

TIME DIFFERENCE OF ARRIVAL DIRECTION FINDER

UPDATES&CHANGES

FROM 102-73170-20:
ADD SYNCHRONOUS DETECTION
AND LED METER

CIRCUIT BOARD SIZE CHANGED
TO FIT HAMMOND 1599E ENCLOSURE

INTERNAL SPEAKER ADDED

SYNCHRONOUS DETECTOR ADDED

ANALOG METER EMULATION
(USING LEDs)

U14/U15 CHANGE TO INVERTING

DAUGHTER CARDS

LED DISPLAY UP

LEDs MOUNTED TOP-SIDE
2 SPACER HOLES AVAILABLE
FOR ALIGNMENT JIG

MUST USE SHORT DAUGHTERCARD
MAY USE WIDE OR NARROW

WIDE DAUGHTERCARD MUST BE
REMOVED TO PROGRAM zNEO

LED DISPLAY DOWN

LEDs MOUNTED BOTTOM-SIDE

MAY USE TALL OR SHORT DAUGHTERCARD
MAY USE WIDE OR NARROW

WIDE DAUGHTERCARD MUST BE
REMOVED TO PROGRAM zNEO

SERIAL CONNECTION
HOST CONFIGURATION

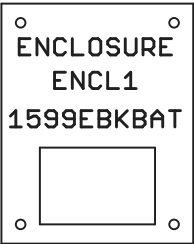
AUDIO CONNECTION FROM
RADIO NON-CRITICAL

ANTENNA ROTATOR
CONNECTION
102-73174-70

SW_P ANALOG LEVELS	
DAUGHTER BOARD	
NAKED	0V
102-73174-71	2.0V
102-73174-82	0V
102-73174-91	0V
102-73174-97	0V

PD1 DIGITAL LEVELS		
DAUGHTER BOARD	NO CARRIER	CARRIER DETECT
NAKED	1	1
102-73174-71	1	1
102-73174-82	0	0
102-73174-91	1	0
102-73174-97	1	0

ON



THIS BOARD CONTAINS
STATIC SENSITIVE
DEVICES. HANDLE
ONLY IN STATIC SAFE
ENVIRONMENT

TOP_FULL

BOARD ASSY

BOT_COMPACT

BOARD-ID

DRAWING FRAME SHOWN ON CIRCUIT BOARD

Drawn

W. ROBISON

Date

10/2025

Designed

W. ROBISON

Date

10/2025

MARK ZERO POINT FOR
PICK & PLACE FILE ON
PRINTED CIRCUIT BOARD

KC0JFQ

PWB RELEASED AS 2D354 102 - 73174 - 41

PWA RELEASED AS 2D354 102 - 73174 - 41

The University of Iowa
Department of Physics & Astronomy
Iowa City, IA, USA

TITLE: ICARC TDOA, STM32

A102_73174_41

CAGE

2D354

Series

102

ICARC FOX HUNT

B

Number

73174

4 Layers

Rev

41

Date:

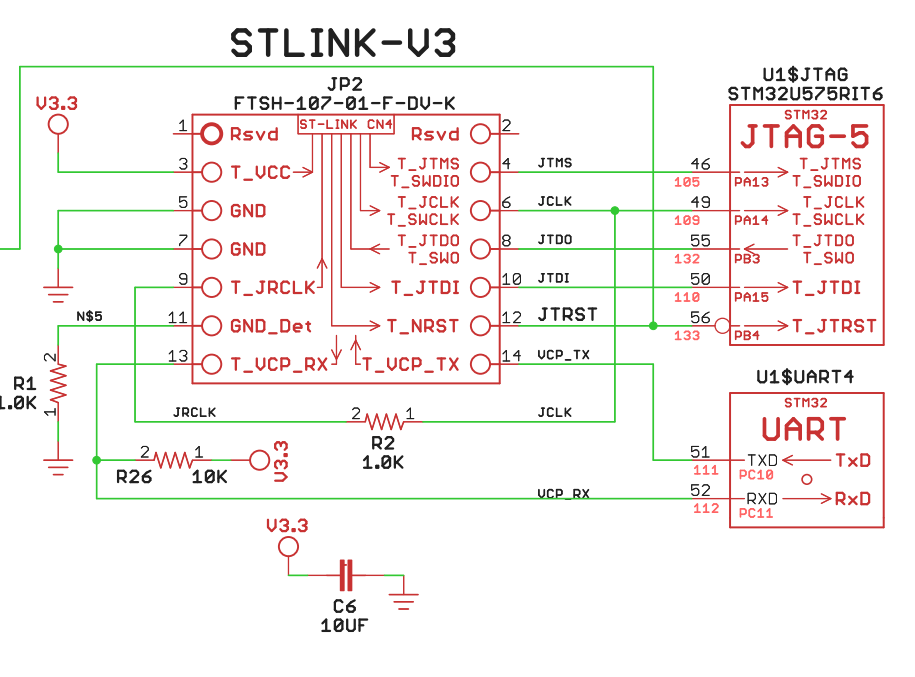
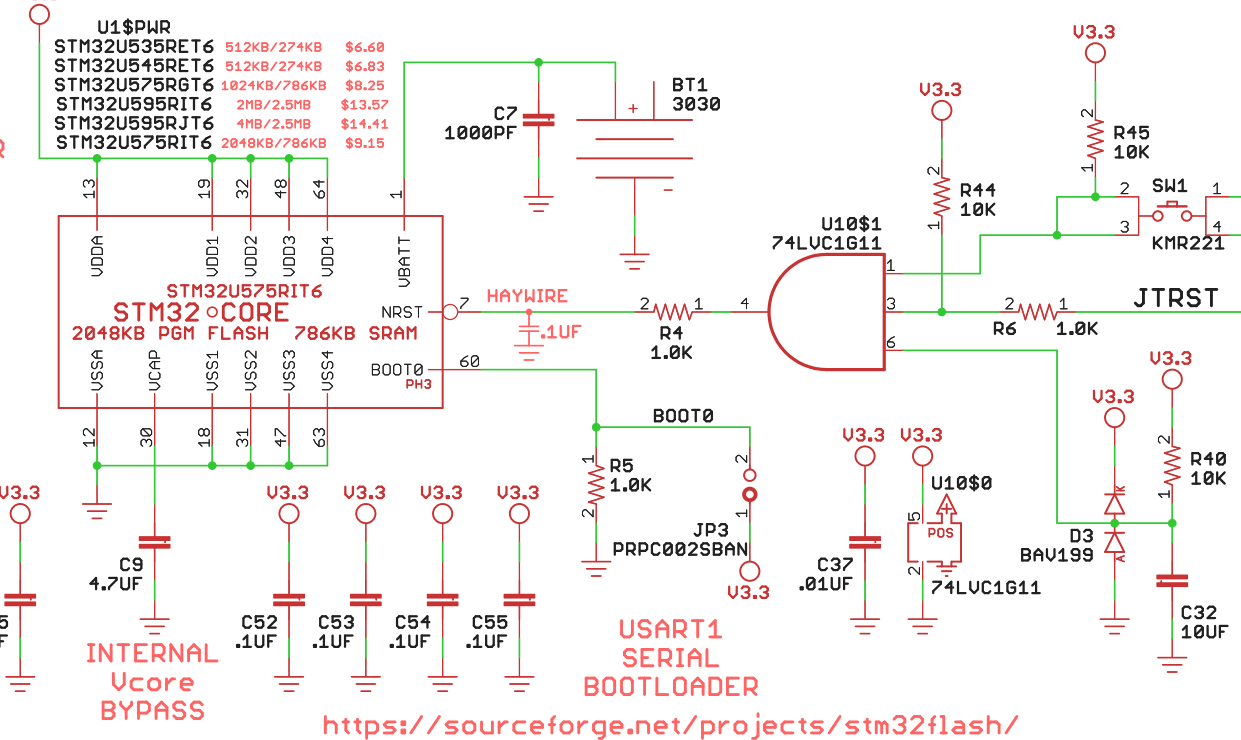
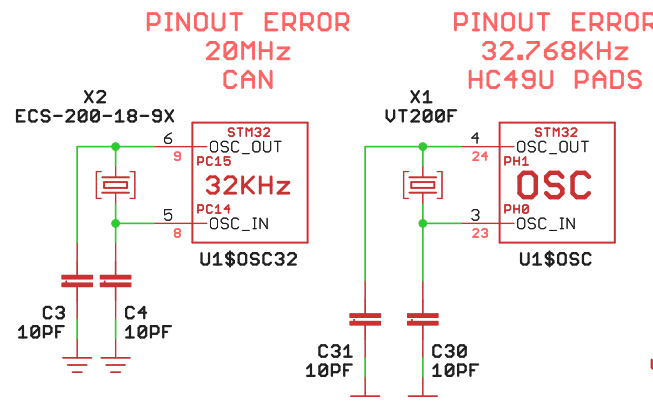
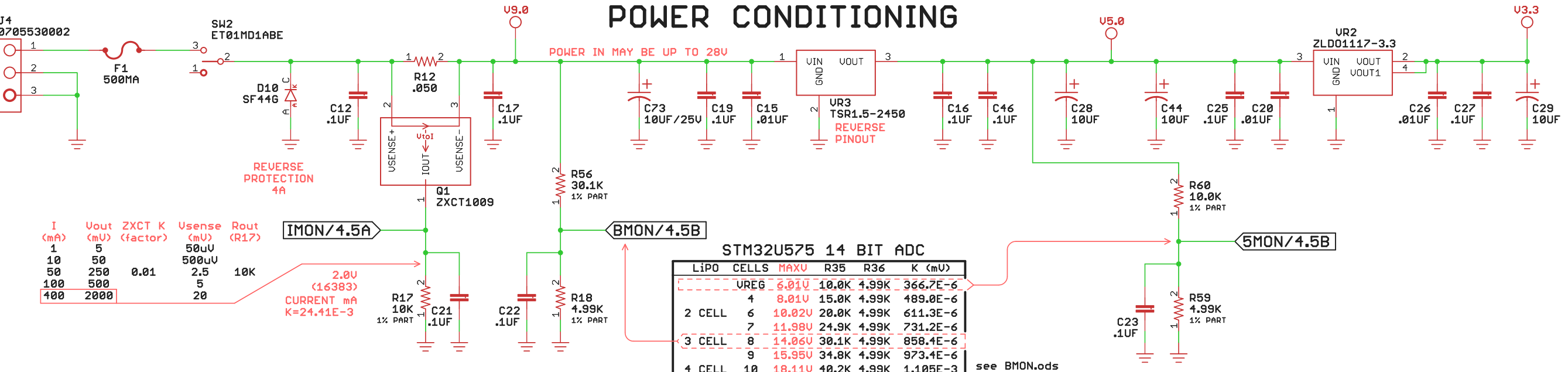
28 Jul 2026 08:10:21

28 Jul 2026 08:10:47

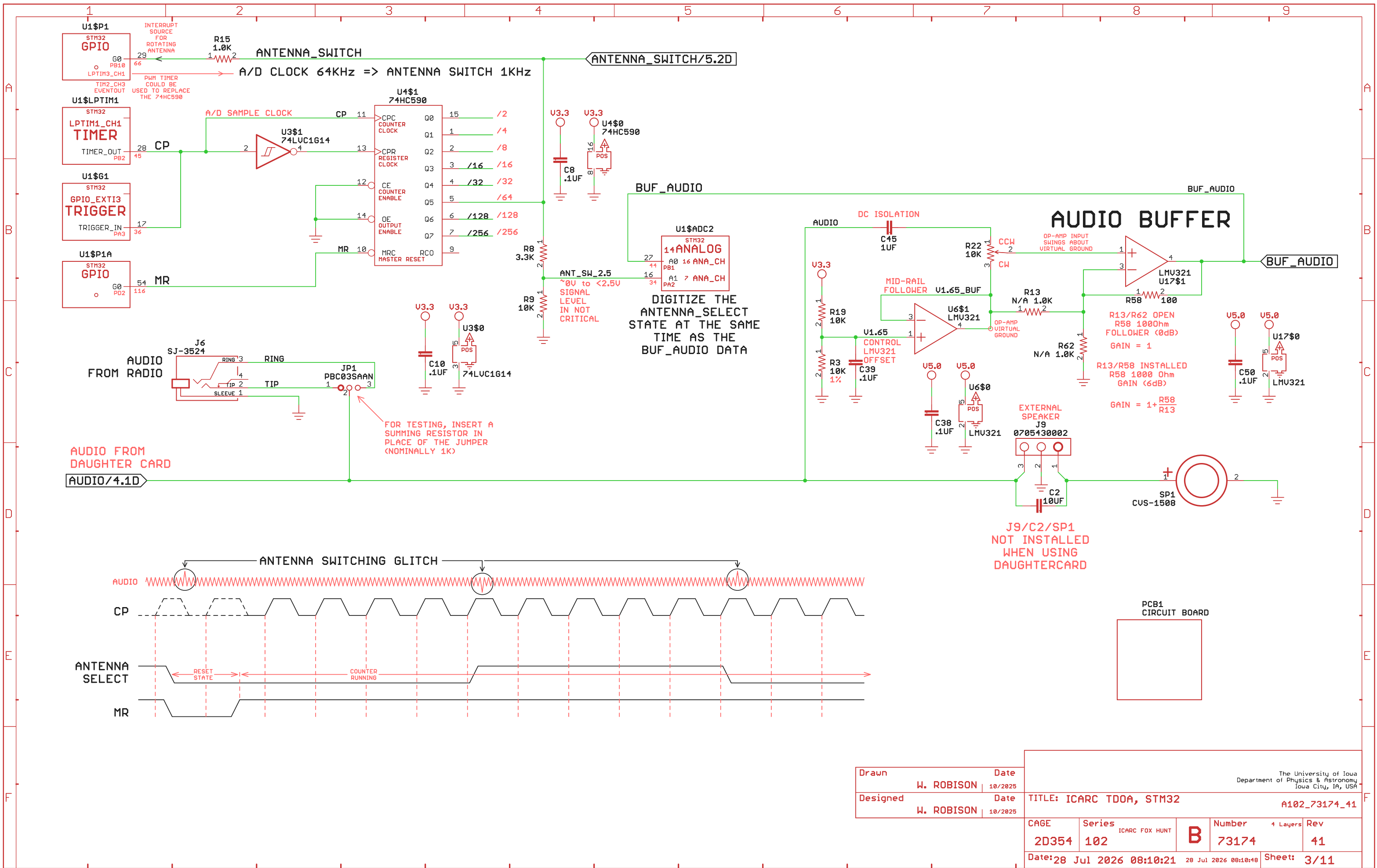
Sheet:

1/11

POWER CONDITIONING

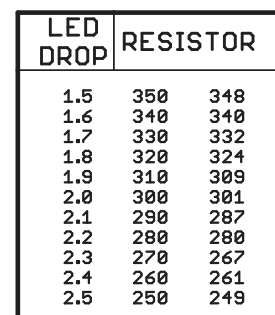
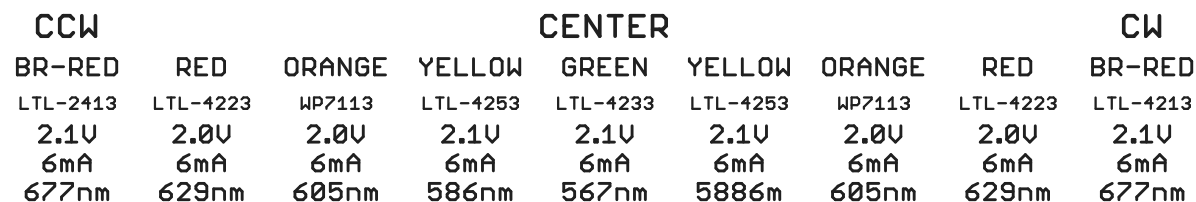
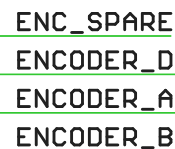
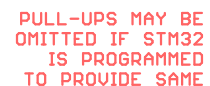


Drawn		Date	The University of Iowa Department of Physics & Astronomy Iowa City, IA, USA					
W. ROBISON		10/2025						
Designed		Date	TITLE: ICARC TDOA, STM32					
W. ROBISON		10/2025	A102_73174_41					
			CAGE	Series	B	Number	4 Layers	Rev
			2D354	102		73174		41
			Date:28 Jul 2026 08:10:21			28 Jul 2026 08:10:48		



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Designed	W. ROBISON	Date	10/2025

The University of Iowa Department of Physics & Astronomy Iowa City, IA, USA			
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CAGE	Series	Number	Rev
2D354	102 ICARC FOX HUNT	B 73174	41
Date: 28 Jul 2026 08:10:21		Sheet: 3/11	



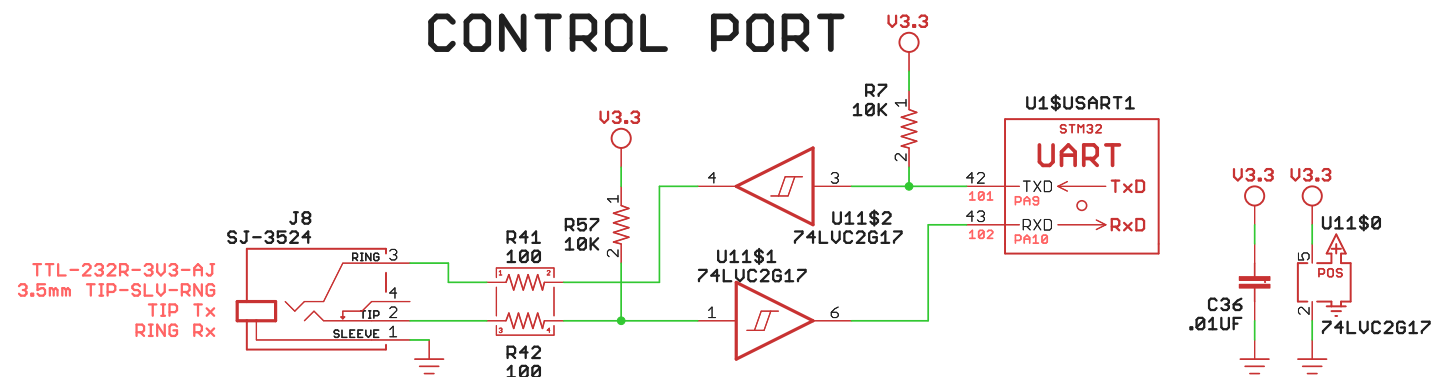
DRIVE CURRENT SELECTED TO
WORK WITH THE STM32U5



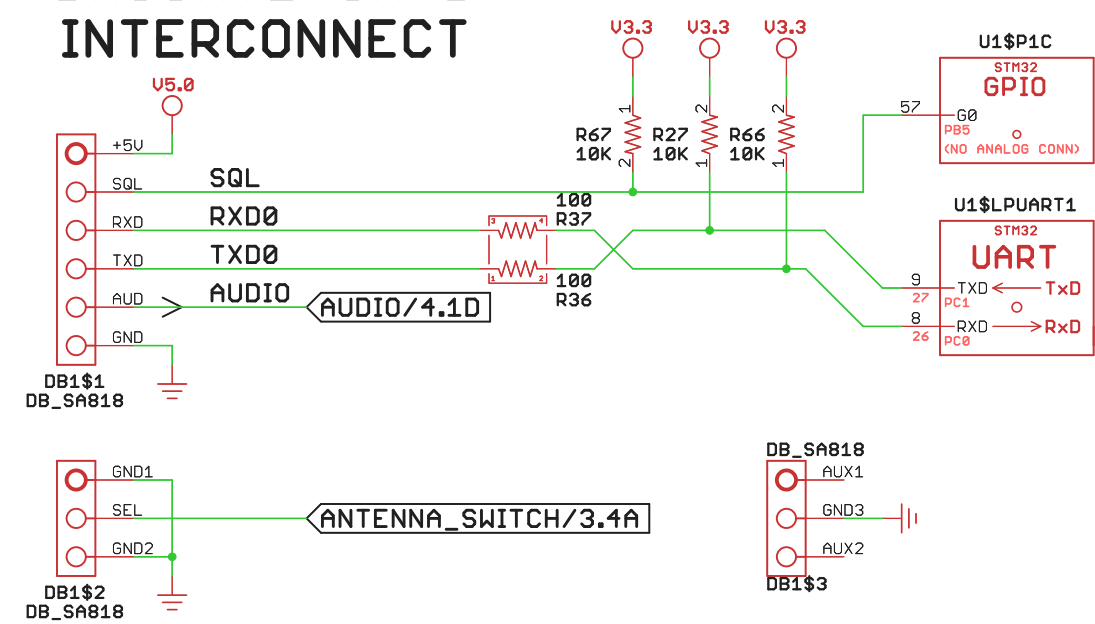
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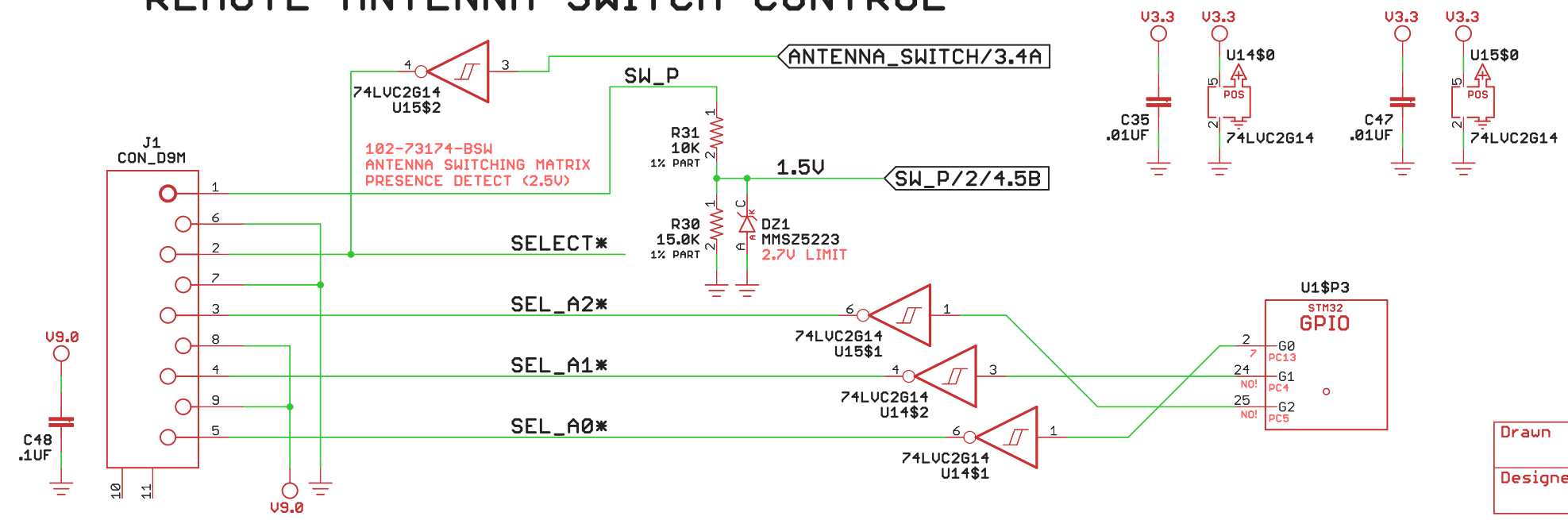
CONTROL PORT



DAUGHTERCARD INTERCONNECT

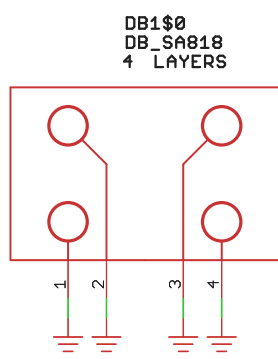
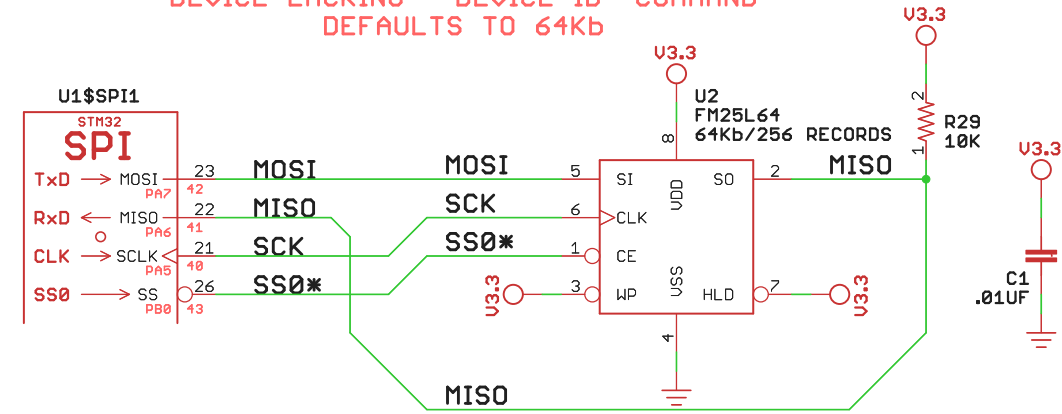


REMOTE ANTENNA SWITCH CONTROL



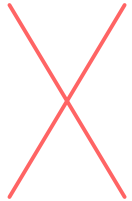
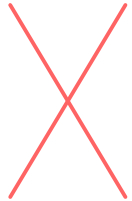
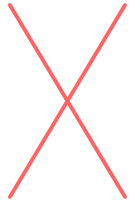
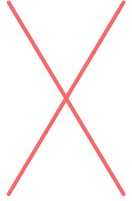
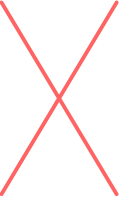
EXTERNAL MEMORY

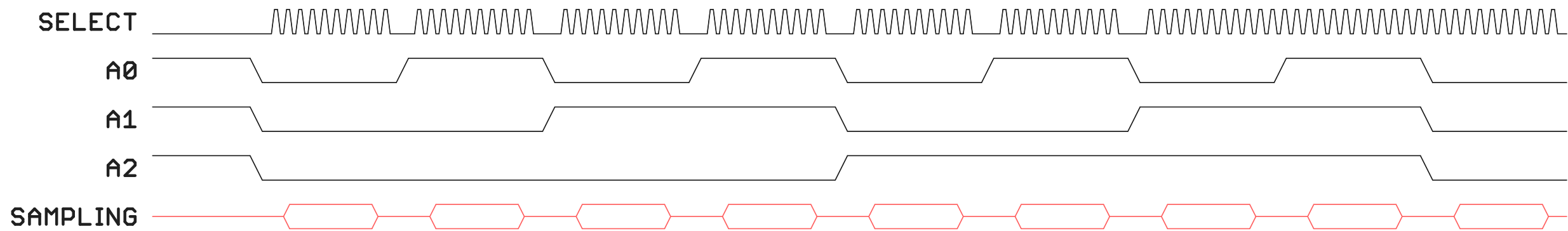
*** MINIMUM FLASH SIZE 64Kb ***
LARGER SIZE MUST
PROVIDE "DEVICE ID" COMMAND
TO ESTABLISH SIZE
DEVICE LACKING "DEVICE ID" COMMAND
DEFAULTS TO 64Kb



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ICARC FOX TDOA RECEIVER PORT ASSIGNMENTS
73174-40

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
PORT A	JTAG TDI 50	JTAG CLK 49	JTAG TMS 46	METER L3 45	METER L4 44	USART1 RXD 43	USART1 TXD 42	METER L5 41	SPI1 MOSI 23	SPI1 MISO 22	SPI1 SCLK 21	DAC OUT 20	GPIO EXTI3 17	ANALOG AUDIO ANT 16	ANALOG SW_P 15	ANALOG 5MON 14
PORT B	ENCODER B 36	ENCODER A 35	ENCODER D 34	ENCODER SPARE 33		ANT_SW IN 29	DAC QUIET 62	RSVD I2C1 SCL 61	RSVD I2C1 SDA 59	METER L1 58	SQL 57	JTAG TRST 56	JTAG TDO 55	LPTIM OUT 28	ANALOG AUDIO 27	SPI1 SS* 26
PORT C	OSC32 OUT 4	OSC32 IN 3	ASEL A0 2	METER L2 53	UART4 RXD 52	UART4 TXD 51	METER L6 40	METER L7 39	METER L8 38	METER L9 37	ASEL A2 25	ASEL A1 24	ANALOG BMON 11	ANALOG IMON 10	LPUART TXD 9	LPUART RXD 8
PORT D														MR OUT 54		
PORT H													BOOT0 60		OSC OUT 6	OSC IN 5



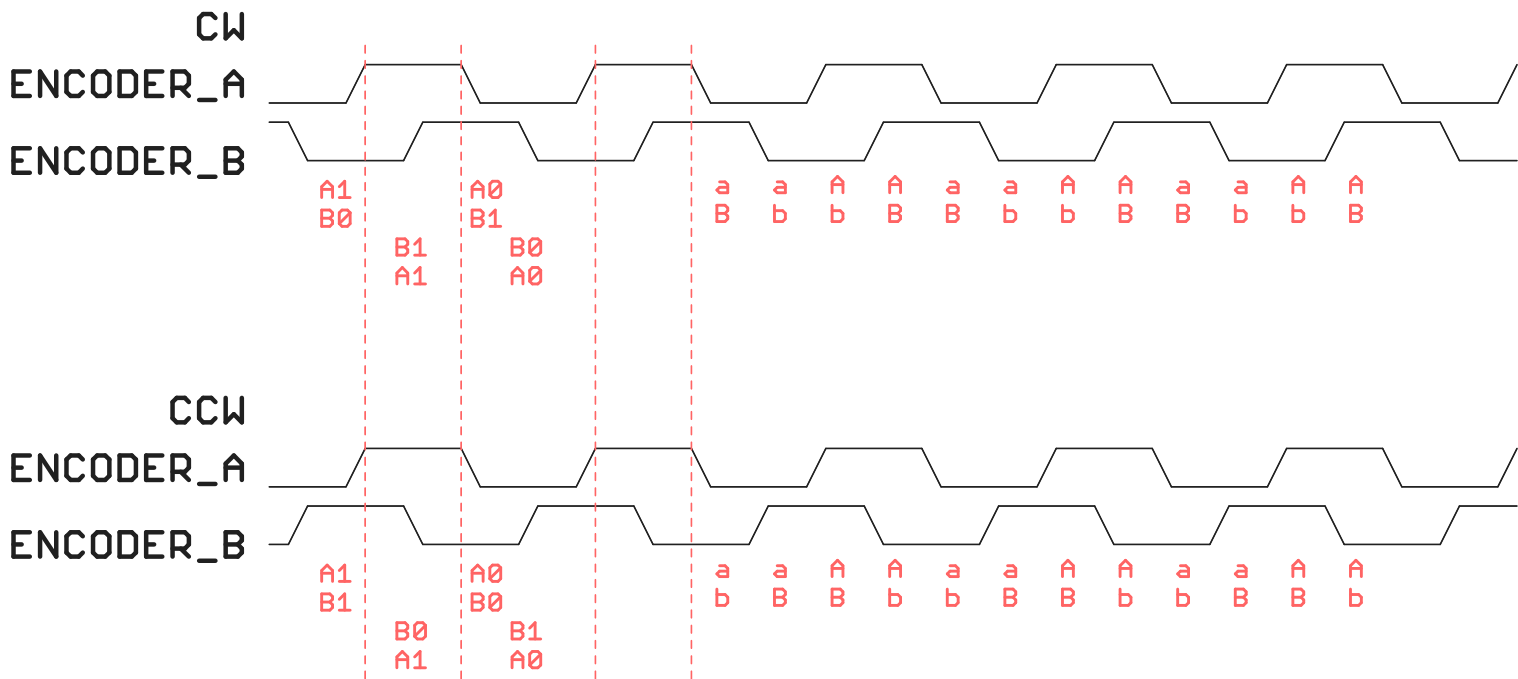
SELECT POLARITY

SELECT POLARITY IS NOT CRITICAL
TO THE HARDWARE;
SOFTWARE MAY NEED TO KNOW
THE SPECIFIC POLARITY TO RESOLVE
AMBIGUITY IN THE 'LINE-OF-POSITION'
DIRECTION (i.e. FORE/AFT)

ANTENNA_SWITCH -> SELECT

SELECT IS DERIVED (DIVIDE BY 64)
FROM THE ADC SAMPLE CLOCK

SELECT MAY BE ENABLED FOR SAMPLING
OR IT MAY BE LEFT CONTINUOUSLY RUNNING



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2D354	102 ICARC FOX HUNT		73174		41
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ICARC FOX TRANSMITTER DMA CHANNEL ASSIGNMENTS

73228-3

GPDMA Ch 0 USART1 Rx HOST CONTROL	
GPDMA Ch 1 ADC1 & DAC1 SCI & HSK	
GPDMA Ch 2 SPI1 Rx CONFIG FRAM	
GPDMA Ch 3 SPI1 Tx CONFIG FRAM	
GPDMA Ch 4 LPUART1 Rx DAUGHTERCARD	
GPDMA Ch 5 UART4 Rx STLINK PROGRAMMER	
GPDMA Ch 6 UNUSED UNUSED	

Drawn	Date
W. ROBISON	10/2025
Designed	Date
W. ROBISON	10/2025

The University of Iowa Department of Physics & Astronomy Iowa City, IA, USA				
TITLE: ICARC TDOA, STM32				
A102_73174_41				
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2D354	102		73174	41
Date: 28 Jul 2026 08:10:21				
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123456789

A

B

C

D

E

F

ICARC FOX TRANSMITTER ANALOG CHANNEL ASSIGNMENTS

73228-3

B

C

D

E

F

ANALOG Ch 0 STM32 VREF	PCSEL 0	
ANALOG Ch 1 STM32 VBATT	PCSEL 18	
ANALOG Ch 2 STM32 VSENSE	PCSEL 19	
ANALOG Ch 3 FOX BMON	PCSEL 5	
ANALOG Ch 4 FOX IMON	PCSEL 6	
ANALOG Ch 5 FOX 5MON	PCSEL 7	
ANALOG Ch 6 DAUGHTER SW	PCSEL 8	
ANALOG Ch 7 DAUGHTER PHOTO	PCSEL N/A	

Drawn

W. ROBISON

Date

10/2025

Designed

W. ROBISON

Date

10/2025

The University of Iowa

Department of Physics & Astronomy

Iowa City, IA, USA

TITLE: ICARC TDOA, STM32

A102_73174_41

CAGE

2D354

Series

ICARC FOX HUNT102

Number

B73174

Rev

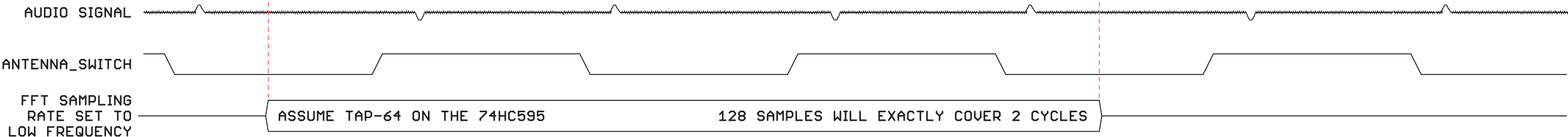
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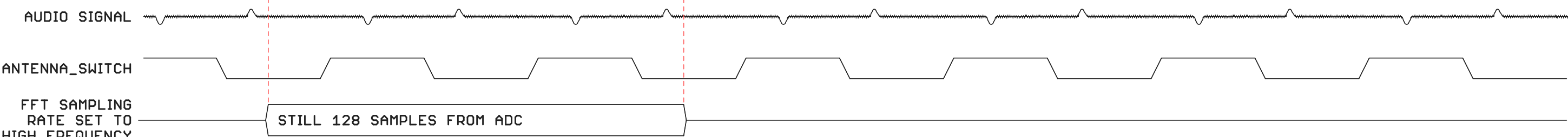
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ICARC FOX TDOA FFT ANALYSIS PLAN



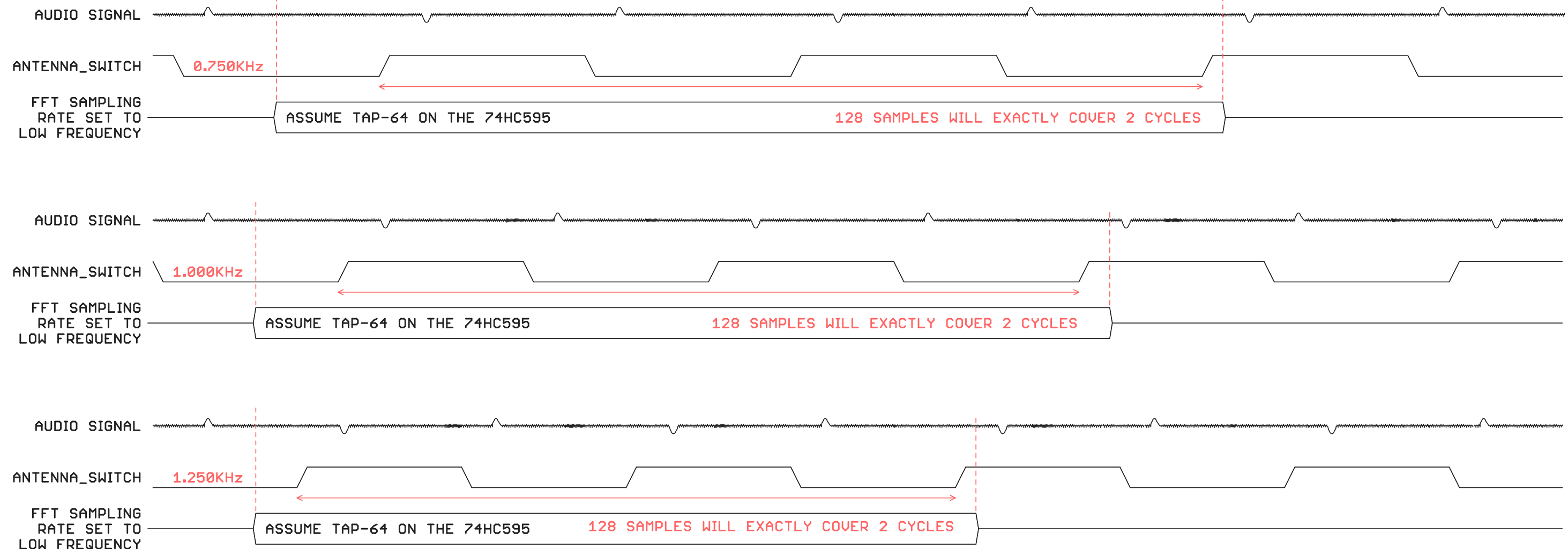
THE FREQUENCY BIN THAT COVERS THE SWITCHING
FREQUENCY WILL BE WELL DEFINED AND INDEPENDANT
FROM THE AUDIO SAMPLING FREQUENCY

WE CAN VARY (SCAN) THE SWITCHING FREQUENCY
TO MOVE THE 'BIN OF INTEREST' AWAY FROM
INTERFERING PARTS OF THE SPECTRUM

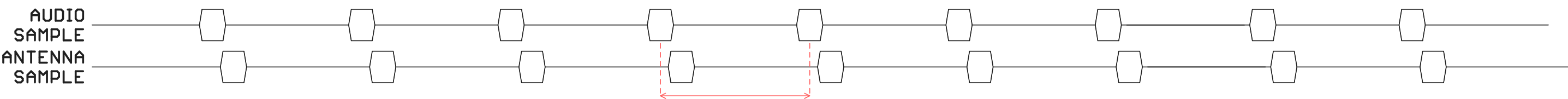


THE ANTENNA SWITCHING SPECTRUM IS LOCKED
TO THE DAC SAMPLING FREQUENCY (74HC590)
EXTERNAL SPECTRUM MAY BE EFFECTIVELY SHIFTED
BY CHANGING THE AUDIO SAMPLING FREQUENCY

ICARC FOX TDOA SIMPLE ANALYSIS PLAN



NOMINAL BUFFER LENGTH: 1024 SAMPLES
16 COMPLETE ANTENNA SWITCHING CYCLES
WE CAN EXTRACT 15 BUFFERS
(OR ADD 64 SAMPLES TO THE BUFFER TO GET A FULL 16)



MINIMUM AUDIO SAMPLE RATE IS SET
WELL ABOVE AUDIO BANDWIDTH OF RECEIVER