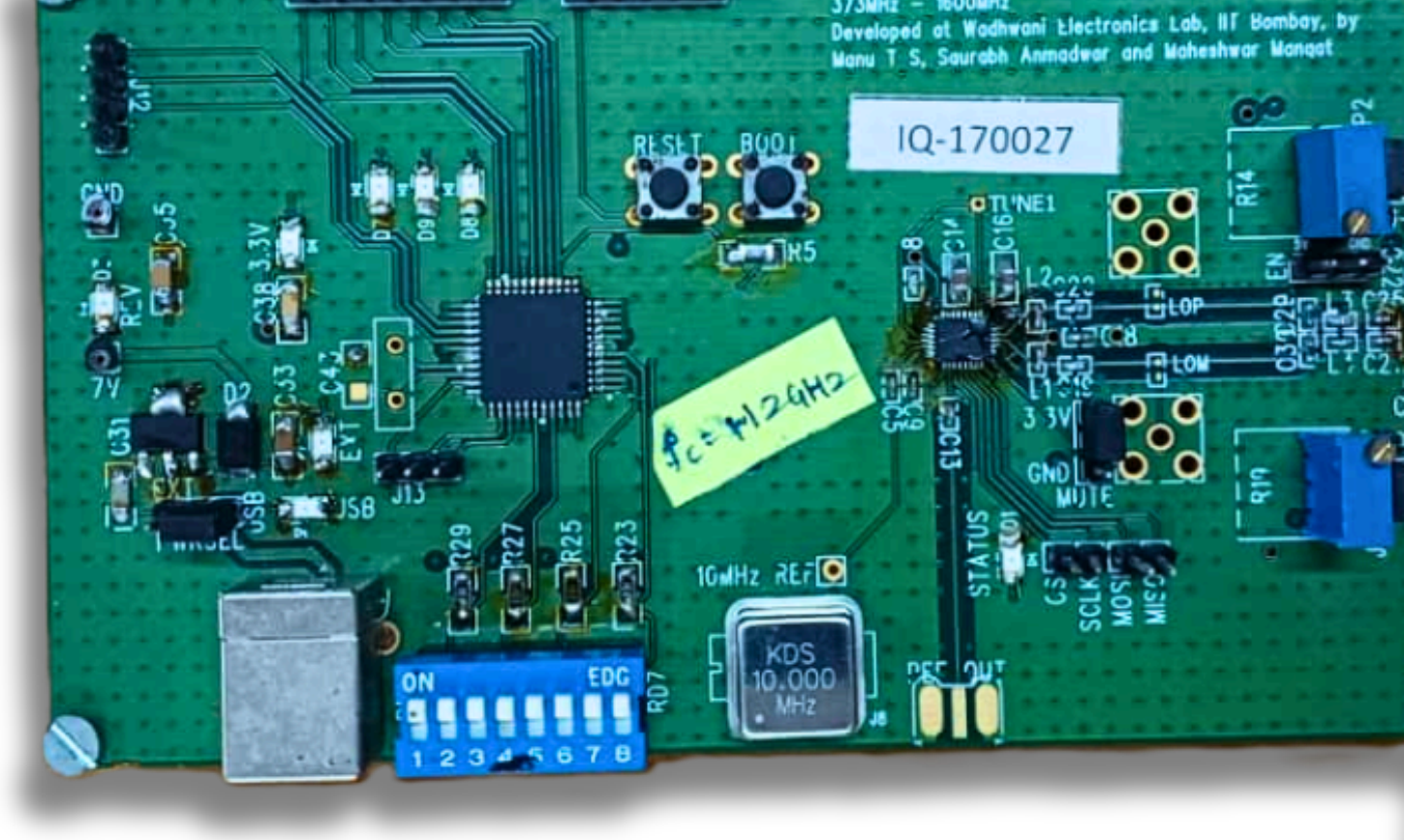


EE 340 Communications Lab

What's inside an

IQ Modulator Board

IQ Modulation implementation

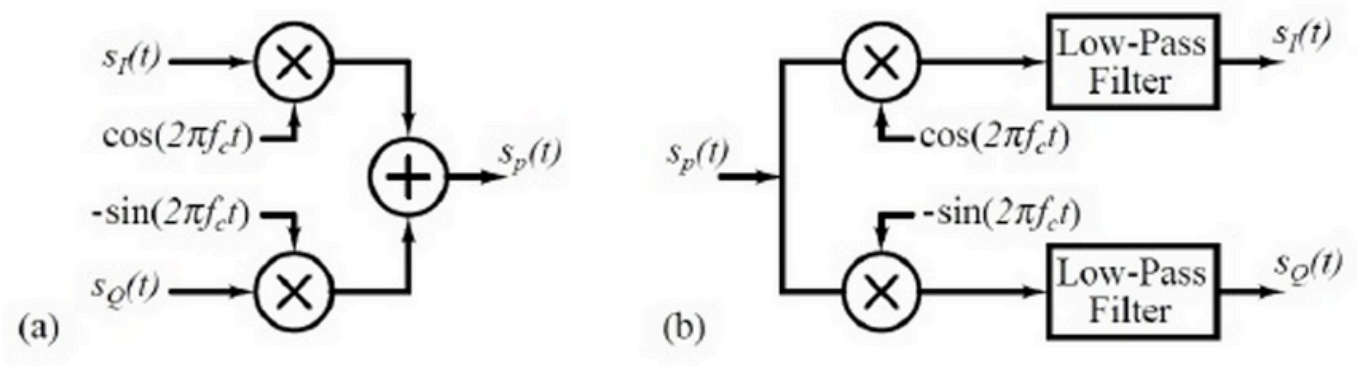


Figure 1: Flowgraph of (a) an IQ modulator, and (b) an IQ demodulator

$$s_p(t) = s_I(t)\cos(2\pi f_c t) - s_Q(t)\sin(2\pi f_c t)$$

IQ Modulation implementation

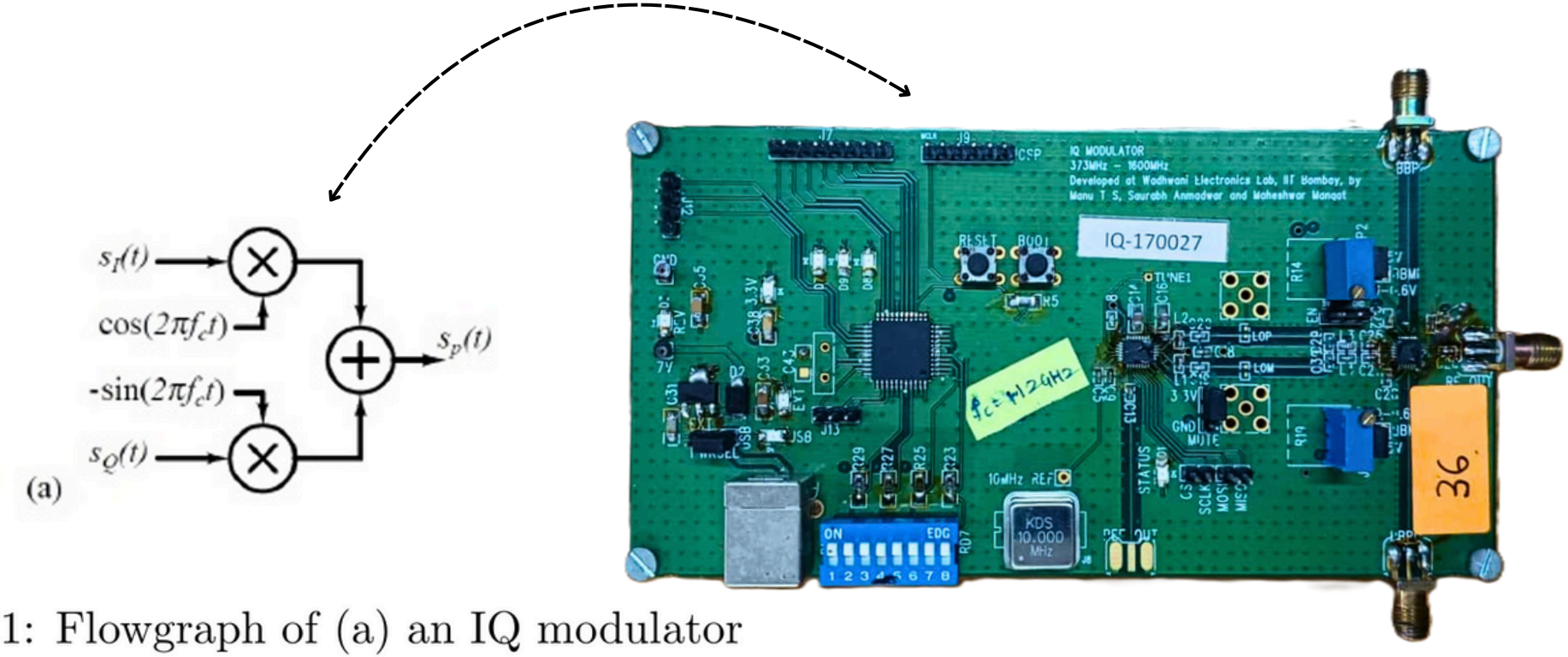
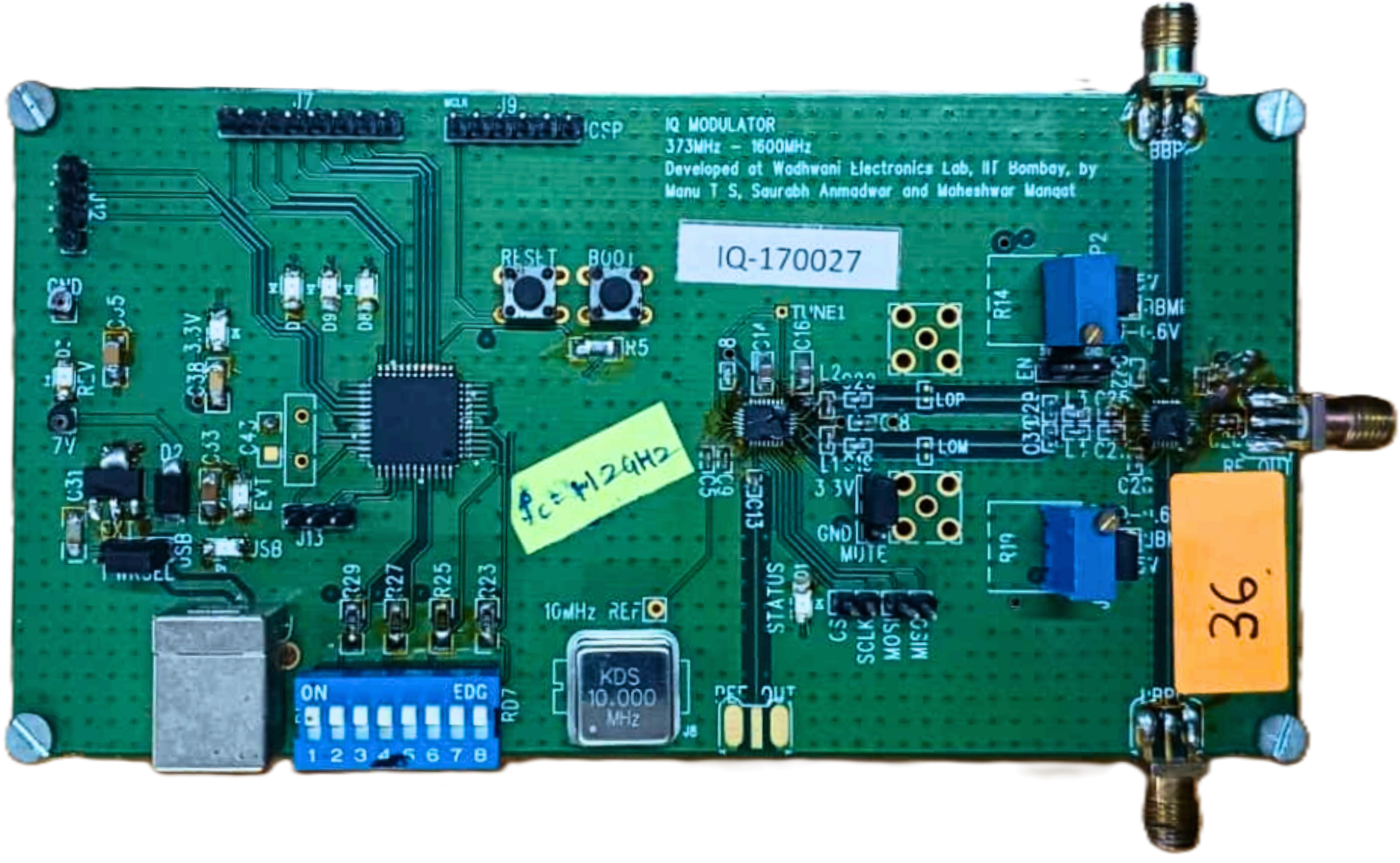
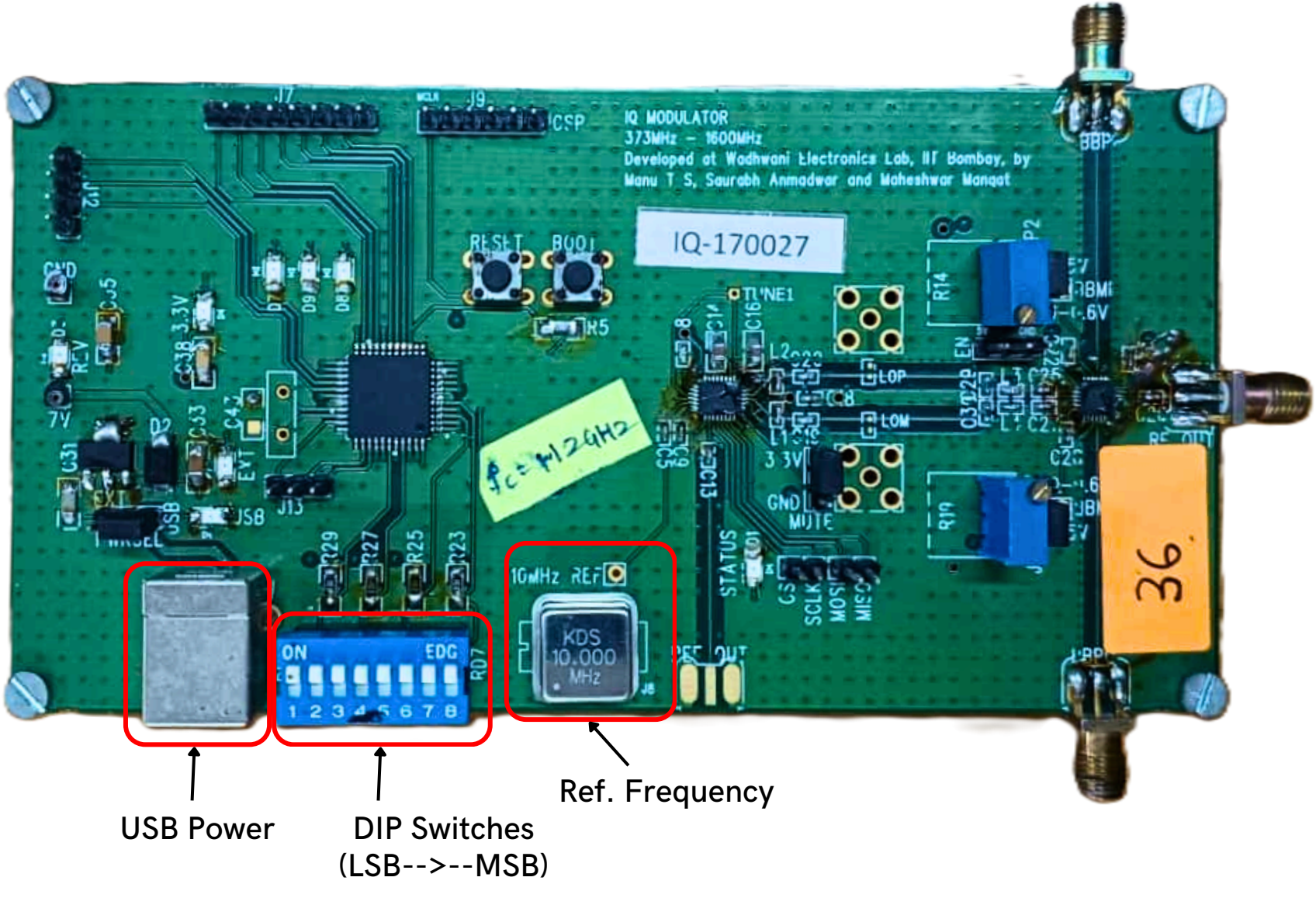


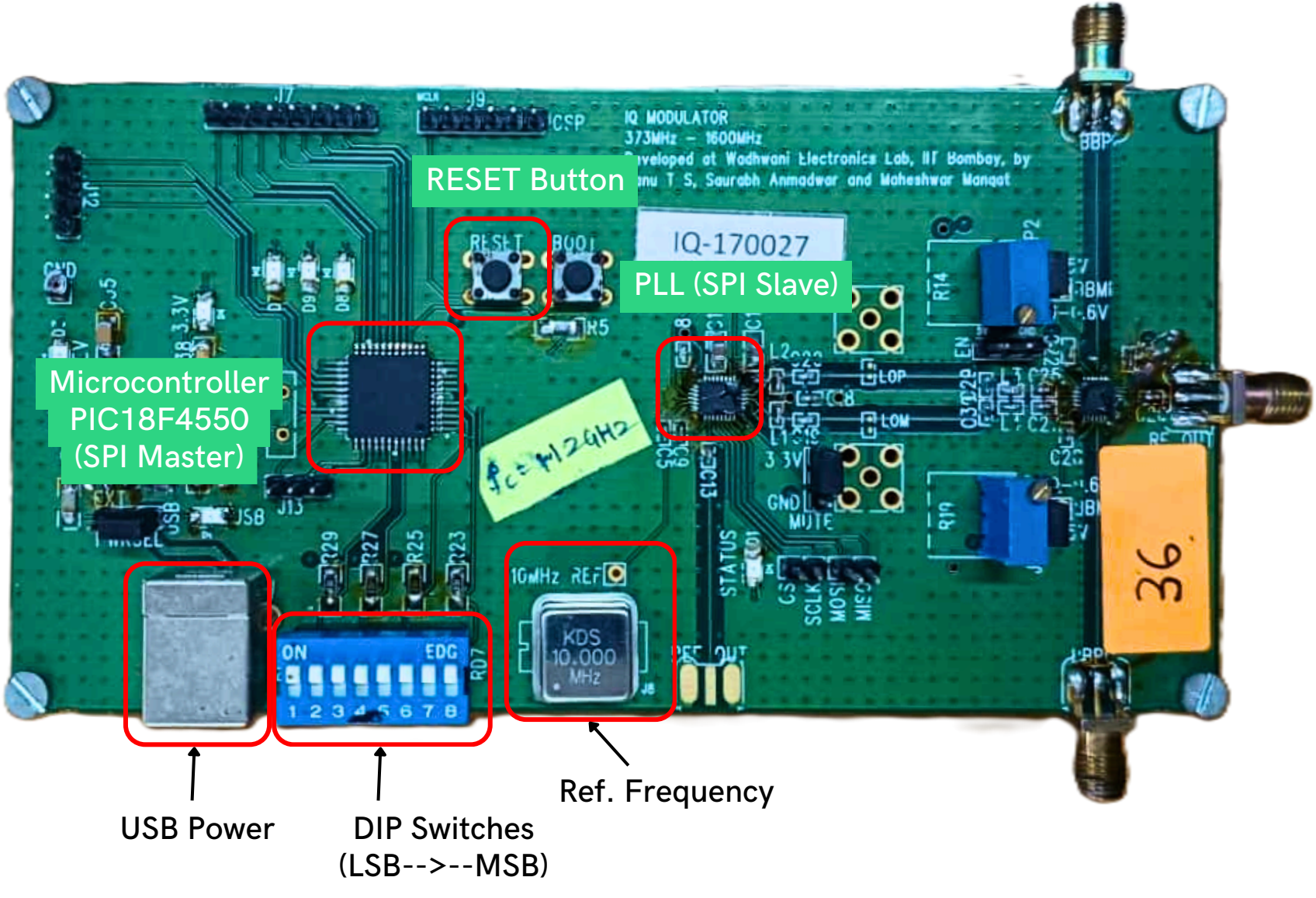
Figure 1: Flowgraph of (a) an IQ modulator

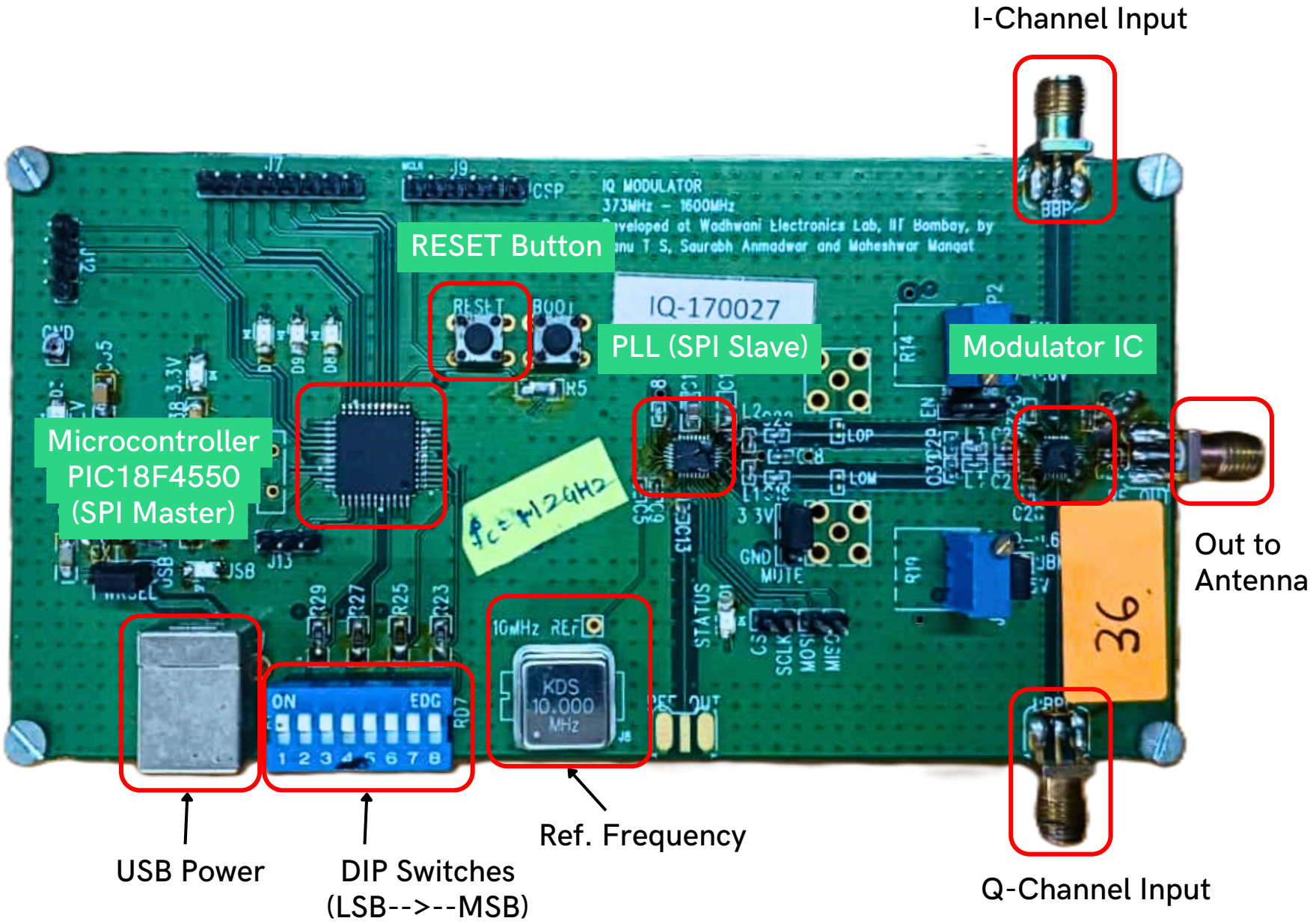
$$sp(t) = sI(t)\cos(2\pi fct) - sQ(t)\sin(2\pi fct)$$

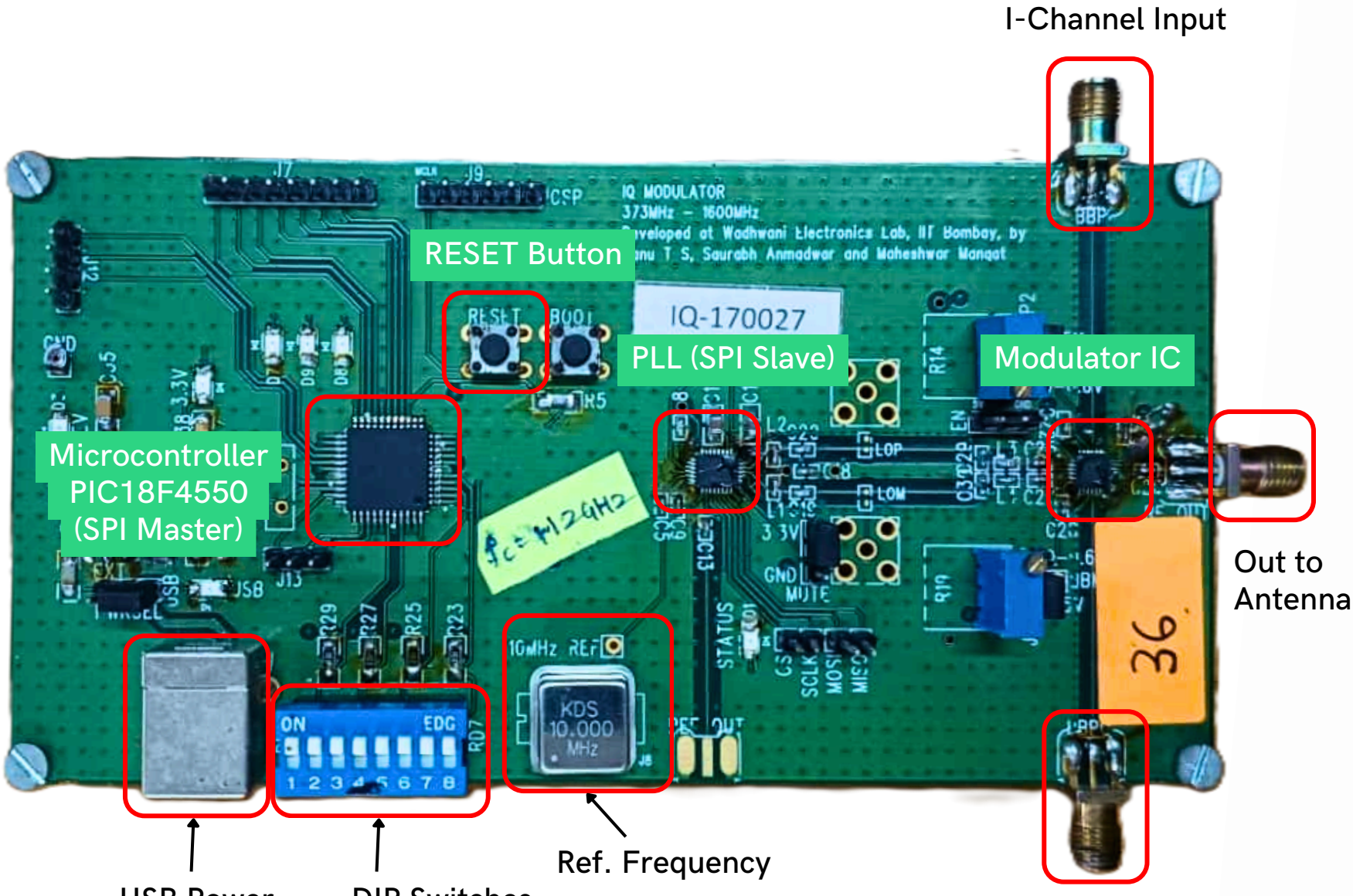
IQ Modulator Board



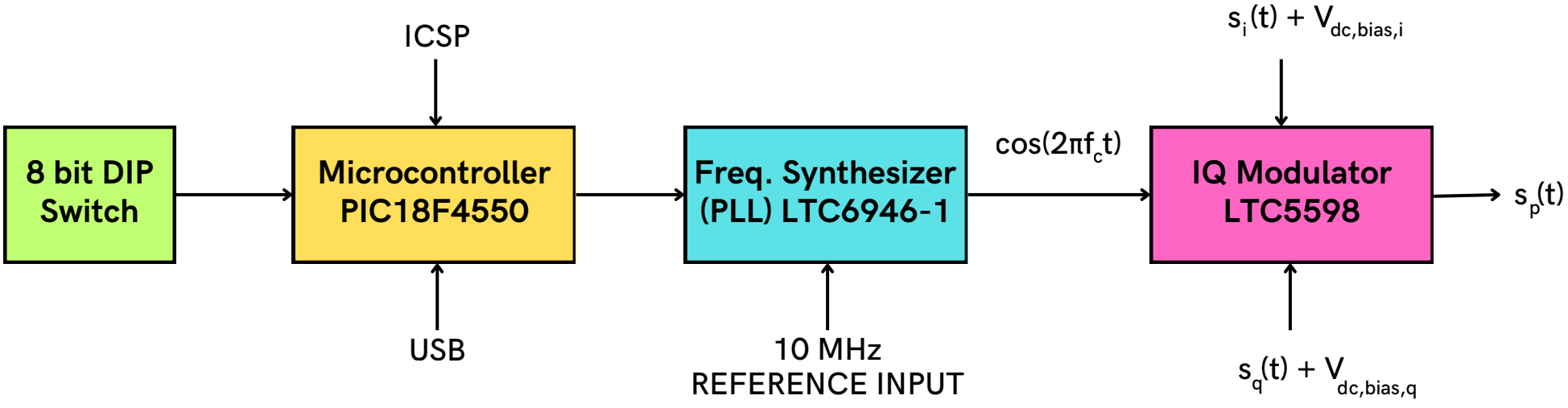

IQ MODULATOR
373MHz - 1600MHz
Developed at Wadhwani Electronics Lab, IIT Bombay, by
Manu T S, Saurabh Anmadwar and Maheshwar Manoat
IQ-170027
RESET
BOOT
10MHz REF
KDS
10.000
MHz
ON
EDG
1 2 3 4 5 6 7 8
LOP
LOM
MUTE
STATUS
SCLK
MOSI
MISO
36
USB Power
DIP Switches
(LSB-->--MSB)
Ref. Frequency

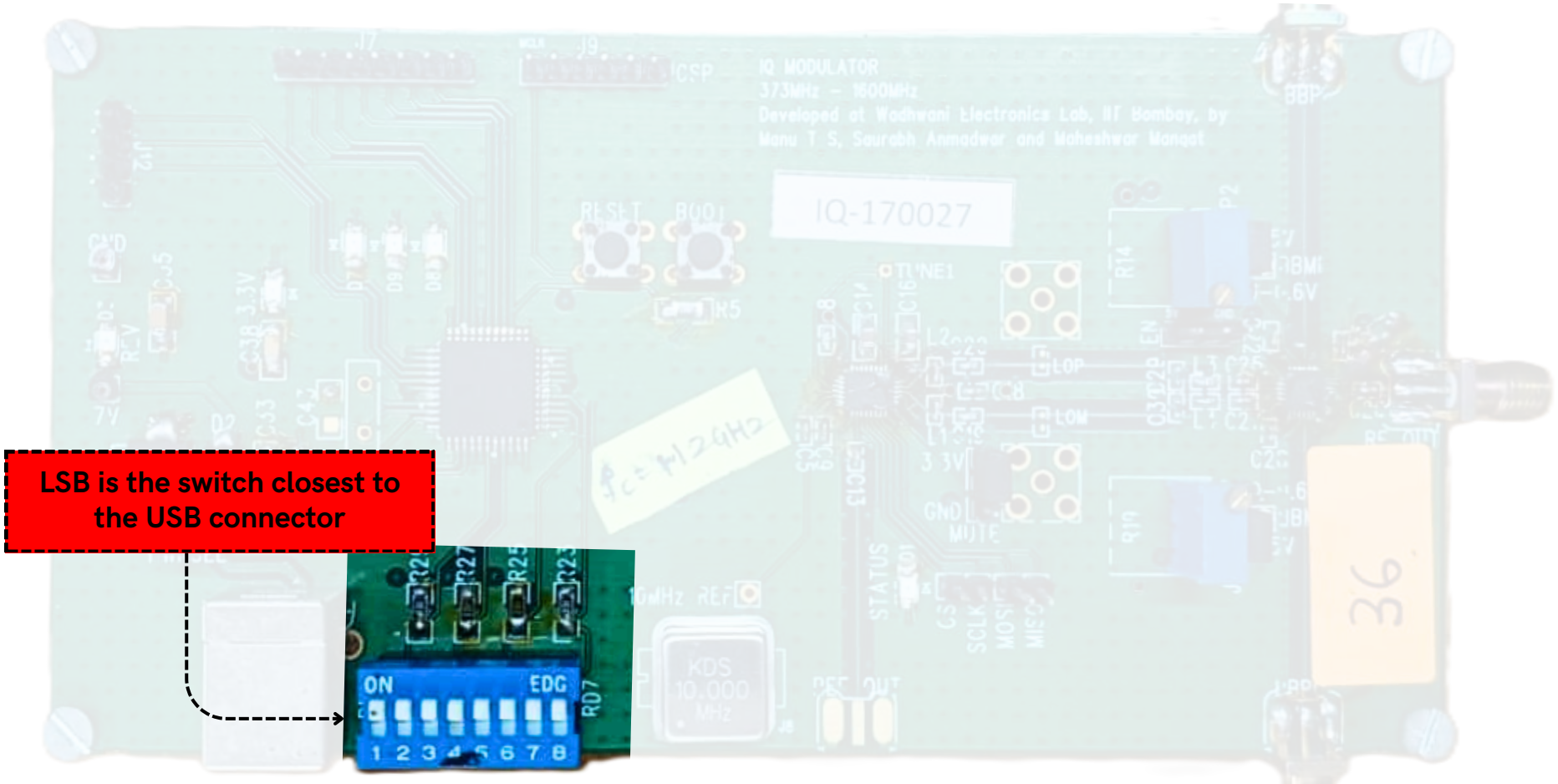

RESET Button
PLL (SPI Slave)
Microcontroller
PIC18F4550
(SPI Master)
USB Power
DIP Switches
(LSB-->--MSB)
Ref. Frequency
IQ MODULATOR
373MHz - 1600MHz
IQ-170027
RESET
BOOT
ON
10MHz REF
KDS
10.000
MHz
STATUS
LOP
LOM
MUTE
3.3V
GND
36

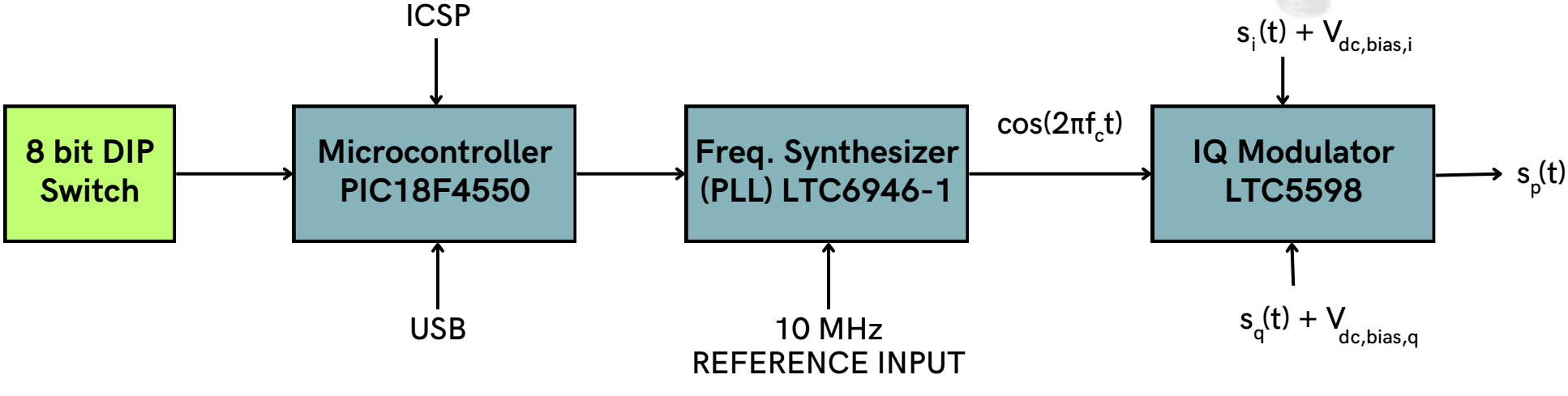

I-Channel Input
RESET Button
PLL (SPI Slave)
Modulator IC
Microcontroller
PIC18F4550
(SPI Master)
Out to
Antenna
USB Power
DIP Switches
(LSB-->--MSB)
Ref. Frequency
Q-Channel Input
IQ MODULATOR
373MHz - 1600MHz
IQ-170027
10MHz REF
KDS
10.000
MHz
ON
EDG
1 2 3 4 5 6 7 8
RESET
BOOT
STATUS
MUTE
LOP
LOM
SCLK
MOSI
MISO

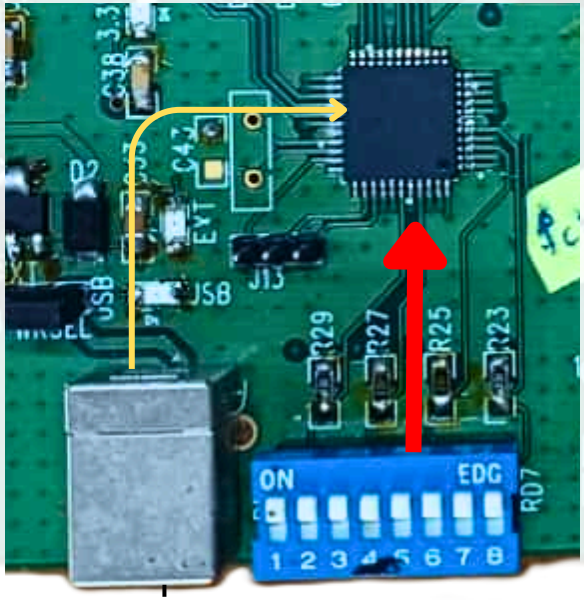

I-Channel Input
RESET Button
PLL (SPI Slave)
Modulator IC
Microcontroller
PIC18F4550
(SPI Master)
Out to
Antenna
USB Power
DIP Switches
(LSB-->--MSB)
Ref. Frequency
Q-Channel Input
IQ MODULATOR
373MHz - 1600MHz
IQ-170027
KDS
10.000
MHz
10MHz REF

Block Diagram




LSB is the switch closest to the USB connector
ON
EDG
1 2 3 4 5 6 7 8


ICSP
$s_i(t) + V_{dc,bias,i}$
8 bit DIP Switch
Microcontroller PIC18F4550
Freq. Synthesizer (PLL) LTC6946-1
$\cos(2\pi f_c t)$
IQ Modulator LTC5598
$s_p(t)$
USB
10 MHz REFERENCE INPUT
$s_q(t) + V_{dc,bias,q}$



Connect to USB port of AFG

ICSP

8 bit DIP Switch

Microcontroller PIC18F4550

USB

Freq. Synthesizer (PLL) LTC6946-1

10 MHz REFERENCE INPUT

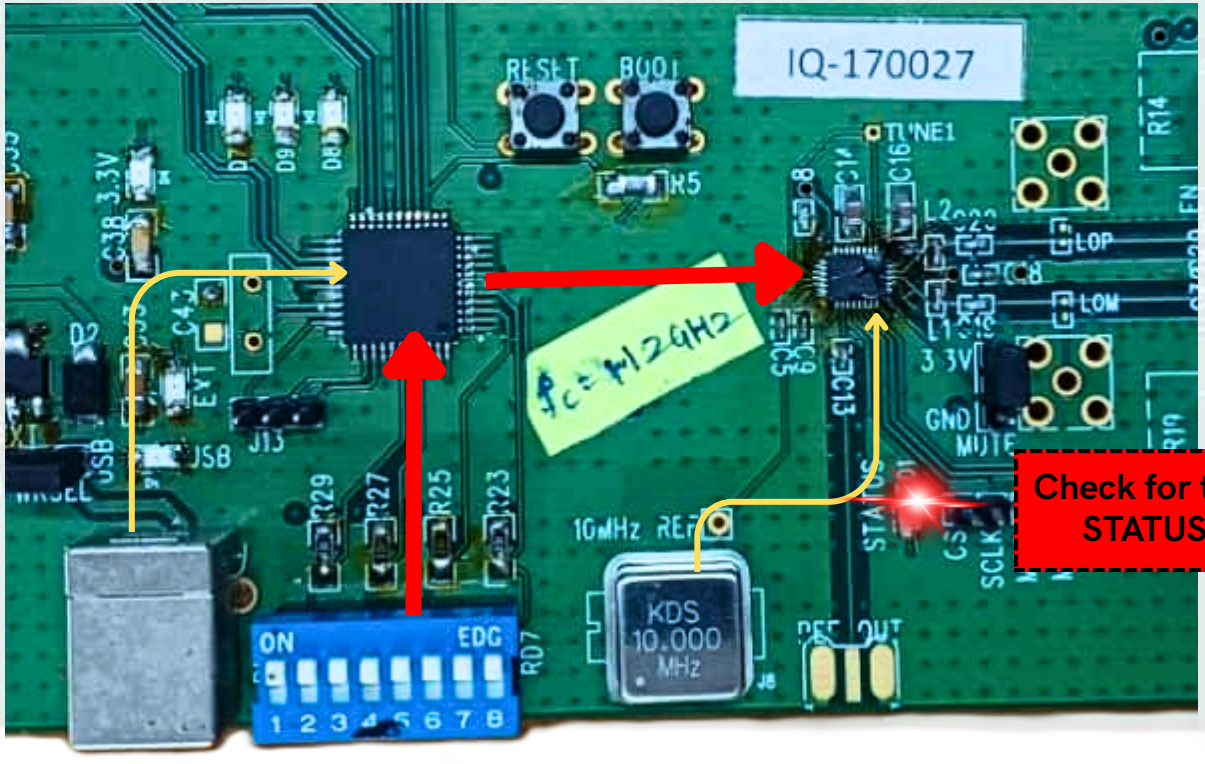
$\cos(2\pi f_c t)$

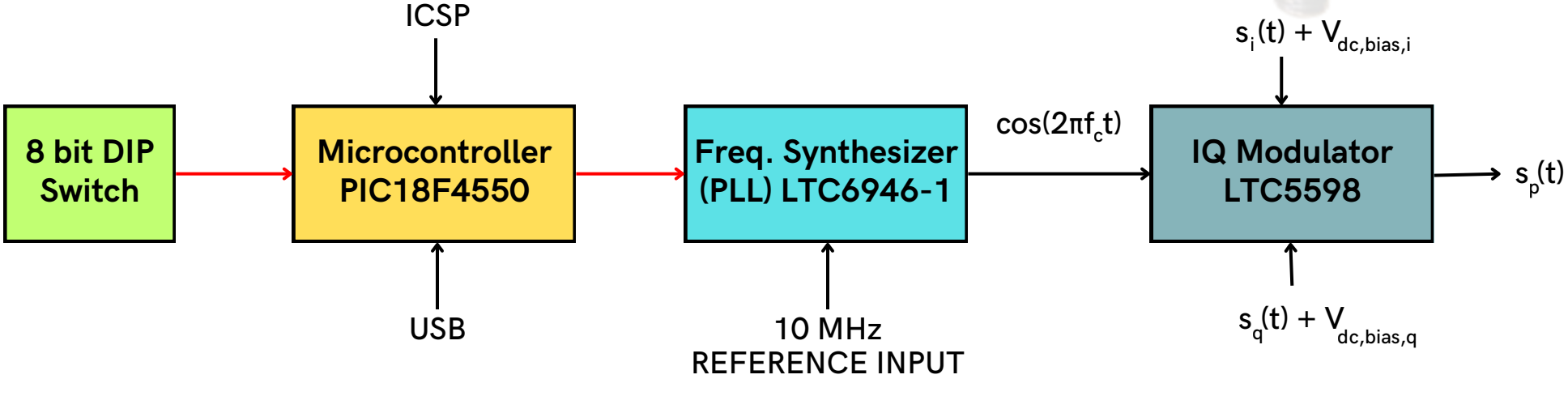
$s_i(t) + V_{dc,bias,i}$

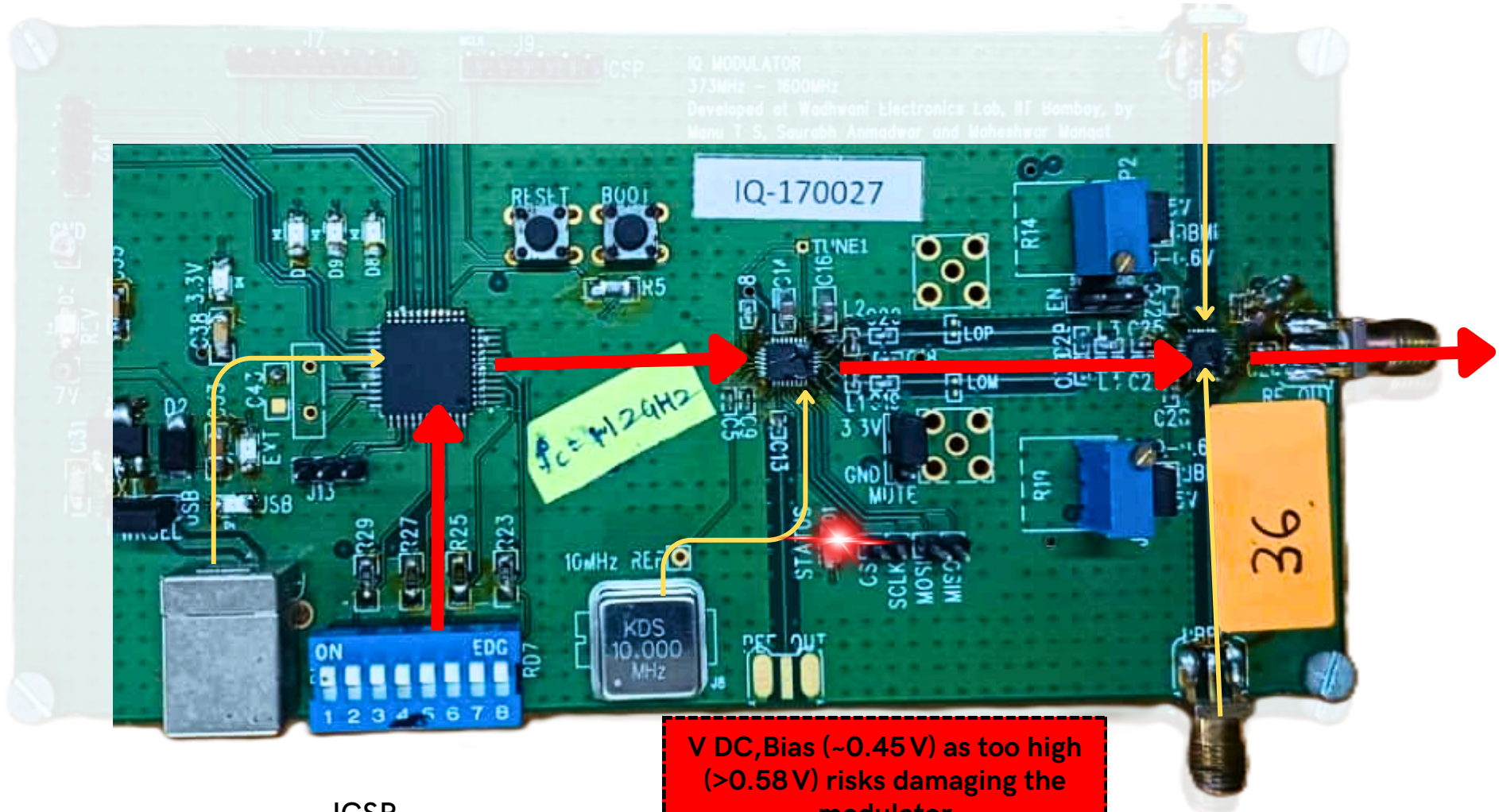
IQ Modulator LTC5598

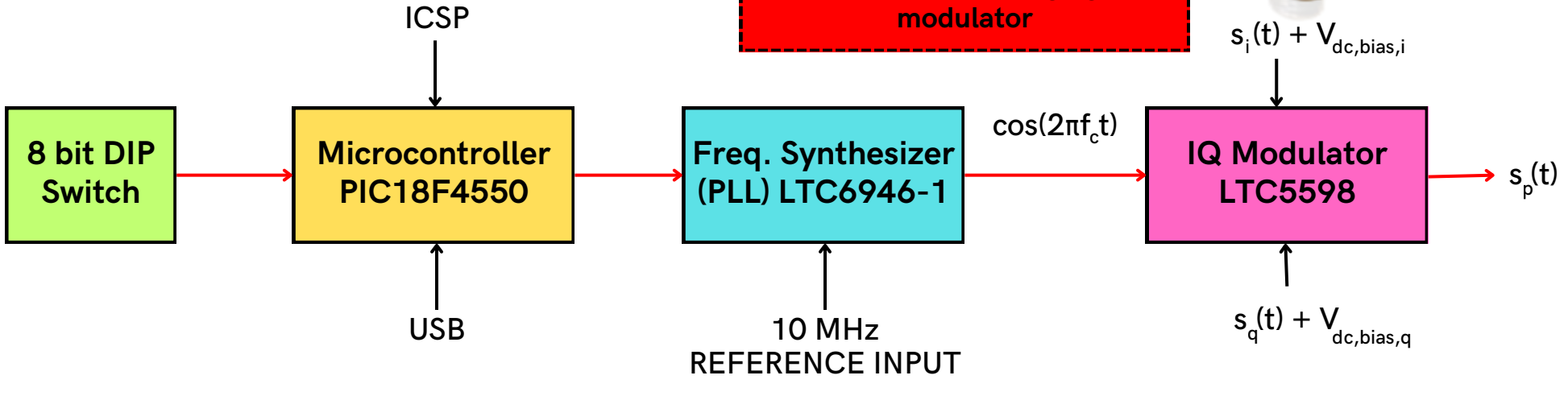
$s_q(t) + V_{dc,bias,q}$

$s_p(t)$

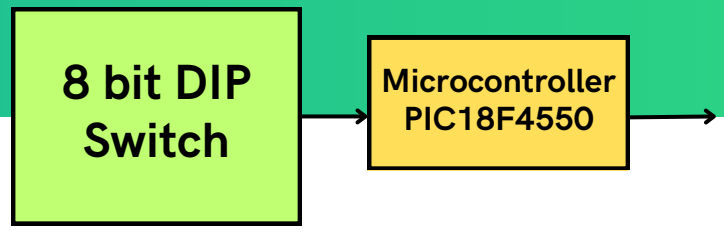

IQ-170027
RESET
BOOT
Check for the RED STATUS LED
ON
EDG
KDS
10.000
MHz


ICSP
8 bit DIP Switch
Microcontroller PIC18F4550
USB
Freq. Synthesizer (PLL) LTC6946-1
10 MHz REFERENCE INPUT
cos(2πf_c t)
s_i(t) + V_dc,bias,i
IQ Modulator LTC5598
s_q(t) + V_dc,bias,q
s_p(t)


IQ-170027
RESET
BOOT
10MHz REF
KDS
10.000
MHz
ON
EDG
1 2 3 4 5 6 7 8
V DC,Bias (~0.45 V) as too high (>0.58 V) risks damaging the modulator


ICSP
8 bit DIP Switch
Microcontroller PIC18F4550
USB
Freq. Synthesizer (PLL) LTC6946-1
10 MHz REFERENCE INPUT
cos(2πf_c t)
s_i(t) + V_dc,bias,i
IQ Modulator LTC5598
s_q(t) + V_dc,bias,q
s_p(t)

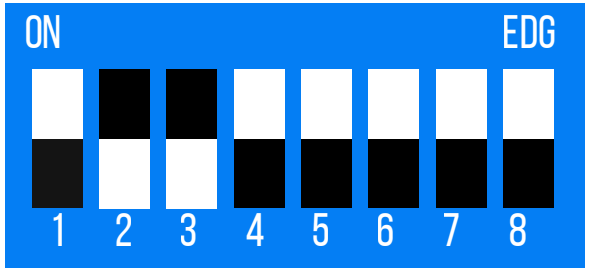
DIP Switch



Let’s say Table no. 3 is setting up

DIP value= 2 × Table No.=2×3=6

Binary: 00000110



On this board, the base frequency is 1.12GHz & the minimum frequency increment has been designed as 1.25 MHz.

fc=1120.002 MHz+(1.25 MHz)×6=1127.502 MHz

Always RESET the board after setting DIP switches.

Thank you

Reach out to us, for any doubts