

ANALOG DEVICES

Video-based

Distributor Training

**“Signal Chain Selling:
High Speed Solutions”**

FOURTH DRAFT

***Approved for Location Production
(HI-SP4.SCR)***

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Animated Title
sequence 15
seconds

Music:

1

Narrator on-
camera walks into
frame and stands
in the hallway
before the network
operations center.
Background
suggests nothing
more than office
hallway.

Narrator:

Hello, and welcome to another in a
series of programs on Analog
Devices products and markets. I'm
Suzanne Schemm.

2

Narrator begins to
walk slowly.
Camera tracks.

Today, we're coming to you from
the New York and New England
Telephone Network Operations
Center in Framingham,
Massachusetts

3

Fast dolly back to
reveal the Network
Operations Center
and Narrator walks

into the
environment

4

Narrator on-
camera

This room monitors the operational
status of all public and private
telephone networks in five
Northeast US states.

5

5

Narrator on-camera It provides network managers with a comprehensive, real-time, graphic view of voice and data traffic. It also shows transmission, switch, and facility status, and details on maintenance and repair activities.

6

Narrator on-camera This room is the central observation point in a huge, high speed voice and data network.

7

Narrator on-camera We're here because this room represents the subject of this program---high speed solutions.

8

Narrator on-camera We're also here because it's important to point out that, just a few years ago, much of the high speed technology in this room didn't exist.

9

Narrator on-camera High speed applications, like these, represent one of the fastest growth areas for Analog Devices.

10

- 10
- Narrator on-camera
- ADI offers the industry's largest portfolio of high speed products. These include Converters, Op Amps, Analog Signal Processors and DSPs.
- 11
- Narrator on-camera
- In this program we'll introduce you to four advanced applications that depend on ADI's high speed products.
- 12
- Narrator on-camera
- Before we get started, we'd like you to take a second look at the generic signal flow diagram we introduced in our last program.
- 13
- Dissolve to generic signal diagram from the previous program.
- Many of the building blocks present in this signal flow also apply to the high speed

Full Screen and applications we'll talk about here.
Static.

14

Narrator on- If you keep this diagram in mind,
camera it'll be easier to follow the new
applications.

15

15

Narrator on-
camera Let's get started.

16

Transition Music

17

Title Graphic **Cellular Basestation**

18

Narrator on-
camera We'll begin with an application
related to the networks that are
monitored here.

19

Narrator on-
camera Cellular telephones are part of a
high speed radio system linked to
the telephone network. We're
Picks up cellular going to talk specifically about a
telephone cellular system's digital
basestation.

20

Narrator on- These basestations provide the

camera interface between cellular telephone radio waves and the wired public telephone network.

21

Narrator on-camera Within the cell, the basestation also performs system management and call routing.

22

- 22
Narrator on-camera The input to this system is a 900 megahertz signal.
- 23
Basestation graphic full screen. The "front-end" requires RF components. In this case, filters, low noise amplifiers, and mixers.
Highlight bold as mentioned
- 24
Graphic Full. Keep the highlights. These components "clean up" the 900 megahertz signal and shift it down to a lower, intermediate frequency.
- 25
Highlight all mixers Down conversion usually occurs in several mixdown stages before the signal gets to the correct frequency.
- 26
Graphic shows ADI products at full level. Other parts The opportunity to sell ADI products starts at the frequency synthesizer and continues through the DSP.

are dim.

27

Enlarge section "A"
Highlight frequency synthesizer.

The frequency synthesizer is a programmable signal generator that tunes the input section much like the tuner on your television or radio.

28

Same as previous graphic.

Frequency synthesizers use 12-bit high speed DACs, high-speed op amps, and references.

29

Change Frequency synthesizer label to DDS

You could also find a DDS or Direct Digital Synthesizer here. A DDS is a specialized frequency synthesizer.

30

Highlight Band Pass Filter (BPF)

Once the signal is tuned and mixed, it's filtered again. The output of the filter is a lower frequency signal that must be amplified by a VGA.

31

Reduce Section "A"

The VGA is a voltage controlled

and Enlarge Section amplifier. Its gain is set by the
"B" Highlight VGA output of the DAC. VGAs are low
noise analog signal processing
devices. They let the DSP control
the "gain" of the system.

32

Highlight DAC The digital to analog converter used
to control the VGA is typically a
twelve bit DAC operating at speeds
of up to fifty kilohertz.

33

Highlight Mixer Next, the signal is again downshifted,
or mixed. This mixing stage requires
high speed, wide bandwidth op amps.

34

Highlight BPF The filtering that occurs after this
mixing stage uses several discrete
components.

35

Reduce Section "B" After the discrete filter, the signal is
and Enlarge Section split in two. One path, the main

"C" Highlight main signal path, is split again, shifted in path. frequency one more time, and conditioned before analog to digital conversion.

36

Highlight mixers. Frequency shifting here is accomplished with low distortion, wide dynamic range mixers available from ADI.

37

Highlight amp. The buffer before the ADC requires a low power, rail to rail, dual op amp.

38

Highlight second path. The second signal path is called the Received Signal Strength Indication or RSSI path.

39

Same as previous graphic This path measures the amplitude of the input signal and controls the variable gain amplifier.

40

previous graphic continues The RSSI path maximizes the input signal to the intermediate frequency or IF section

41

Highlight Log amp This chain consists of a logarithmic amplifier. Log amps strengthen low level signals more than high level signals.

42

previous graphic continues These are "Analog Signal Processors" or ASPs.

43

Highlight main ADC There are actually three ADC's in this application. The ADC in the main signal path is a **dual** ADC operating with **fifteen** bits of resolution at speeds of up to ninety kilohertz

(Need to check on the accuracy of the resolution)

44

- 44
Highlight ADC in RSSI The ADC in the RSSI path usually requires twelve bits of resolution at about five hundred kilohertz.
- 45
Highlight DSP Finally, the DSP performs error correction, and decompresses the information before routing the data to the telephone network
- 46
Narrator on-camera In this example, we've concentrated on the receive side of the call. All cellular systems are duplex, meaning that they consist of a receive and transmit side. The transmit side performs all of these same operations in reverse
- 47
Show full graphic with Part count Now, we'll take a final look at the complete Cellular Basestation.

and dollar amount This is the sales opportunity
of sale presented by this application.

48

48
Narrator on-camera This particular signal chain also creates a need for many standard linear support components. These might include Temperature Sensors, Trim DACS, and In Amps.

49
Narrator on-camera Support components are sometimes overlooked because they serve purposes auxiliary to the functions of the main signal chain.

50
Narrator on-camera Remember. . . Ask your customers about these support components.

51
Transition Music:

52
Title Graphic: **Wireless Local Area Network**

Narrator on-camera
Positioned so that
network graphics
are clear on the wall
or at the
workstations.

The wide area data networks
monitored here use wire, fiber,
satellite, and microwave
technology to connect corporate
and institutional networks.

54

Narrator on-
camera

At individual business sites,
smaller, local area networks used
to be connected by wire alone.
That's not true anymore.

55

Narrator on
camera

In hospitals, factories, and many
office buildings today, it can be
difficult or impossible to hardwire
computers and peripherals
together.

56

Narrator on
camera

Wireless local area network
connections are becoming more
and more popular as a way to

solve this problem.

57

Narrator on-camera

In this next example, wireless local area network terminals connect two computers together so they can communicate over short distances the same way they would if they were hardwired..

58

Narrator on-camera

A wireless LAN terminal must be installed at each end of the connection.

59

- 59
Narrator on-camera The connection is made either by infra-red signals or radio frequency signals.
- 60
Narrator on-camera Our example covers a radio frequency application
- 61
Graphic full Like the basestation application, a wireless LAN includes both a transmit and receive section.
- 62
graphic The input in this case is a two point five or five point eight gigahertz signal picked up by an antenna. In infrared systems, the signal is picked up by a photodiode.
- 63
Enlarge Section Like the cellular basestation, the

"A" input here is an extremely high frequency signal..

64

Highlight the devices Because of this high frequency, the input filters and low noise amps are often "RF" devices

65

Highlight mixer The opportunity to sell ADI starts at the first mixer where the incoming signal is converted to a lower frequency.

66

same as previous graphic. This mixer requires low distortion and a wide dynamic range.

67

Reduce Section "A" and Enlarge Section "B" The IF frequency section requires analog signal processing components such as high speed amplifiers and demodulators.

68

Highlight
Baseband
Receiver Port

The "baseband receiver port" is a specialized highly integrated device consisting of an analog filter and analog to digital converters all on one chip.

69

Same as previous

Several different versions of this building block are available from ADI

70

Highlight DSP

The DSP performs echo cancellation, signal processing and formats the data.

71

71

Highlight PC

The information is then routed to its final destination. In this case, the information will go to a personal computer.

72

Back to Full
Screen Graphic
Highlight in
reverse

The transmit channel essentially performs all of these functions in reverse..

73

The digital data from the DSP is coded and modulated, converted to analog by the baseband transmit port.

74

The signal is then shifted up to the carrier frequency by the mixer and boosted by a power amplifier.

75

It's then transmitted through the antenna

76

Highlight baseband transmit port (identical to receive port) The baseband transmit port is a combination filter, memory and dual ten bit DAC. Several versions of this type of device are available from ADI.

77

Narrator on-camera Once again, we'll take a final look at the entire system and identify the sales opportunity presented in wireless LAN applications.

78

graphic of part count and opportunity

79

Transition Music

80

Title Graphic

CCD Document Scanner

81

Narrator on-camera

Each of these workstations gives the network manager access to a huge amount of information,---

Sitting at a workstation.

repair status, traffic reports, maintenance schedules, and electronic mail.

82

Narrator on-camera

In spite of this "paperless" design, some information still arrives on paper.

83

83

Narrator on-camera Picks up a paper document.	As workstations become the primary tool for communication and information exchange, their will be an increasing interest in getting paper documents, like this one, off the desk, into a scanner, and on line.
--	--

84

Click on workstation to reveal a scanned document on-line.

85

Narrator on-camera	The need to deliver an image like this on line brings us to our next application, image processing.
--------------------	---

86

Narrator on-camera	Imaging applications use special optics to separate reflected light
--------------------	---

into red, blue and green components.

87

Narrator on-camera

CCD's or Charged Coupled Devices are then used to convert the three color components to digital information.

88

Narrator on-camera

Image processing applications require three identical signal channels, one for each of the color components.

89

Narrator on-camera

We're going to show you only one of these three identical channels.

90

Narrator on-camera

Image processing is the foundation for a variety of applications, including high speed commercial document scanning.

- 91
Graphic full Each channel generates a voltage stream representing the image on the document.
- 92
Enlarge Section Before this signal can be
"A" converted to digital information, it must pass through several analog signal conditioning stages.
- 93
Highlight coarse The first stage makes coarse
adjustment, adjustments to the DC level of the
amplifier, and fine signal. The second stage amplifies
adjustment as that signal, and the third stage
mentioned. finely adjusts the output of the
 amplifier so that the signal
 precisely matches the input
 requirements of the ADC.
- 94
graphic Multiple medium to high speed, low

cost op amps perform these functions.

95
Reduce Section "A" Enlarge Section "B" Highlight ADC
The analog-to-digital converters in this application typically require ten to twelve bits of resolution, and a throughput rate of one to three megahertz.

96
same as previous
The actual speed and resolution are driven by the overall performance requirements of the scanner.

97
Highlight reference and buffer
As you know, many ADCs also require an external reference, and, in this case, the reference is buffered by an op amp before going to the ADC.

98
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98

Highlight DSP

After the signal is digitized by the ADC, the information is often sent to a DSP for further gain and offset error correction.

99

Reduce Section
"B" and Enlarge
Section "C"

The signal is then processed and digitally enhanced by the image processor.

100

Back to the full
screen Graphic
and show
opportunity

Here's a look at the sales
opportunity in this application.

101

Transition

Music

102

Title Graphic

Digital Camera

103

Camera pans

Voice over pictures

network operations

center

104

Pan continues

Our final example is a digital video
camera.

105

105

Camera comes to
rest on a quad
video split of
security camera
images.

Narrator on-
camera

Narrator walks into
the frame of one of
these security
cameras

106

Narrator on- All video applications, including
(security)- camera this security camera scan images
at very high speeds.

107

Narrator on- Video applications include
camera. cameras that are typically found in

(Use mirror to broadcast, medical, and graphics
show camera systems.
recording picture)

108

Full Screen As you can see, the block diagram
Graphic is similar to the document scanner.
The sensor is a CCD.

109

Enlarge Section The output from the CCD is
"A". Highlight adjusted to the proper dc level,
parts then amplified by a programmable
gain amplifier. The signal is fine
tuned to match the input of the
ADC.

110

Same as previous Several video speed, low cost op
graphic amps perform these functions.

111

Reduce Section Once again we have a requirement
"A" Enlarge for an ADC and reference.

Section "B"

Highlight both ADC
and reference

112

Highlight ADC The ADC requires a resolution of
eight to twelve bits at video
speeds of five megahertz or
greater, depending on the exact
application

113

113 Reduce Section "B" and Enlarge Section "C" Once the data has been digitized, the digital images may also be manipulated or enhanced with software to create a better color picture

114 . The microprocessor supervises all of the functions that are controlled digitally.

115 Back to the Full Screen diagrams Show part count and dollar potential Here's the sales opportunity in Digital Cameras

116 Narrator on-camera Keep in mind that, for both the Document Scanner and this Camera, we're showing you only

one of multiple channels.

117

Narrator on-
camera

For many applications, the total
opportunity is much larger.

118

118

Narrator on-
camera

By the way, don't forget that in all these applications you will find additional opportunities to sell interface and power management products as peripherals to microprocessor.

119

Turn, walk for
close.

Music Under

120

Narrator on-
camera
Wide shot similar
to open.

The examples in this program cover only a few of many emerging high speed applications.

121

Narrator on-
camera

As this technology evolves, your opportunities will increase.

122

Narrator on-

If you carefully review these signal

camera

chains, you'll notice the similarities across all high speed applications, and you'll be better prepared to recommend Analog Devices products.

123

123

Narrator on-
camera

That's all we have time for now.
Thanks for joining us. Good luck,
and good selling.

124

Analog logo.

Music fade to end

125

Credit

*Our special thanks to the managers and staff
of the NYNEX Network Operations Center in
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cooperation and assistance in the production
of this program.*

126