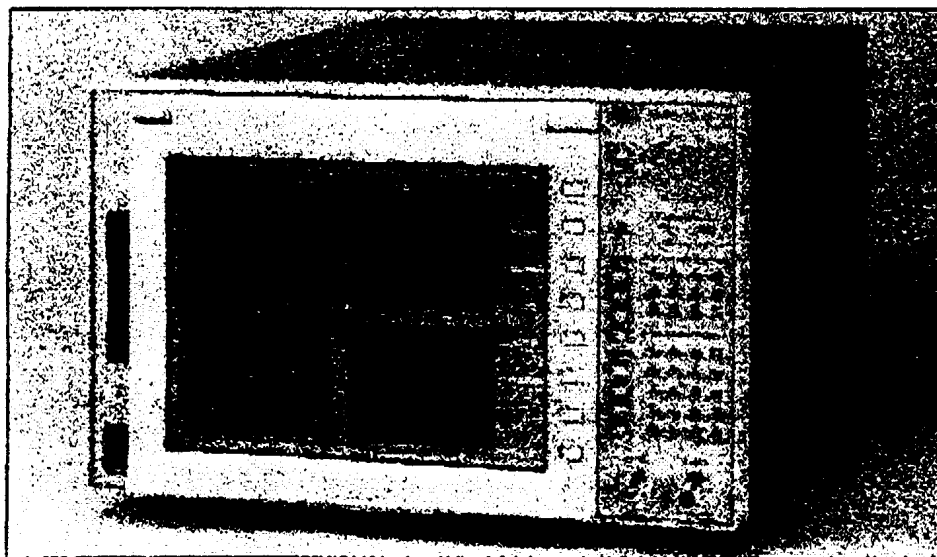


Tektronix

3066, 3086 Real-Time Spectrum Analyzers



The 3066 and 3086 are DC to 3 GHz real-time spectrum analyzers that allow the seamless capture of frequency spectra with spans up to 30 MHz. (5 MHz – 3066). This allows the spectrum of burst signals, such as those from GSM, IS-136, PDC, or partial rate CDMA mobile stations, to be easily captured and examined. Real-Time spectrum analyzers take a whole different approach compared to traditional sweeping spectrum analyzers. Rather than acquiring one frequency step at a time, the real-time instrument captures a block of frequencies all at once. Because the instrument samples these full frames constantly (rather than waiting for each discrete frequency step to be measured), the signal can come or go as it pleases and the real-time spectrum analyzer will detect the change instantly.

The color, 12.1-in., TFT display allows easy viewing of spectrum, waterfall displays, spectrograms, and digital modulation analysis screens. Constellation and vector diagrams can be displayed as well as frequency, phase, magnitude, I and Q versus time for in-depth analysis of digitally modulated signals. Users can move a marker through the time record and analyze the modulation at any point. In particular, signals with symbol rates up to 20.48 Msymbols/sec (3066 – 5.3 Msymbols/sec) may be analyzed during and after capture. This facilitates analysis of W-CDMA signals with chip rates up to 16.384 Mcps.

In addition, a frequency mask trigger allows the capture of randomly occurring, or infrequent, signals such as intermittent spurious emissions. If the user is not interested in the period between transmis-

FEATURES AND BENEFITS

Seamless Acquisition for Capture of Short Duration or Intermittent Events

Analyzes in Frequency, Time, and Modulation Domain

DC to 3 GHz Coverage

Frequency Event Trigger for Acquisition of Burst or Infrequently Occurring Signals

Post Capture 1000:1 Zoom Allows Analysis of Individual Signals After Wideband Capture

APPLICATIONS

1st, 2nd, and 3rd Generation Cellular/PCS R&D – Including GSM, CDMA, IS-136, PDC, W-CDMA

Signature Analysis

Spectrum Monitoring

Setting Time Measurements for Oscillators and Synthesizers

Phase Hit Capture and Measurement

Debugging of Hardware/Software Interface Problems

sion bursts, the frequency mask trigger allows capture of the "burst-on" periods, thus maximizing the number of bursts that can be captured in memory for subsequent spectral, time, or modulation analysis. The user can graphically define the frequency

trigger mask; this allows the trigger condition to be generated by a particular event in the frequency domain irrespective of other activity within the displayed span. This is a major benefit when the trigger condition is used to capture signals arising

from intermittent spurious or spectral re-growth events.

A 1000:1 zoom capability permits analysis to be performed on an individual signal in a multi-signal environment.

3066/3086

Characteristics

INPUT/MEMORY MODE RELATED

Input Mode – RF, Baseband; Wideband, IQ (3086 only).

Input Connector – N type (RF, Baseband, Wideband), BNC type (IQ).

Input Impedance – 50 Ω .

VSWR (N type) – 1.5 (Reference Level ≥ -20 dBm).

Acquisition Mode – Roll, Block.

Acquisition Memory Size – 16 Mbytes.

Acquisition Memory Management –

RF, Baseband Input –

Memory Mode: Frequency, Dual, Zoom.

FFT Points: 1024, 256 (Frequency Mode).

FFT Window: Rectangular, Hamming, Blackman-Harris.

Block Size:

1 to 16,000 Frames (Frequency Mode, 256 pt).

1 to 4,000 Frames (Frequency Mode, 1024 pt).

1 to 2,000 Frames (Dual, Zoom Mode).

Minimum Frame Update Time:

20 μ s (Frequency Mode, 256 pt).

80 μ s (Frequency Mode, 1024 pt).

160 μ s (Dual, Zoom Mode).

Wideband, IQ Input (3086 only) –

Memory Mode: Zoom.

FFT Points: 1024.

FFT Window: Rectangular, Hamming, Blackman-Harris.

Block Size: 1 to 2,000 Frames. Minimum

Frame: 25 μ s.

FREQUENCY STANDARD RELATED

Characteristic	Description
Reference frequency	10 MHz
Initial frequency tolerance	± 0.1 ppm
Frequency stability	
Aging	± 0.0005 ppm/day
Temperature	± 0.002 ppm (5 to 40 $^{\circ}$ C)

RF INPUT RELATED

Frequency –

Range: 10 MHz to 3 GHz.

Center Frequency Settability: 0.1 Hz.

Span: 100 Hz to 3 GHz.

Vector Span: 100 Hz to 6 MHz.

Real-time Span: 100 Hz to 5 MHz.

Number of Bins:

641 (100 Hz to 2 MHz span).

801 (5 MHz span).

481 (6 MHz span).

Span/6250 + 1 (span ≥ 10 MHz).

Spectrum Purity: -100 dBc/Hz (1 GHz CF, 200 kHz span, 0 dBm ref, 10 kHz offset).

Residual FM: 3 Hz p-p.

Amplitude –

Reference Level: -50 dBm to $+30$ dBm.

Maximum Nondestructive Input Power:

$+30$ dBm.

BASEBAND INPUT RELATED

Frequency –

Range: DC to 10 MHz.

Center Frequency Settability: 0.1 Hz.

Span: 100 Hz to 10 MHz.

Vector Span: 100 Hz to 6 MHz.

Real-time Span: 100 Hz to 5 MHz.

Number of Bins:

641 (100 Hz to 2 MHz span).

801 (5 MHz and 10 MHz span).

481 (6 MHz span).

Spectrum Purity: -100 dBc/Hz (5 MHz CF, 200 kHz span, 0 dBm ref, 10 kHz offset).

Residual FM: 2 Hz p-p.

Amplitude –

Reference Level: -30 dBm to $+30$ dBm.

Maximum Nondestructive Input Power:

$+30$ dBm.

Reference Level Accuracy: ± 0.5 dB at 5 MHz.

Flatness: ± 1.0 dB (1 MHz to 10 MHz).

Input Equivalent Noise: -150 dBm/Hz.

2nd Harmonic Distortion: -70 dBc (at 4.5 MHz).

DC Offset: -40 dBfs.

Residual Response: -70 dBfs (5 MHz CF, 5 MHz span, 0 dBm ref).

Alias Suppression: 65 dB.

Spurious Free Dynamic Range (5 MHz CF, 0 dBm ref, sinusoidal signal at the center, spur apart more than 10 kHz from the signal):

85 dB at 50 kHz span.

80 dB at 100 kHz span.

75 dB at 200 kHz span.

70 dB at 500 kHz span.

70 dB at 1/2/5 MHz span.

WIDEBAND INPUT RELATED (3086 ONLY)

Frequency –

Range: 50 MHz to 3 GHz.

Center Frequency Settability: 0.1 Hz.

Span: 10 MHz, 20 MHz, 30 MHz.

Vector Span: 10 MHz, 20 MHz, 30 MHz.

Number of Bins:

501 (10 MHz and 20 MHz span).

751 (30 MHz span).

3066/3086 **Characteristics** **Continued**

Amplitude –
Reference Level: –50 dBm to +30 dBm.
Maximum Nondestructive Input Power: +30 dBm.
Flatness within Span: ± 1 dB (25 °C ± 5 °C).
Input Equivalent Noise: –140 dBm/Hz.
3rd Order Distortion: –65 dBc (–10 dBfs input, at 1 GHz).
Residual Response: –60 dBfs (0 dBm ref, 30 MHz span).
Image Suppression: 70 dB.
Spurious Free Dynamic Range (1 GHz CF, 0 dBm ref, sinusoidal signal at the center, spur apart more than 500 kHz from the signal):
65 dB at 10 MHz span,
60 dB at 20 MHz and 30 MHz span.

IQ INPUT RELATED (3086 ONLY)

Frequency –
Range: ± 15 MHz.
Span: 10 MHz, 20 MHz, 30 MHz.
Vector Span: 10 MHz, 20 MHz, 30 MHz.
Number of Bins:
501 (10 MHz and 20 MHz span).
751 (30 MHz span).
Amplitude –
Reference Level: 100 mV (amplitude of IQ signal).
Maximum Nondestructive Input Power: ± 5 V.
Flatness within Span: ± 0.5 dB (25 °C to 5 °C).
Residual Response: –60 dBfs (30 MHz span).
Alias Suppression: 55 dB.

FRAME TIME RELATED

FRAME TIME (3086)

Span	1024 point FFT	256 point FFT
Baseband Mode:		
10 MHz	80 μ s	20 μ s
RF Mode and Baseband Mode:		
6 MHz	80 μ s	20 μ s
5 MHz	160 μ s	40 μ s
2 MHz	320 μ s	80 μ s
1 MHz	640 μ s	160 μ s
500 kHz	1280 μ s	320 μ s
200 kHz	3200 μ s	800 μ s
100 kHz	6.4 ms	1.6 ms
50 kHz	12.8 ms	3.2 ms
20 kHz	32 ms	8 ms
10 kHz	64 ms	16 ms
5 kHz	128 ms	32 ms
2 kHz	320 ms	80 ms
1 kHz	640 ms	160 ms
500 Hz	1280 ms	320 ms
200 Hz	3200 ms	800 ms
100 Hz	6400 ms	1600 ms
Wideband/IQ Input Modes: 3086 only		
30 MHz	25 μ s	25 μ s
20 MHz	25 μ s	25 μ s
10 MHz	50 μ s	50 μ s

Spurious free dynamic range (1 GHz CF, 0 dBm ref, sinusoidal signal at the center, spur apart more than 500 kHz from the signal):
65 dB at 10 MHz span.
60 dB at 20 MHz and 30 MHz span.

TRIGGER RELATED

Trigger Mode – Auto, Normal, Quick, Delayed, Interval, Quick-interval, Timeout, Auto, Normal [RF (span ≤ 6 MHz) and Baseband Input, Wideband and IQ Input (3086 only)].
Trigger Source – Internal/External.
Trigger Domain – Frequency, Time.
Trigger Position – 0 to 100%.

MINIMUM FRAME UPDATE TIME

Span	1024 point FFT	256 point FFT
Baseband/Frequency Mode		
10 MHz	80 μ s	20 μ s
RF/Baseband/Frequency Mode		
500 kHz to 6 MHz	80 μ s	20 μ s
50 kHz to 500 kHz	200 μ s	50 μ s
5 kHz to 20 kHz	2000 μ s	500 μ s
500 Hz to 2 kHz	20 ms	5 ms
200 Hz	50 ms	12.5 ms
100 Hz	100 ms	25 ms
RF/Baseband/Dual Mode		
500 kHz to 6 MHz	160 μ s	N/A
50 kHz to 500 kHz	400 μ s	N/A
5 kHz to 20 kHz	4 ms	N/A
500 Hz to 2 kHz	40 ms	N/A
200 Hz	100 ms	N/A
100 Hz	200 ms	N/A
RF/Baseband/Zoom Modes		
5 MHz	160 μ s	N/A
2 MHz	320 μ s	N/A
1 MHz	640 μ s	N/A
500 kHz	1.28 ms	N/A
200 kHz	3.2 ms	N/A
100 kHz	6.4 ms	N/A
50 kHz	12.8 ms	N/A
20 kHz	32 ms	N/A
10 kHz	64 ms	N/A
5 kHz	128 ms	N/A
2 kHz	320 ms	N/A
1 kHz	640 ms	N/A
500 Hz	1280 ms	N/A
200 Hz	3200 ms	N/A
100 Hz	6400 ms	N/A
Wideband/IQ Input Modes – 3086 Only		
30 MHz	25 μ s	N/A
20 MHz	25 μ s	N/A
10 MHz	50 μ s	N/A

3066/3086 Characteristics Continued

Frequency Trigger Mask –
Frequency Resolution: 1 bin.
Trigger Level Range: 0 dBfs to -70 dBfs.
Time Trigger Mask –
Time Resolution: 1 data point.
Trigger Level Range: 0 dBfs to -40 dBfs.
External Trigger Threshold Level – 1.6 V.

DISPLAY/VIEW

Data Display –
Waveform:
Frequency vs. Amplitude/Phase.
Frequency vs. I/Q voltage.
Time vs. Amplitude/Phase.
Time vs. I/Q voltage.
Spectrogram: Time vs. Frequency vs. Amplitude/Phase.
Waterfall:
Time vs. Frequency vs. Amplitude/Phase.
Time vs. Frequency vs. I/Q Voltage.
Time vs. Amplitude/Phase Multi-Frame.
Time vs. I/Q Voltage Multi-Frame.
AM Demodulation: Time vs. Modulation depth.
FM Demodulation: Time vs. Frequency deviation.
PM Demodulation: Time vs. Phase deviation.
FSK Demodulation: Time vs. Frequency deviation.
Polar: Vector diagram, Constellation diagram.
Eye Pattern: I, Q, Trellis.
Symbol Table: Binary, Octal, Hexadecimal.
Error Vector: EVM, Magnitude error, Phase error, Waveform quality (p).
View –
Number of Views: 1, 2, 4.
Settable Views: 8 maximum.
Display Traces: 2 on waveform display.
LCD Panel –
Size: 12.1 inch.
Display Resolution: 1024 x 768 pixels.
Color: 256 color (maximum).

DIGITAL DEMODULATION RELATED

Characteristic	Description
Demodulator	
Carrier type	Continuous, Burst
Modulation format	BPSK, QPSK, $\pi/4$ Shift DQPSK, 8PSK, OQPSK, 16QAM, 64QAM, GMSK
Measurement filter	Root Cosine
Reference filter	Cosine, Gauss
Filter parameter	α /BT: 0.0001 to 1, 0.0001 step
Maximum symbol rate	5.3 Msps (RF, Baseband); 20.48 Msps (Wideband, IQ: the 3086 only)
Standard setup	PDC, PHS, NADC, TETRA, GSM, CDPD, IS-95, T-53
Display format	
Vector diagram	Symbol/Locus display, Frequency error measurement, Origin offset measurement
Constellation diagram	Symbol display, Frequency error measurement, Origin offset measurement
Eye diagram	I/Q/Trellis display (1 to 16 symbols)
Error vector diagram	EVM, Magnitude error, Phase error, Waveform quality (p) measurement
Symbol table	Binary, Octal, Hexadecimal
Error measurement accuracy	
PDC	10 frames averaged EVM <1.2 %, Mag error <1.0 %, Phase error <0.8 °(100 kHz span)
PHS	EVM <1.4 %, Mag error <1.2 %, Phase error <0.8 °(1 MHz span)
GSM	EVM <1.8 %, Mag error <1.2 %, Phase error <1.0 °(1 MHz span)
IS-95 reverse link	EVM <2.0 % (5 MHz span)
QPSK, 4.096 Msps, 2 GHz	EVM <2.5 % (20 MHz span)
QPSK, 16.384 Msps, 2 GHz	EVM <3.0 % (30 MHz span, 25 °C $\pm$ 5 °C)

MARKER ZOOM RELATED

Marker –
Marker Type: Normal, Delta, Band-Power.
Search Function: Peak Right, Peak Left, Maximum.
Link between Views: On/Off.
Measurement Function – Noise Power, Power within Band, C/N, Adjacent Channel Power, Occupied Bandwidth.
Digital Zoom –
Zoom Ratio: 2 to 1000.
Maximum Span in the Zoom Mode: 5 MHz (RF, Baseband), 30 MHz (Wideband, IQ, 3086 only).

SYSTEM CONTROLLER

Pentium MMX 200 MHz, 64 Mbyte SIMM, Windows 95®, PCI, ISA, TMP68301 16 MHz, 2.1 Gbyte 3.5 inch EIDE, 1.44 Mbyte floppy drive, GPIB IEEE488.1, Keyboard PC/AT, (order separately), Centronics parallel port, SCSI 2.

ENVIRONMENTAL

Temperature Range –
Operating: +5 to +40 °C (floppy not used), +10 to +40 °C (floppy used).
Non-operating: -20 to +60 °C.
Humidity – Operating and nonoperating: 80% non-condensing. Maximum wet-bulb temperature 29 °C.
Altitude –
Operating: Up to 2,000 m (6,500 ft).
Nonoperating: Up to 12,000 m (40,000 ft).
Random Vibration –
Operating: 0.27 g, 5 to 500 Hz, 10 minutes each axis.
Nonoperating: 2.28 g, 5 to 500 Hz, 10 minutes each axis.
Shock – Nonoperating: 20 g half-sine, 11 ms duration, 3 shocks per axis in each direction (18 shocks total).
Package Product –
Vibration and Bounce: Meets ASTM D999-75, Method A, Para. 3.1g, (NSTA proj 1-A-B-1).
Drop: Meets ASTM D775-61, Method 1, Para. 5, (NSTA proj. 1-A-B-2).

EMC COMPLIANCE

Emissions –
Enclosure: EN55011 Class A, limits for radiated emissions.
AC Main: EN61000-3-2 Power line harmonics; EN55011 Class A, limits for radiated emissions.
Immunity –
Enclosure: EN61000-4-2 ESD (Up to 8 kV, 150 pF through 330 Ω) Internal terminals of connectors do not allow ESD test.
AC Main: EN61000-4-3 Radiation; EN61000-4-4 Fast Transient Burst; EN61000-4-5 Surge; EN61000-4-6 Conductive Immunity.

SAFETY

Safety Standard – IEC1010-1 (Self-Declaration).

POWER

Line Voltage – 100 to 240 VAC Nominal.
Line Frequency – 47 Hz to 66 Hz.
Line Fuse – 10 A, fast.

3066/3086 **Characteristics** **Continued**

Primary Circuit Dielectric Voltage Withstand Grounding Impedance – 1,500 Vrms, 50 Hz for 15 s, without break-down. Verify continuity of grounding connection, by any suitable means, between a representative part required to be grounding and attachment– plug cap grounding pin. (0.1 Ω at 30 A).

Maximum Power – 280 W.

Maximum Line Current – 3.0 A rms at 50 Hz.

Surge Current – 15 A at 100 VAC; 30 A at 200 VAC.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Height	270	10.6
Width	430	16.9
Depth	600	23.6
Weight	kg	lb
Net	28	62

WARRANTY

One year parts and labor.

3066/3086 **Ordering** **Information**

3066

Real-time Spectrum Analyzer
Includes: User Manual, U.S. Power Cord, module.

3086

Real-time Spectrum Analyzer
Includes: User Manual, U.S. Power Cord.

Options

- Opt. 1S** – Data capture software.
- Opt. C3** – Three years of calibration services.
- Opt. C5** – Five years of calibration services.
- Opt. D1** – Test Data.
- Opt. D3** – Test data (requires Opt. C3).
- Opt. D5** – Test data (requires Opt. C5).
- Opt. R3** – Three years of repair protection.
- Opt. R5** – Five years of repair protection.

International Power Options

- Opt. A1** – Universal Euro 220 V, 50 Hz.
- Opt. A2** – United Kingdom 240 V, 50 Hz.
- Opt. A3** – Australian 240 V, 50 Hz.
- Opt. A4** – North American 240 V, 60 Hz.
- Opt. A5** – Switzerland 220 V, 50 Hz.

Recommended Accessories

- PC Display Analysis Software** –
- 3066: Order SL7PC66.
- 3086: Order SL7PC86.

For further information, contact Tektronix:

Worldwide Web: for the most up-to-date product information visit our web site at: www.tektronix.com

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