

CCITT SGXV

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Dear Sirs and Mesdammes

The CCITT video coding experts group is currently finalizing a standard for ISDN video conferencing at channel bit-rates of $n \times 384$ kbits/sec, where n varies from one to five. Part of this standard algorithm involves a separable transform of 8×8 blocks of data, and for this we will require a VLSI chip implementation. We hereby solicit proposals for a chip design that will be designated as a CCITT standard.

The chip design should have the following properties:

1. Forward transform input 9-bits signed, output 12-bits signed, approximating a DCT.
2. Inverse transform input 12-bits, output 9-bits.
3. Back-to-back operation as transparent as possible.
4. Transform algorithm amenable to DSP implementation.
5. Low cost, high availability, etc., etc., etc.

In addition, could each proposal address the following questions:

1. Which patents are relevant? Is nondiscriminatory licensing available? What are the terms?
2. When will a technical specification exist?
3. When will samples exist? Price?
4. When will chips in quantity be available?
5. Will there be second sources?
6. Can mask data be licensed? Symbolic data?
7. What market size is required?

We look forward to your response by January 1, 1988. Please send to:

Barry G. Haskell
AT&T Bell Labs 4C-538
Holmdel, N.J. 07733 USA

ITEM: Maximum pixel rate?

Thomson Semiconducteurs
Grenoble, FRANCE

13.5 MHz (later 27 MHz)

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

20 MHz

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

15 MHz
(16x16 tested at 14.3 MHz)

AT&T Microelectronics
Allentown, Pennsylvania
USA

7 MHz (later 15 MHz)

Telettra

11 MHz

ITEM: What market size is required?

Thomson Semiconducteurs
Grenoble, FRANCE

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

Total: 250K/year by 1990
INMOS: 10K/year by 1990

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

VLSI Technology Inc. 2k/year

AT&T Microelectronics
Allentown, Pennsylvania
USA

None required for samples.

ITEM: How close to a DCT?

Thomson Semiconducteurs
Grenoble, FRANCE

1 level error 11%
2 level error 0.11%

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

AT&T Microelectronics
Allentown, Pennsylvania
USA

ITEM: Back-to-back operation - How close to transparent?

Thomson Semiconducteurs
Grenoble, FRANCE

1 level error 1%, random image.

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

1 level error 12.5%, Lenna.
1 level error ~ 1%, random image

AT&T Microelectronics
Allentown, Pennsylvania
USA

maximum error 1 level, typical

Telettra

s.d., 12-15

peak +1, -2

ITEM: How amenable to DSP implementation?

Thomson Semiconducteurs
Grenoble, FRANCE

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

OK Simple multiply/accumulate

NCR Microelectronics
Fort Collins, Colorado
USA

Proposed chip is a DSP

Bell Communications Research
Red Bank, New Jersey
USA

OK, but distributed arithmetic

AT&T Microelectronics
Allentown, Pennsylvania
USA

OK Simple rotations.

ITEM: Which patents are relevant? Is nondiscriminatory licensing available? What are the terms?

Thomson Semiconducteurs
Grenoble, FRANCE

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

Applied for. License available.
Royalty on sale price. 1-2%

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

Applied for. License available.
Reasonable terms.

AT&T Microelectronics
Allentown, Pennsylvania
USA

U.S. 928894 Usual AT&T license.
Royalty on sale price.

ITEM: When will a technical specification exist?

Thomson Semiconducteurs
Grenoble, FRANCE

Advanced specifications attached.

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

Advanced data sheet attached.
Detailed data sheet 1Q88

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

4Q88

AT&T Microelectronics
Allentown, Pennsylvania
USA

Advanced data sheet attached.

Telettra

*Advanced data sheet
attached*

ITEM: When will samples exist? Price?

Thomson Semiconducteurs
Grenoble, FRANCE

3Q88
First silicon April 88

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

4Q88

NCR Microelectronic
Fort Collins, Colorado
USA

3Q89 tentatives

Bell Communications Research
Red Bank, New Jersey
USA

3Q88 for 8x8 tentative
Forward DCT tested for 16x16

AT&T Microelectronics
Allentown, Pennsylvania
USA

2Q88 ~ \$200
Forward and inverse tested

Telettra

samples tested

ITEM: When will chips in quantity be available?

Thomson Semiconducteurs
Grenoble, FRANCE

Decision to be made 3Q88

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

2Q89 Approx. \$27

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

4Q88 possible

AT&T Microelectronics
Allentown, Pennsylvania
USA

Possible 4Q88

Telettra

1Q89

ITEM: Will there be second sources?

Thomson Semiconducteurs
Grenoble, FRANCE

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

Yes.

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

Yes, if full production.

AT&T Microelectronics
Allentown, Pennsylvania
USA

Yes, if full production.

ITEM: Can mask data be licensed? Symbolic data?

Thomson Semiconducteurs
Grenoble, FRANCE

Raytheon Semiconductor
Mountain View, California
USA

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

Masks licensed under normal terms.

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

Yes. Yes.

AT&T Microelectronics
Allentown, Pennsylvania
USA

Not usually (see second source)

ITEM: Bit I/O format, signed. 9 in, 12 out - 12 in, 9 out

Thomson Semiconducteurs
Grenoble, FRANCE

OK 2's complement

Raytheon Semiconductor
Mountain View, California
USA

OK sign/magnitude

Siemens Components Group
Munich, FRG

INMOS Limited
Bristol, UK

OK 2's complement

NCR Microelectronics
Fort Collins, Colorado
USA

Bell Communications Research
Red Bank, New Jersey
USA

OK 2's complement

IDCT output 12 bits ??

AT&T Microelectronics
Allentown, Pennsylvania
USA

OK 2's complement