset Dynamic Range, relative ^{ab} Sensitivity, absolute ^c Accuracy Relative ^d Absolute (20 to 30°C)	75.5 dB -92.5 dBm ±0.21 dB	Radio standard is: 802.11b/g (DSSS/CCK/PBCC) Center Frequency in 2.4 GHz Band 80.7 dB (typical) -96.5 dBm (typical) ±0.50 dB (nominal)

- a. The dynamic range specification is the ratio of the channel power to the power in the offset specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Default measurement settings include 100 kHz RBW.
- b. This dynamic range specification applies for the optimum mixer level, which is about -14 dBm. Mixer level is defined to be the average input power minus the input attenuation.
- c. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal. The sensitivity at this offset is specified in the default 100 kHz RBW, at a center frequency of 2.412 GHz.
- d. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

WLAN Measurement Application
List Sequence Measurements

Description	Specifications	Supplemental Information
<p>64QAM EVM</p> <p>RF Input Level = -10 dBm, Attenuation = 10 dB, 20 to 30°C</p> <p>EVM Floor^{ab} Accuracy (EVM Range:0 to 8.0%) Frequency Error Range Accuracy</p>		<p>Radio standards are: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11n (20 MHz) or 802.11ac (20 MHz), Center Frequency in 2.4 GHz Band</p> <p>Code Rate: 3/4 EQ Training: Channel Est Seq Only Track Phase On Track Amp Off Track Timing Off</p> <p>-49.0 dB (0.36%) (nominal)</p> <p>±0.30% (nominal)</p> <p>±100 kHz (nominal)</p> <p>±10 Hz + tfa^c (nominal)</p>

- a. In these specifications, those values with dB units are the specifications, while those with % units, in parentheses, are conversions from the dB units to % for reader convenience.
- b. The EVM Floor specification applies when Phase Noise Optimization is set to Wide-offset (>30 kHz)
- c. tfa = transmitter frequency × frequency reference accuracy.

Description	Specifications	Supplemental Information
<p>64QAM EVM RF Input Level = -10 dBm, Attenuation = 10 dB, 20 to 30°C</p> <p>EVM Floor^{abc} Accuracy (EVM Range:0 to 8.0%) Frequency Error Range Accuracy</p>		<p>Radio standards are: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11n (20 MHz) or 802.11ac (20 MHz) Center Frequency in 5.0 GHz Band</p> <p>Code Rate: 3/4 EQ Training: Channel Est Seq Only Track Phase On Track Amp Off Track Timing Off</p> <p>-47.0 dB (0.45%) (nominal)</p> <p>±0.30% (nominal)</p> <p>±100 kHz (nominal)</p> <p>±10 Hz + tfa^d (nominal)</p>

- a. In these specifications, those values with dB units are the specifications, while those with % units, in parentheses, are conversions from the dB units to % for reader convenience.
- b. The EVM Floor specification applies when Phase Noise Optimization is set to Wide-offset (>30 kHz)
- c. The EVM Floor specification applies when μ W Path Control is set to μ W Preselector Bypass.
- d. tfa = transmitter frequency \times frequency reference accuracy.

WLAN Measurement Application
List Sequence Measurements

Description	Specifications	Supplemental Information
<p>64QAM EVM RF Input Level = -10 dBm, Attenuation = 10 dB, 20 to 30°C</p> <p>EVM Floor^{abc} Accuracy (EVM Range:0 to 8.0%) Frequency Error Range Accuracy</p>		<p>Radio standards are: 802.11n (40 MHz) or 802.11ac (40 MHz), Center Frequency in 2.4 GHz Band</p> <p>Code Rate: 3/4 EQ Training: Channel Est Seq Only Track Phase On Track Amp Off Track Timing Off</p> <p>-46.5 dB (0.47%) (nominal)</p> <p>±0.30% (nominal)</p> <p>±100 kHz (nominal)</p> <p>±10 Hz + tfa^d (nominal)</p>

- a. In these specifications, those values with dB units are the specifications, while those with % units, in parentheses, are conversions from the dB units to % for reader convenience.
- b. The EVM Floor specification applies when Phase Noise Optimization is set to Wide-offset (>30 kHz)
- c. The EVM Floor specification applies when B40 is available.
- d. tfa = transmitter frequency × frequency reference accuracy.

Description	Specifications	Supplemental Information
64QAM EVM RF Input Level = -10 dBm, Attenuation = 10 dB, 20 to 30°C EVM Floor ^{abcd} Accuracy (EVM Range: 0 to 8.0%) Frequency Error Range Accuracy		Radio standards are: 802.11n (40 MHz) or 802.11ac (40 MHz), Center Frequency in 5.0 GHz Band Code Rate: 3/4 EQ Training: Channel Est Seq Only Track Phase On Track Amp Off Track Timing Off -45.5 dB (0.53%) (nominal) ±0.30% (nominal) ±100 kHz (nominal) ±10 Hz + tfa ^e (nominal)

- In these specifications, those values with dB units are the specifications, while those with % units, in parentheses, are conversions from the dB units to % for reader convenience.
- The EVM Floor specification applies when Phase Noise Optimization is set to Wide-offset (>30 kHz)
- The EVM Floor specification applies when *B40*, *B85*, *B1A*, or *B1X* is available.
- The EVM Floor specification applies when μ W Path Control is set to μ W Preselector Bypass.
- tfa = transmitter frequency \times frequency reference accuracy.

Description	Specifications	Supplemental Information
CCK 11Mbps RF Input Level = -10 dBm, Attenuation = 10 dB 20 to 30°C EVM Floor ^{ab} (EQ Off) Floor (EQ On) Accuracy (EVM Range: 0 to 2.0%) (EVM Range: 2 to 20.0%) Frequency Error Range Accuracy		Radio standard is: 802.11/b/g (DSSS/CCK/PBCC) Center Frequency in 2.4 GHz Band Reference Filter: Gaussian -39.7 dB (1.03%) (nominal) -46.0 dB (0.50%) (nominal) ±0.90% (nominal) ±0.40% (nominal) ±100 kHz (nominal) ±10 Hz + tfa ^c (nominal)

- In these specifications, those values with dB units are the specifications, while those with % units, in parentheses, are conversions from the dB units to % for reader convenience.
- The EVM Floor specification applies when Phase Noise Optimization is set to Wide-offset (>30 kHz)
- tfa = transmitter frequency \times frequency reference accuracy.

In-Band Frequency Range for Warranted Specifications

Description	Spectrum Range	Supplemental Information
Radio standard is 802.11b/g (DSSS/CCK/PBCC)	2.4 GHz Band	Channel center frequency = 2407 MHz + 5 × k MHz, k = 1,...,13
Radio standards are: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11n (20 MHz), 802.11n (40 MHz), 802.11ac (20 MHz), or 802.11ac (40 MHz),	2.4 GHz Band	Channel center frequency = 2407 MHz + 5 × k MHz, k = 1,...,13
Radio standards are: 802.11a/g/j/p (OFDM), 802.11g (DSSS-OFDM), 802.11n (20 MHz), 802.11n (40 MHz), 802.11ac (20 MHz), 802.11ac (40 MHz), 802.11ac (80 MHz) or 802.11ac (160 MHz)	5.0 GHz Band	Channel center frequency = 5000 MHz + 5 × k MHz, k = 0, 1, 2, ...,200