DAFTAR PUSTAKA

[1] Rahma Alfitri, Sherly “Antena Susunan Mikrostrip Untuk Sensor Circularly Polarized Synthetic Aperture Radar (Cp-Sar) Onboard Unmanned Aerial Vehicle (UAV)”, Universitas Telkom Bandung 2018.

[2] Mubarokah. Hamdan, Wijanto. Heroe, Wahyu. Yuyu “Antena Mikrostrip E-Ganda Dengan Celah T-Ganda Untuk Multi- Pita 2.4-3.4-5.8 GHz”, Universitas Telkom Bandung 2017.

[3] Ruliyanta, " Wifi-6 Antenna Design to Imcrease Data Traffic Offloading with HFFS and PCAAD Software ", EECSI, 2022.

[4] M. Nadi and M. K. Amirhosseini, " Design of microstrip patch antenna to deploy unmanned aerial vehicle as UE in 5G wireless network ", International Journal of Electrical and Computer Engineering (IJECE), 2021.

[5] A. A. Yaqin, I. Santoso and T. Prakoso, "Perancangan Antena Skew-Planar untuk Komunikasi Unmanned Aerial Vehicle Frekuensi 2.4 GHz," Transient: Jurnal lmiahTeknik Elektro, vol. 5, no. 4, pp. 473-481, 2016.

[6] G. Sotirov and S. Zabunov, "Circularly Polarized 2.4 GHz Antenna Suitable for Small UAVs," Engineering and Science Education, vol. 2, no. 1, 2019.

[7] I. M. . Budi, E. S. Nugraha, and A. Agung, “Perancangan Dan Analisis AntenaMikrostrip Mimo Circular Pada Frekuensi 2.35 GHz Untuk Aplikasi LTE,” J. Infotel,vol. 9, no. 1, p. 136, 2017, doi: 10.20895/infotel.v9i1.130.

[8] Ibrahim, I. Santoso and T. Prakoso, "Perancangan Antena Cloverleaf untuk Komunikasi Unmanned Aerial Vehicle (UAV) Frekuensi 2.4 GHz," Transmisi, vol. 18, no. 3, pp. 130-136, 2016.

[9] NITA AMELIA L, “RANCANG BANGUN ANTENA MIMO UNTUK TEKNOLOGI 5G,” Angew. Chemie Int. Ed. 6(11), 951–952., pp. 1–11, 1967.

[10] J. Rexiramdhan and F. Thalib, "Design and Analysis of Circular Polarized Receiver Antenna as Video Stabilizer in UHF Television," International Journal of Computer Applications, vol. 175, no. 30, pp. 12-18, 2020.

[11] M. Nadi and M. K. Amirhosseini, "Multi-petal antenna with omnidirectional circular polarized radiation," International Journal of RF and Microwave Computer-Aided Engineering, 2018.

[12] Anggraini, Trisnatama, Heroe Wijanto, Ir.,MT, Soetamso, Drs., “Rancang Bangun Dan Simulasi Berbasis Matlab Antena Bicula Unidirectional Dengan Penyepadan Chebyshev (300 – 3000)MHz Bercatuan England”, IT Telkom Bandung 2010.

[13] U. Fadlilah, “Simulasi Pola Radiasi Antena Dipole Tunggal,” Tek. Elektro Univ.Diponegoro, vol. 1, pp. 1–12, 2003.

[14] R. Yuwono, “Unjuk Kerja Antena UWB Egg Berdasarkan Dimensinya,” Eeccis, vol. IV, no. 2, pp. 1–8, 2010.

[15] Nurbani, Y. S. Rohmah and D. A. Nurmantris, "Realisasi Antena Mikrostrip Sistem Aerial Video pada Sisi Ground Segment di Frekuensi 5.8 GHz," Jurnal Elektro Telekomunikasi Terapan, vol. 4, no. 1, p. 2017.

[16] R. E. Putra, H. Wijanto and A. D. Prasetyo, "Perancangan dan Realisasi Antena Mikrostrip Array Polarisasi Sirkular pada Frekuensi 5.8 GHz dengan Catuan Proximity Coupled untuk Aplikasi First Person View Pesawat Tanpa Awak pada Sisi Ground Segment," e-Proceeding of Engineering, vol. 2, no. 2, p. 3120, 2015.

[17] A. A. Yaqin, I. Santoso and T. Prakoso, "Perancangan Antena Skew-Planar untuk Komunikasi Unmanned Aerial Vehicle Frekuensi 2.4 GHz," Transient: Jurnal Ilmiah Teknik Elektro, vol. 5, no. 4, pp. 473-481, 2016.

[18] Y. B. A. Setio, H. Wijanto and A. D. Prasetyo, "Antena Mikrostrip Polarisasi Sirkular 5.8 GHz dengan Front-End Parasitik untuk Video Pemantauan Udara pada Ground Control Station UAV," e-Proceeding of Engineering, vol. 5, no. 1, p. 354, 2018.

[19] M. Nadi and M. K. Amirhosseini, "Multi-petal antenna with omnidirectional circular polarized radiation," International Journal of RF and Microwave Computer-Aided Engineering, 2018.

[20] S. Rahmat, A. A. Muayyadi and A. Fahmi, "Perancangan dan Realisasi Antena Mikrostrip Biquad Ganda untuk Antena Penerima FPV," e-Proceeding of Engineering, vol. 3, no. 1, p. 437, 2016.

[21] U. Fadlilah, “Simulasi Pola Radiasi Antena Dipole Tunggal,” Tek. Elektro Univ.Diponegoro, vol. 1, pp. 1–12, 2003.

[22] R. Yuwono, “Unjuk Kerja Antena UWB Egg Berdasarkan Dimensinya,” Eeccis, vol. IV, no. 2, pp. 1–8, 2010.

[23] A. H. Rambe and Suryanto, “Analisis Pengaruh Frekuensi Terhadap Redaman,” J.Singuda Ensikom, vol. 2, no. 3, pp. 90–95, 2013.

[24] A. A. Yaqin, I. Santoso and T. Prakoso, "Perancangan Antena Skew-Planar untuk Komunikasi Unmanned Aerial Vehicle Frekuensi 2.4 GHz," Transient: Jurnal lmiahTeknik Elektro, vol. 5, no. 4, pp. 473-481, 2016.

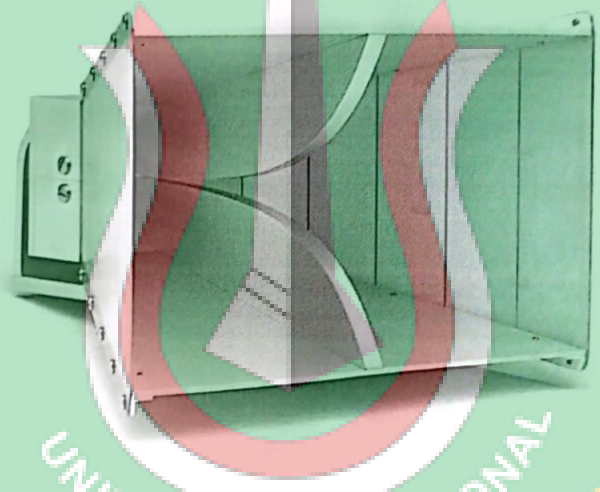
LAMPIRAN

A. Lampiran *Datasheet* Antena *Horn*

Model 3115

Double-Ridged Waveguide Horn

MANUAL

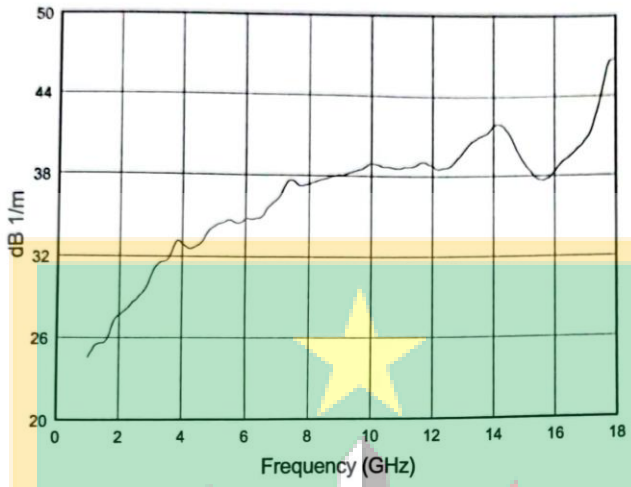


ETS·LINDGREN™

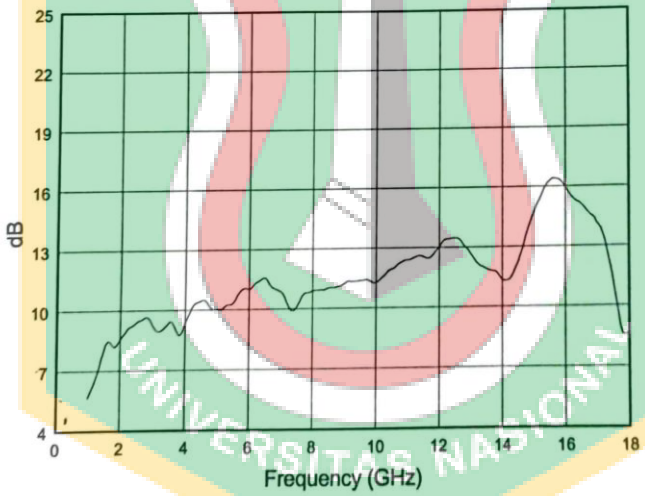
An ESCO Technologies Company

REV D – PN 399039

TYPICAL DATA



Model 3115 Antenna Factor at 1 meter



Model 3115 Gain

SPECIFICATIONS

ELECTRICAL

Frequency Range	1 – 18 GHz
VSWR Ratio (AVG)	<1.5:1
Maximum Continuous Power	300 Watts
Peak Power	500 Watts
Impedance	50 Ω
Connector	Type N precision female
Front to Back Ratio	20 dB
Cross Polarization	20 dB minimum

PHYSICAL

Width	24.4 cm 9.6 in
Depth	27.9 cm 11.0 in
Height	15.9 cm 6.2 in
Weight	1.8 kg 4.0 lb

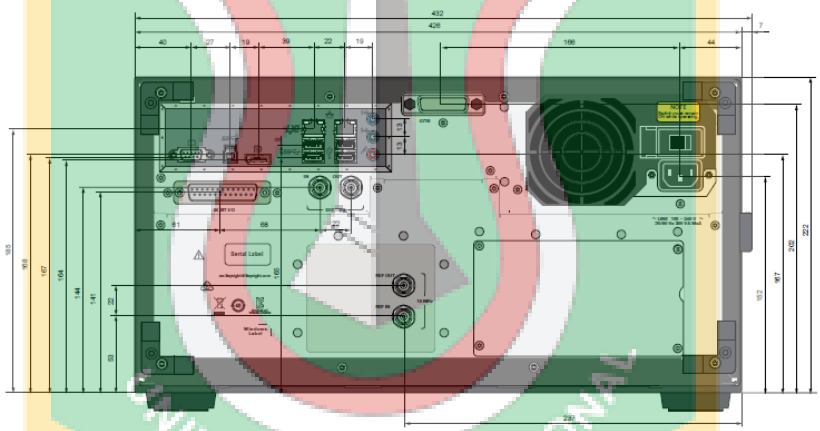
REV D – PN 399039

B. Lampiran *Datasheet Network Analyzer Keysight* E5063A

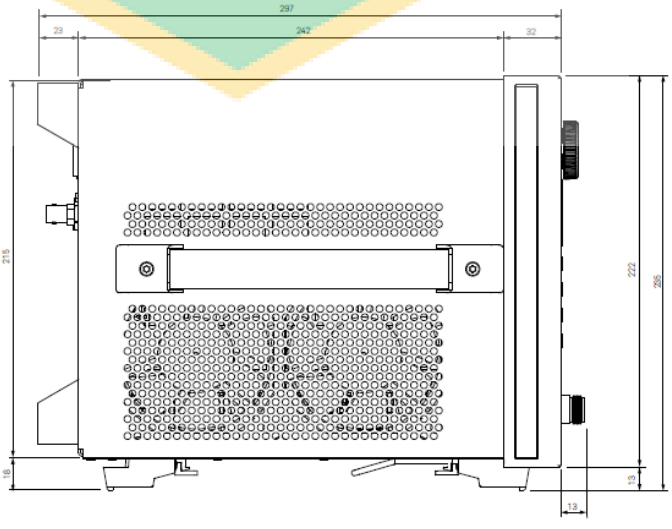
Dimensions (front view)

(in millimeters)

Dimensions (rear view)



Dimensions (side view)



(in millimeters)

	Specification (dB)							
Description	100 kHz to 300 kHz	300 kHz to 1 MHz	1 to 100 MHz	100 MHz to 3 GHz	3 to 6 GHz	6 to 10 GHz	10 to 13 GHz	13 to 18 GHz
Directivity	10 dB	10 dB	25 dB	25 dB	20 dB	15dB	10 dB	10 dB
Source match	20 dB	20 dB	25 dB	25 dB	20 dB	15dB	15 dB	15 dB
Load match	7 dB (typ.)	11 dB (typ.)	14 dB	11 dB	10 dB	7dB	8 dB (typ.)	6 dB (typ.)
Reflection tracking	± 3.0 dB	± 3.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB
Transmission tracking	± 3.0 dB	± 3.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB

Test Port Output (Source)

Test port output frequency

Description	Specification	Typical
Frequency range		Frequency can be set from 50 kHz. The performance data from 50 to 100 kHz is typical.
Option 205	100 kHz to 500 MHz	
Option 215	100 kHz to 1.5 GHz	
Option 235	100 kHz to 3 GHz	
Option 245	100 kHz to 4.5 GHz	
Option 265	100 kHz to 6.5 GHz	
Option 285	100 kHz to 8.5 GHz	
Option 2D5	100 kHz to 14 GHz	
Option 2H5	100 kHz to 18 GHz	
Resolution	1 Hz (100 kHz to 6.5 GHz) 2 Hz (6.5 to 13 GHz) 11 Hz (13 to 18 GHz)	
Source stability		± 7 ppm (5 to 40 °C)
CW accuracy	± 7 ppm	

Test port output power

Description	Specification	Typical
Nominal power (preset power)	–5 dBm	
Range 50 kHz to 100 kHz		–20 to –5 dBm
100 kHz to 300 kHz	–20 to –5 dBm	
300 kHz to 8.5 GHz	–20 to 0 dBm	
8.5 to 18 GHz	–15 to –5 dBm	
Resolution	0.05 dB	
Level accuracy		
At 50 MHz, –5 dBm, absolute		± 0.9 dB
(level flatness)[1]		
50 kHz to 300 kHz		± 3.7 dB
300 kHz to 1 MHz		± 2.0 dB
1 MHz to 4.34 GHz		± 1.0 dB
4.34 to 8.5 GHz		± 1.6 dB
8.5 to 12 GHz		± 3.6 dB
12 to 18 GHz		± 5.8 dB
Level linearity[2]		
–10 to –5 dBm, 50 kHz to 300 kHz		± 1.6 dB
–10 to 0 dBm, 300 kHz to 8.5 GHz		± 1.6 dB
–10 to –5 dBm, 8.5 to 18 GHz		± 1.8 dB
–20 to –10 dBm, 50 kHz to 8.5 GHz		± 2.7 dB
–15 to –10 dBm, 8.5 to 18 GHz		± 2.9 dB

Test Port Input

Description		Specification	Typical
Test port input level			
	Maximum input level	+6 dBm	
Crosstalk	50 kHz to 100 kHz		–88 dB
	100 kHz to 300 kHz	–88 dB	
	300 kHz to 8.5 MHz	–93 dB	
	8.5 MHz to 4.34 GHz	–115 dB	
	4.34 to 6 GHz	–105 dB	
	6 to 13 GHz	–100 dB	
	13 to 16 GHz	–90 dB	
	16 to 18 GHz	–85 dB	
Test Port Noise Floor			
	(IFBW=1 Hz)		
	50 kHz to 100 kHz		–103 dBm
	100 kHz to 8.5 MHz	–103 dBm	
	8.5 to 100 MHz	–126 dBm	
	100 MHz to 4.34 GHz	–127 dBm	
	4.34 to 8.5 GHz	–116 dBm	
	8.5 to 13 GHz	–115 dBm	
	13 to 16 GHz	–105 dBm	
	16 to 18 GHz	–102 dBm	
Compression level (at maximum test port input level = +6 dBm)			
Magnitude			
	50 kHz to 1 MHz		± 0.2 dB
	1 MHz to 4.34 GHz		± 0.2 dB
	4.34 to 13 GHz		± 0.2 dB
	13 to 18 GHz		± 0.2 dB
Phase			
	50 kHz to 1 MHz		± 5 deg.
	1 MHz to 4.34 GHz		± 1.5 deg.
	4.34 to 13 GHz		± 6 deg.
	13 to 18 GHz		± 10 deg.

C. Lampiran *Datasheet Signal Generator* Saluki Technology LSG022

LSG Series Signal Generator

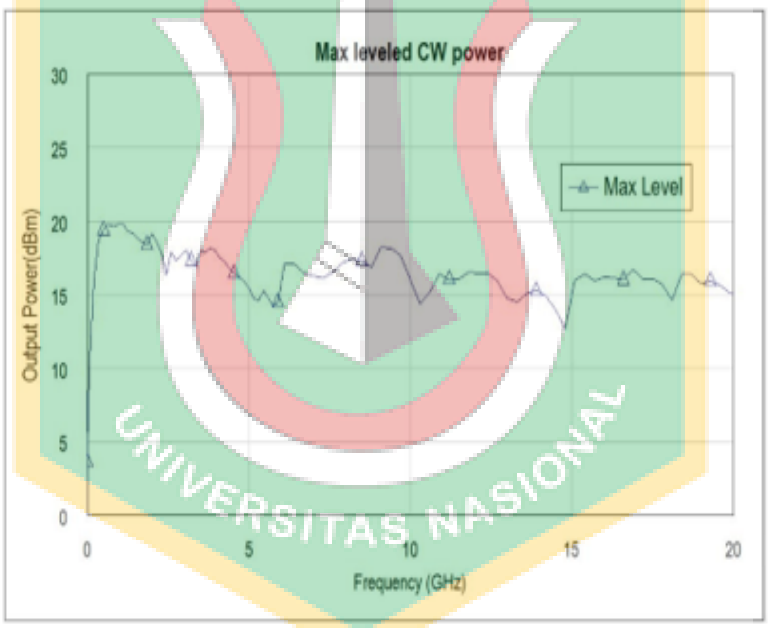
Saluki Technology Inc.

Frequency

Frequency range	
Frequency range	100 kHz to 22 GHz
Resolution	0.1 Hz
Phase offset	Adjustment in normal 1° increasement
Frequency switching speed	
CW mode	10 ms
Frequency reference	
Accuracy	± (time since last adjustment x aging rate)
	± temperature effects
	± line voltage effects
	± calibration accuracy
Internal time base reference oscillator aging rate	≤±1 ppm/year
	≤±0.02 ppm/day
Initial achievable calibration accuracy	≤±1 ppm
Adjustment resolution	≤0.6 ppb
Temperature effects	≤±0.1 ppm
Line voltage effects	≤±0.2 ppm
Reference output	
Frequency	10 MHz
Amplitude	≥4 dBm, nominal into 50 Ω load
External reference input	
Input frequency	10 MHz
Stability	Follow the stability of external reference input signal
Lock range	±5 ppm
Impedance	50 Ω
Waveform	Sine
Sweep modes (frequency and amplitude)	
Operating modes	Step sweep
	List sweep
Sweep range	Within instrument frequency range
Dwell time	1 ms to 100 s
Number of points	2 to 127
Step change	Linear or logarithmic
Triggering	Free run, external, Timer, bus (USB)

Amplitude

Output parameters	
Settable range	+20 to -80 dBm
Resolution	0.5 dB
Step attenuator	0 to 90 dB in 0.5 dB step electronic type
Connector	SMA 50 Ω
Max output power	
Frequency	Output power
100 kHz to 1 MHz	3.0 dBm
1 MHz to 10 MHz	6.0 dBm
10 MHz to 300 MHz	15 dBm
300 MHz to 6 GHz	19 dBm
6 GHz to 10 GHz	18 dBm
10 GHz to 20GHz	16 dBm



Absolute level accuracy in CW mode		
Range	Max power to -20 dBm	< -20 to -65 dBm
100 kHz to 3 GHz	±0.7 dB	±0.9 dB
3 GHz to 6 GHz	±1.0 dB	±1.3 dB
6 GHz to 20 GHz	±0.8 dB	±1.0 dB

General Data

Remote programming	
Interfaces	USB Version 2.0
Control languages	Factory defined
Power requirements	
12 VDC, 15 W maximum	
Operating temperature range	
0 to 40°C	
Storage temperature range	
-20 to 70°C	
Operating and storage altitude	
Up to 15,000 feet	
Humidity	
Maximum Relative Humidity (non-condensing): 95% RH up to 40°C, decreases linearly to 45% RH at 55°C	
Memory	
Memory is same as PC computer	
Weight	
≤ 800g	
Dimensions	
37 mm H x 159 mm W x 190 mm L (with rubber gaskets)	
Recommended calibration cycle	
24 months	
ISO compliant	
This instrument is manufactured in an ISO-9001 registered facility in concurrence with Saluki Technology commitment to quality.	

D. Lampiran *Datasheet Signal Analyzer* Saluki Technology CSA2026

CSA Series Signal Analyzer

Saluki Technology Inc.

Frequency and Time Specifications

Frequency range		
Frequency range		100 kHz to 26.5 GHz
Band	**LO multiple (N)**	
0	1	100kHz to 3.05GHz
1	2	2.95GHz to 7.55GHz
2	2	7.45GHz to 9.25GHz
3	2	9.15GHz to 11.05GHz
4	2	10.95GHz to 12.75GHz
5	4	12.65GHz to 14.55GHz
6	4	14.45GHz to 16.55GHz
7	4	16.45GHz to 18.55GHz
8	4	18.45GHz to 20.55GHz
9	4	20.45GHz to 24.55GHz
10	4	24.45GHz to 26.5GHz
Frequency reference		
Accuracy	±[(time since last adjustment x aging rate) + temperature stability + calibration accuracy]	
Aging rate	$\pm 3x10^{-7}$/ year (First year)	
Temperature stability		
20 to 30°C	$\pm 3x10^{-8}$	
Full temperature range	$\pm 3x10^{-8}$	
Achievable initial calibration accuracy	$\pm 8x10^{-8}$	
Example frequency reference accuracy	$=\pm(3x10^{-7}+3x10^{-8}+8x10^{-8})$	
1 year after last adjustment	$=\pm 4.1x10^{-7}$	
Residual FM	≤1Hz p-p in 20 ms nominal	
Frequency readout accuracy (start, stop, center, marker)		
±(marker frequency x frequency reference accuracy + 0.25 % x span + 5 % x RBW + 2Hz + 0.5 x horizontal resolution)		
Marker frequency counter		
Accuracy	±(marker frequency x frequency reference accuracy + 0.100Hz)	
Delta counter accuracy	±(delta frequency x frequency reference accuracy + 0.141Hz)	
Counter resolution	0.001Hz	
Frequency span (FFT and swept mode)		
Range	0Hz(zero span),10Hz to maximum frequency of instrument	
Resolution	2Hz	
Accuracy		
Swept	±(0.25% x span + horizontal resolution)	
FFT	±(0.10% x span + horizontal resolution)	

Sweep time and triggering		
Range	Span = 0Hz	1µs to 6000s
	Span ≥ 10Hz	1ms to 4000s
Accuracy	Span ≥ 10Hz, swept	±0.01% nominal
	Span ≥ 10Hz, FFT	±40% nominal
	Span = 0Hz	±1% nominal
Trigger	Free run, video, external, RF burst, periodic timer	
Trigger delay	Span = 0 Hz or FFT	-150 to +500ms
	Span ≥ 10 Hz, swept	1µs to 500ms
	Resolution	0.1µs
Time gating		
Gate methods	Gated LO; gated video; gated FFT	
Gate length range (except method = FFT)	100.0ns to 5.0s	
Gate delay range	0 to 100.0s	
Gate delay jitter	33.3ns p-p nominal	
Sweep (trace) point range		
All spans	1 to 40001	
Resolution bandwidth (RBW)		
Range (-3.01 dB bandwidth)	1 Hz to 3 MHz (10 % steps), 4, 5, 6, 8 MHz	
Bandwidth accuracy (power)	1Hz to 750kHz	±1.0%(±0.044dB) nominal
	820kHz to 1.2MHz	±2.0%(±0.088dB) nominal
	1.3 to 2.6MHz	±0.13dB nominal
	2.2to 3MHz	±0.22dB nominal
	4 to 8MHz	±0.32dB nominal
Bandwidth accuracy (-3.01 dB)	1Hz to 1.3MHz	±2% nominal
RBW range		
Selectivity (-60 dB/-3 dB)	4.1:1 nominal	
Analysis bandwidth		
Maximum bandwidth	25MHz (40MHz Option)	
Video bandwidth (VBW)		
Range	1 Hz to 3 MHz (10 % steps), 4, 5, 6, 8 MHz, and wide open (labeled 50 MHz)	
Accuracy	±6% nominal	
Measurement speed		
Local measurement and display update rate	11ms (90/s) nominal	
Remote measurement and LAN transfer rate	6ms (167/s) nominal	
Marker peak search	5ms nominal	
Center frequency tune and transfer	22ms nominal	
Measurement/mode switching	75ms nominal	

General Specifications

Temperature range	
Operating	0 to 55°C
Storage	-40 to 70°C
Environmental stress	
Samples of this product have been type tested in accordance with the Saluki Technology 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.	
Power requirement	
Power drawn from chassis	≤90W
Weight	
Net	2.2kg(4.9 lbs)
Shipping	4.2kg(9.3 lbs)
Dimensions	
Height	64mm(2.5 in)
Width	150mm(5.9 in)
Length	175mm(6.9 in)
Calibration cycle	
The recommended calibration cycle is one year; calibration services are available through Saluki Technology service centers	

Inputs and Outputs

RF input	
Connector	2.92mm-K,50Ω nominal
10 MHz in	
Connector	SMA-K,50Ω nominal
10 MHz out	
Connector	SMA-K,50Ω nominal
Trigger in	
Connector	SMA-K,10kΩ nominal
Trigger out	
Connector	SMA-K,50Ω nominal
Analog out	
Connector	SMA-K,50Ω nominal

I/Q Analyzer

Frequency			
Frequency span			
Standard instrument		100kHz to 25MHz	
Option B40		100kHz to 40MHz	
Resolution bandwidth (spectrum measurement)			
Range			
Overall		100mHz to 3MHz	
Span = 1MHz		50Hz to 1MHz	
Span = 10kHz		1Hz to 10kHz	
Span = 100Hz		100mHz to 100Hz	
Window shapes			
Flat top, Uniform, Hanning, Gaussian, Blackman, Blackman-Harris, Kaiser Bessel (K-B 70 dB, K-B 90 dB and K-B 110 dB)			
Analysis bandwidth			
Standard instrument		100kHz to 25MHz	
Option B40		100kHz to 40MHz	
IF frequency response (standard 10 MHz IF path)			
IF frequency response (demodulation and FFT response relative to the center frequency, 20 to 30°C)			
Center frequency (GHz)	Span (MHz)	Max. error	RMS (nominal)
≤3.0	≤10	±0.40dB	0.03dB
3.0<f≤26.5	≤10		0.10dB
IF phase linearity (deviation from mean phase linearity, nominal)			
Center frequency (GHz)	Span (MHz)	Peak-to-peak	RMS
≤3.0	≤10	0.5°	0.2°
3.0<f≤7.5	≤10	0.5°	0.4°
7.5<f≤26.5	≤10	0.5°	0.4°
Data acquisition (standard 10 MHz IF path)			
Time record length	4,000,000 IQ sample pairs		
Sample rate	90MSa/s		
ADC resolution	14 Bits		
Data acquisition (B40 IF path)			
Time record length			
IQ analyzer	4,000,000 IQ sample pairs		
Sample rate	90MSa/s		
ADC resolution	14 Bits		