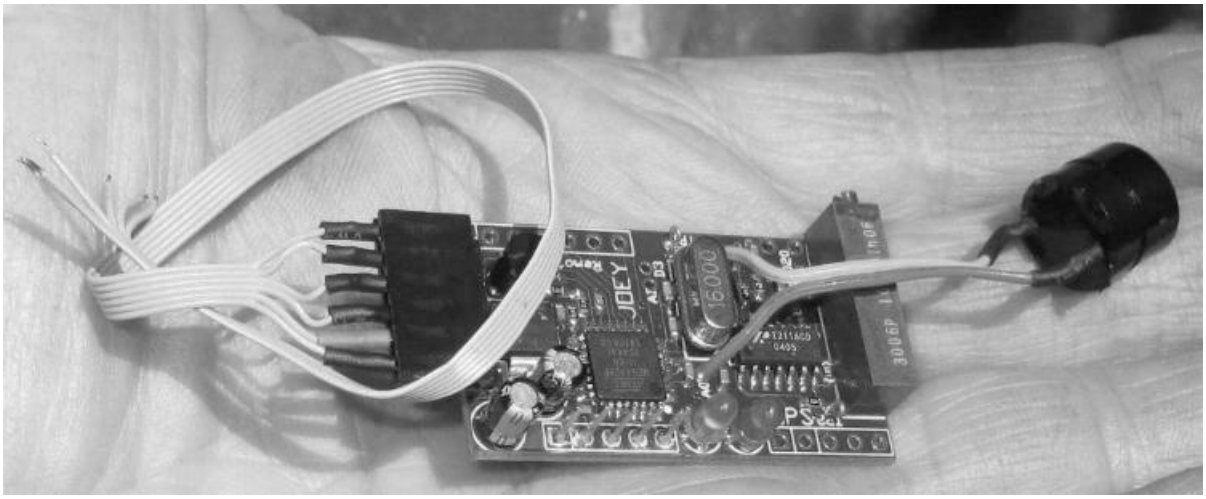
JOEY MkI

CCIR493 Selcall & ECCM Frequency Hopping Controller for ICOM transceivers.
Adds Codan HF Selcall to ICOM radios.



HF Selcall and ECCM Frequency Hopping Controller for ICOM transceivers.

Adds Land-Mobile Selcall to ICOM radios - no radio mods required.

Ideal for IC706, IC7000, IC7100, IC7200, IC7300 Radios.

All configuration parameters are stored in the radio Memory Channels.

Joey provides:

- Secure HF communication.
- Resistance to deliberate jamming or random interference.
- Compatibilty with existing HF 4 digit Selcall networks.
- Selcall
- Beacon Call
- Status Request and Call
- GPS Request and Call
- PageCall
- Telcall

Joey supports Land-Mobile Selcall Modes:

- Adds 4 digit HF Selcall capability to ICOM transceivers.
- Send and receive Selcall, Beacon call and Group call, GPS position, Pagecall, GPS Request, Status Request and Telcall.

Special Joey Selcall functions:

- The Senders selcall number is stored in the receiving ICOM radio, and also the time in minutes since the selcall.
- On receipt of a selcall, transmits a local area alert on a VHF or UHF frequency (IC706, IC7000 etc).
- Adds Codan syle Roger Beep when PTT is released (emulates an NGT).
- Optional GPS is supported – can send that position to other JOEY, COOEE, Barrett and Codan units. Responds to GPS Requests.

Built in Secure ECCM Frequency Hopping mode:

- The hop rate is user configurable between 1 and 40 hops/sec.
- Hop band shape optimised for mobile whip antennas. Alternativly emulates Barrett and Codan hop patterns.
- Over-the-air-sync frequency hopping mode is supported.
- If a UBLOX NEO6 or NEO7 GPS is connected, full stealth GPS synced frequency hopping mode is available. The easy to use frequency hopping mode requires no central synchronisation station, has no entry or late entry time delay and requires no handshaking. The system provides excellent protection against electronic warfare (EW) attacks and can be operated indefinitely in theatre without syncronisation.
- At hop rates below 11 hops/sec, Joey hop modes are compatible with Skippy hop modes.

JOEY Initial Radio Setup

1. Set the radio baud rate to **4800** or **AUTO** (IC706 initial setup 35) **Required**

2. Set the radio **CAT** to transceive on. (IC706 initial setup 36) **Required**

3. Set the radio CAT address to 48h (IC706 initial setup 34) **Required**

4. Set vsend to off (IC706 initial setup 30) **Required**

5. Load your own four digit selcall number AND the four digit selcall number you wish to call into **Memory 40**. (eg 12349876) **Required**
The leftside four digits are My selcall number. The rightside four digits are the Target selcall number.

6. Load the call channel you wish to use into **Memory 41. (** eg 7.153 khz **)** **Required**

7. Cycle the power to allow JOEY to pick up the new settings. **Required**

Recommendation: Nett the radio +/- 20hz or better for reliable FSK encode/decode
Recommendation: Set radio CAT address to 48h for fastest Bootup.

Joey will autodetect the ICOM Radios CAT address. On the very first initial Bootup this could take 2 minutes, thereafer Joey will remember the CAT address of the radio.
Recommendation: Set radio CAT address to 48h for fastest Bootup.

LED status indicators:

Green: Microprocessor has booted sucessfully.
Blinking rapidly: Receiving a Selcall Preamble.
Blinking at the HOP rate, indicates HOP mode active.

Red & Green: both alternating and blinking quickly continuously: Have received a Selcall addressed to me.

Red: Comes on for a few seconds whilst the microprocessor is booting up.
Comes on whilst sending a selcall. ie. Tx is active.
Comes on breifly when a valid FH sync chirp is received in Tone Sync mode.
At one second interval indicates presence GPS PPS signal

ICOM Memory channel summary:

	JOEY v777
MEM39	6.000 kHz Clear 6.100 kHz send selcall, beacon etc 6.200 kHz Start Tone Hop 6.300 kHz Start GPS Hop 6.400 kHz Scan Mode
MEM 40	**Selcall Numbers**
MEM 41	**Home channel** Scan 1
MEM42- MEM45	Scan 2, 3, 4, 5
MEM 46	s/ware version
MEM 47	Who called.
MEM 48	Hop Rate
MEM 49	VHF revertive
MEM 50	1000001 04xxxxxxxx MESSAGE RECEIVED
MEM 50	1000002 04xxxxxxxx CHECKING IN,ALL OK
MEM 50	1000003 04xxxxxxxx I WILL BE DELAYED
MEM 50	1000004 04xxxxxxxx Sxxxxxxxx Exxxxxxxx
MEM 50	1000005 04xxxxxxxx LISTENING xxdialxx
MEM 50	1000006 I AM LISTENING ON xxdialxx
MEM 50	1000007 xxxx LISTENING ON xxdailxx
MEM 50	1000009 CLONE reject
MEM 51	1000000 Selcall
MEM 51	1000001 Beacon
MEM 51	1000002 Send GPS
MEM 51	1000003 GPS Req
MEM 51	1000004 Stat Req
MEM 51	1000005 Send MSG
MEM 51	1000006 Telcall 04xxxxxxxx
MEM 51	1000007 Hop band 4 khz wide
MEM 51	1000008 Hop band 50khz wide
MEM 51	100001x Supress Roger Beep
MEM 51	100002x Logging Mode On
MEM 51	10001xx Fast Bootup
MEM 52	Last 8 digits of mobile phone number
MEM 53	Coax Relay control frequqency cutover

ICOM power must be cycled in order to pick up any Memory changes.

Using SELCALL Mode:

1. Using VFO or Memory knob Select 6100kHz, listen for the double beep.
2. Using VFO or Memory knob Select MEM41 Call Channel, listen for the double beep.
3. Press PTT, then JOEY will send the selcall.

If a freq > 100Mhz is loaded into Memory 49 (eg 146.000Mhz FM), upon receipt of a selcall the ICOM will also send a revertive tone on that frequency, to alert a handheld radio that a selcall has been received. If the freq in Memory 49 is the same as the freq in Memory 41 it makes for an extended revertive tone.
For IC706 MKIIG radios Menu item 30 VSEND SEL must be set to OFF, otherwise PTT will not key up on the VHF freq.

Beacon Calls:
In BEACON mode (MEM51 = 1000001)
Joey sends a beacon, remote units will respond with a revertive call, but will not alert the operator.

Group calls:
Joey will also respond to Selcall and Beacon Group calls ending in 00.
eg if the Target selcall is 3200, then all units with Mycall between 3200 and 3299 will respond.

Call timer:
Joey displays the time in munutes since the last selcall addressed to me.
Every 5 minutes this information is loaded into radio Memory channel 46.

On receipt of a Selcall:
Joey beeps repetitivly, and loads the caller information into ICOM Memory channel 47.

Using Selcall Scan Mode:

1. Using VFO or Memory knob Select 6400kHz, listen for the doulbe beep.
2. Using VFO or Memory knob Select the Call Channel, listen for the doulbe beep.
3. Press PTT, then JOEY will begin Selcall Scan of scan channels 41, 42, 43, 44 and 45.
The selcall preamble is increased by 200mS for each extra scan channel loaded.
4. Press PTT to halt Scan.

ICOM Memory 50

Icom radio Memory 50 is used to select from the preloaded Pagecall messages. If MEM 50 is set to 1000009 it prevents the Joey unit from being remotely cloned.

ICOM Memory 52

Icom radio Memory 52 is used to load in the last 8 digits of a mobile phone number, this number is included in the preloaded Pagecall message.

ICOM Memory 51

Icom radio Memory 51 is used to define a number of Selcall and hop bandwidth parameters.

If MEM51 is Empty then Joey will send a standard Selcall when the Send switch is pressed. This is the Joey default mode, the Hop bandwidth is 150 KHz wide with a special cosine shaped hop band to optimse performance with high Q antennas. The cosine shaped hop band makes it difficult for monitoring stations to determine the exact hop band edges and therefore the call channel.

If MEM51 is 1000001 then Joey will send a Beacon Call when the Send switch is pressed.

If MEM51 is 1000002 then Joey will send GPS position data when the Send switch is pressed. The position data is in Barrett open format.

If MEM51 is 1000003 then Joey will send a GPS Request in Barrett open format.

If MEM51 is 1000004 then Joey will send a Barrett STATUS Request.

If MEM51 is 1000005 then Joey will send a preloaded Pagecall message.

If MEM51 is 1000006 then Joey will dial the phone number loaded into MEM50. The 04 is hardcoded and the following 8 digits are loaded into MEM50.

If MEM51 is 1000007 then Joey will emulate a Barrett 2090 in 4khz wide hop mode.

If MEM51 is 1000008 then the hop bandwidth is 50khz, with Cosine shaping.

Memory 48

Icom radio Memory 48 is used to set Joeys hop rate in hops/sec.

If MEM48 is Empty then Joey will default to 6 hops/sec.

Eg. If MEM48 is 1000005 the hop rate will be 5 hops/sec.

Memory 53

A frequency entered into Memory 53 can be used to switch a coax relay.
eg if 50.000.000 is put into MEM53 the status of the output pin will change above or below 50Mhz depending on the radio dial frequency. This can be used for switching coax relay to select a 6m antenna above (say) 50Mhz. The status on the output pin can be inverted by changing the MEM53 frequency from USB to LSB or vice versa.

Over-the-Air Clone mode

On both units select any frequency and mode you wish to use as the call channel. Establish voice communications between the two units and press SEND on the Master unit, the Selcall and Hop parameters will be transferred via a special Selcall message and the Slave unit will reboot to replicate the Master unit.

Note: The Selcall numbers will be reveresd in the Slave unit.

The Slave unit receiving the CLONE need have nothing entered in any Memories, and any data already in Joey Memories 40, 41, 48 & 51 will be overwritten.

Roger-Beep:

When PTT is released a Roger-Beep is generated. (It exactly emulates a codan roger-beep)

Roger beep is not generated at hop rates faster than 10 hops/sec. Putting a 1 in the Tens position of MEM51 eg. 1000013 will supress the Roger Beep.

Frequency Hopping functions common to both FH modes:

All units must have the same frequency loaded into Memory 41.
The frequency in Memory 41 defines the Hop Pattern.
The default hop band is specifically shaped to optimise performance with high-Q mobile whips.
The center freq of the hop band is normally the freq loaded into Memory 41.
However if Memory 41 is within ham bands (80,40,20,15,10,6 and 2 only), the hop band edges will remain within the amateur bands and so reduce the possibility of a unit inadvertently slipping out of ham bands. The nominal center of the Hop band automatically slides up or down the band to keep the hops within the amateur band. This function only applies to Hop nets initiated from within the 80,40,20,15,10, 6 and 2 meter bands.

The hop net does not need to start on Memory 41, however Memory 41 defines the hop band parameters.

Default parameters (MEM51 & MEM48 empty)
Below 30Mhz the hop band is 150Khz wide, 6 hops/sec.
Above 30Mhz the hop band is 1 Mhz wide, 6 hops/sec.

Memory 41 Is the CALL channel, and defines the Hop pattern.

Memory 48 sets the individual Hop rate in hops/sec.
Eg 1000001 = 1 hop/sec 1000010 = 10 hops/sec

Memory 51 sets the Hop bandwidth.

Each Joey unit in a Hop-Net **MUST** have identical values in MEM41, MEM48 and MEM51 otherwise the units will never syncronise with each other.

Using Over-The-Air Tone Sync Frequency Hopping Mode: (When GPS is not available)

The Over The Air tone sync frequency hopping mode uses periodic over-the-air FSK sync chirps, it will remain in sync as long as band conditions hold up.

1. Using VFO or Memory knob Select 6200kHz, listen for the double beep.
2. Using VFO or Memory knob Select the Call Channel (MEM 41). listen for the double beep.
3. Press PTT, then JOEY will Initialise a Hop Net.

The JOEY unit, which initiates the Frequency Hopping net, is the Master, there can be multiple Slaves in a Frequency Hopping net.
The Slave JOEY units align themselves with the sync chirp sent from the Master to maintain long term syncronisation. If no valid sync chirp is received for approx 12 mins JOEY will go back to the initial call channel (Memory 41).

When JOEY receives a valid sync chirp from another JOEY unit the RED LED blinks.

On the Master unit only:
The freq loaded into Memory 41 is the freq used to call latecomers into an existing hopping net.
A Latecomer Call is placed at about 6 minute intervals to bring Latecomers into the Hop Net.

In the event of a GPS signal becoming available to JOEY whilst a Tone Sync Frequency hopping net is in progress, that GPS signal will be ignored until either JOEY times out due to missed syncs, or JOEY is reset.

A Slave unit will start as a Tone sync Slave unit even if it has a GPS signal. Once it starts as a Slave, the GPS signal will be ignored until either JOEY times out due to no syncs, or JOEY is reset. The maximum hop rate in Tone sync mode is 10 hops / sec.

Each missed sync increments the Timeout by one, if Timeout =12 the Joey unit resets and goes back to the call channel. Once 10 consecutive syncs are missed, the hop is usually unrecoverable.

Every 5-10 minutes the Master will attempt to draw any latecomers into an existing Hop-Net.

All Joey units in a Tone Sync Hop-net must be in Tone Sync mode.
GPS sync mode is not compatible with Tone Sync mode.
Joey and Skippy Tone Sync hopping modes are compatible.

To terminate the Hop, cycle the ICOM power.

Using GPS Synced Frequency Hopping Mode: (Full Stealth Mode, Requires GPS)

When optional GPS PPS and NMEA Data is available the GPS frequency hopping mode hops at default 6 hops/second with no on-air trnsmissions. The Red LED will indicate the presence of a valid PPS signal. The valid PPS automatically puts JOEY into GPS sync mode. The 9600-baud GPS NMEA data must also be valid for JOEYs to sync.

1. Using VFO or Memory knob Select 6300kHz, listen for the double beep.
2. Using VFO or Memory knob, select the Call Channel, listen for the double beep.
3. Press PTT, then JOEY will join a Hop Net

JOEY units automatically align themselves using GPS NMEA data and PPS. There is no limit to the number of units in the hop net, latecomes can join the Hop Net immediately.
There is no Master-Slave relationship between JOEY units operating in GPS mode, all units are independent. If GPS is not available, Joey will automatically start in Tone-Sync mode.

In the event of a GPS signal becoming unavailable to JOEY whilst a GPS Frequency hopping net is in progress, JOEY will flywheel, and will eventually lose sync after 5 to 10 minutes, JOEY will immediatly rejoin the hop net once a GPS signal is restored.

Note: for GPS synced mode, the GPS data. as well as the PPS, must be valid. With most GPS units the availablity of valid GPS data can lag the availability of valid PPS by several minutes.

All Joey units in a GPS Sync Hop-net must be GPS Sync mode.
GPS sync mode is not compatible with Tone Sync mode.
Joey and Skippy GPS Sync hopping modes are compatible below 11 hops/sec.

To terminate the Hop, cycle the ICOM power.

Installation into the ICOM radio

Consult the relevent ICOM service manul for the connection points inside the radio.
The simplest method is to solder to the connections where the 13Pin DIN connector is mounted on the PCB. And one connection on the CAT socket.

Connector Pinouts

RADIO 6 Pin connector.
1 Gnd
2 Power (+12 VDC) in from ICOM
3 PTT to/from ICOM
4 CAT Serial 4800 baud to/from ICOM
5 Tx Audio to ICOM
6 Rx Audio from ICOM

GPS 5 pin connector.
1. 5V
2. Gnd
3. Tx data TTL level 9600baud
4. Rx data TTL level 9600baud
5. PPS

PROGRAMMING 5 pin connector.
1. Gnd
2. 5V
3. RESET
4. Rx data TTL level 9600baud
5. Tx data TTL level 9600baud

D3 Pulls high when selcall received TTL level 10mA max.

Software versions > 7.xx Dry Creek

Specifications

Size: Width 42mm x Depth 23mm x Height 10mm.

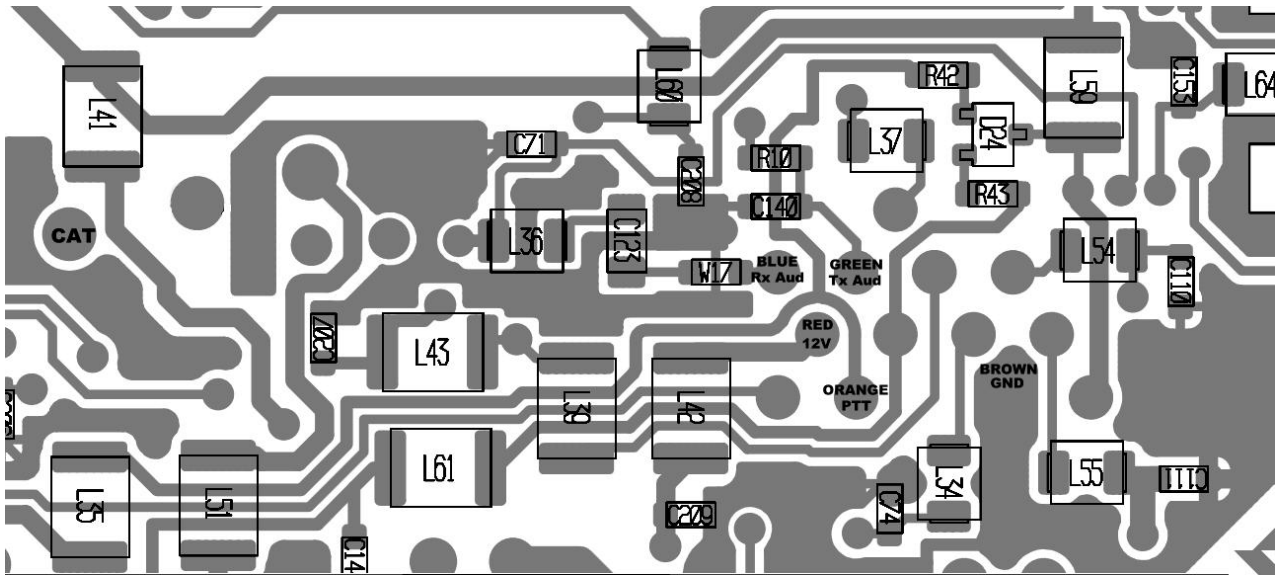
Weight: 50gm

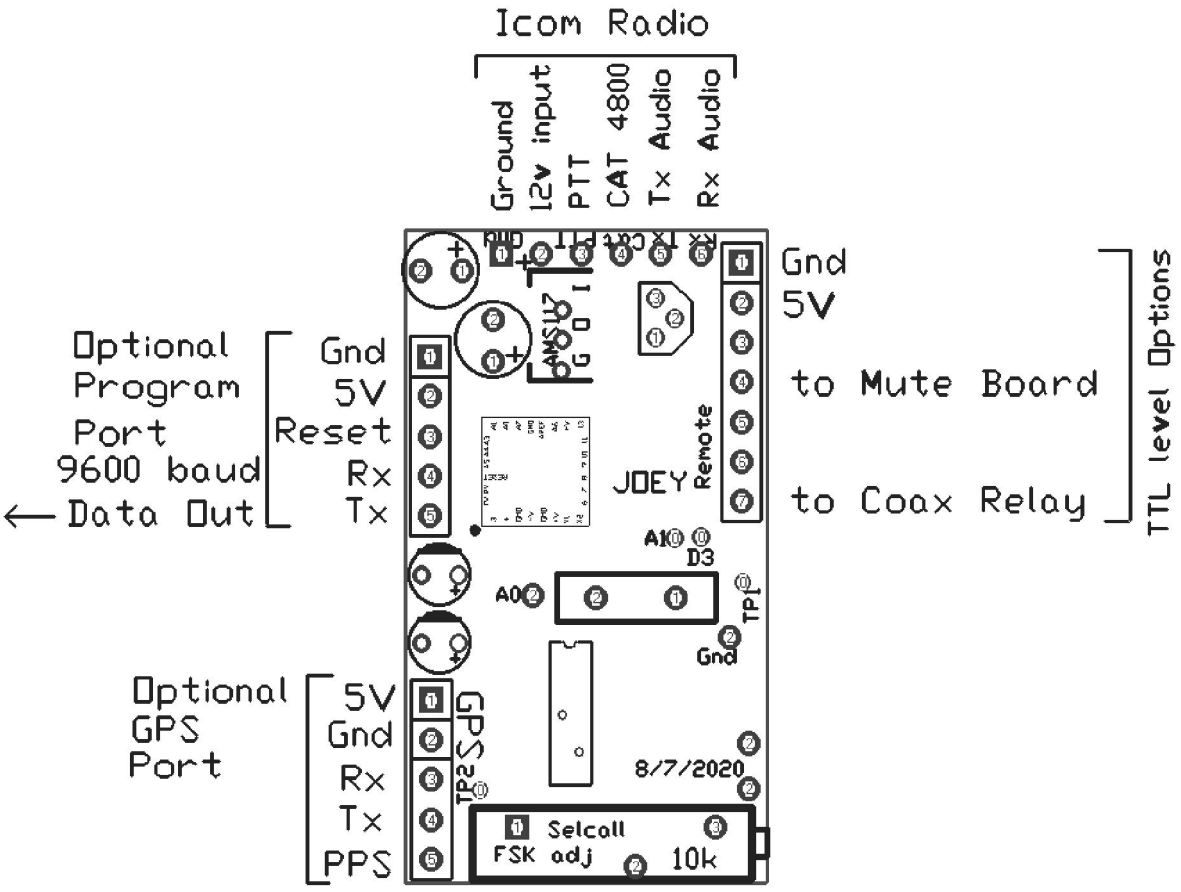
Power requirements:
Nominal 12v (from radio)
Max 150mA

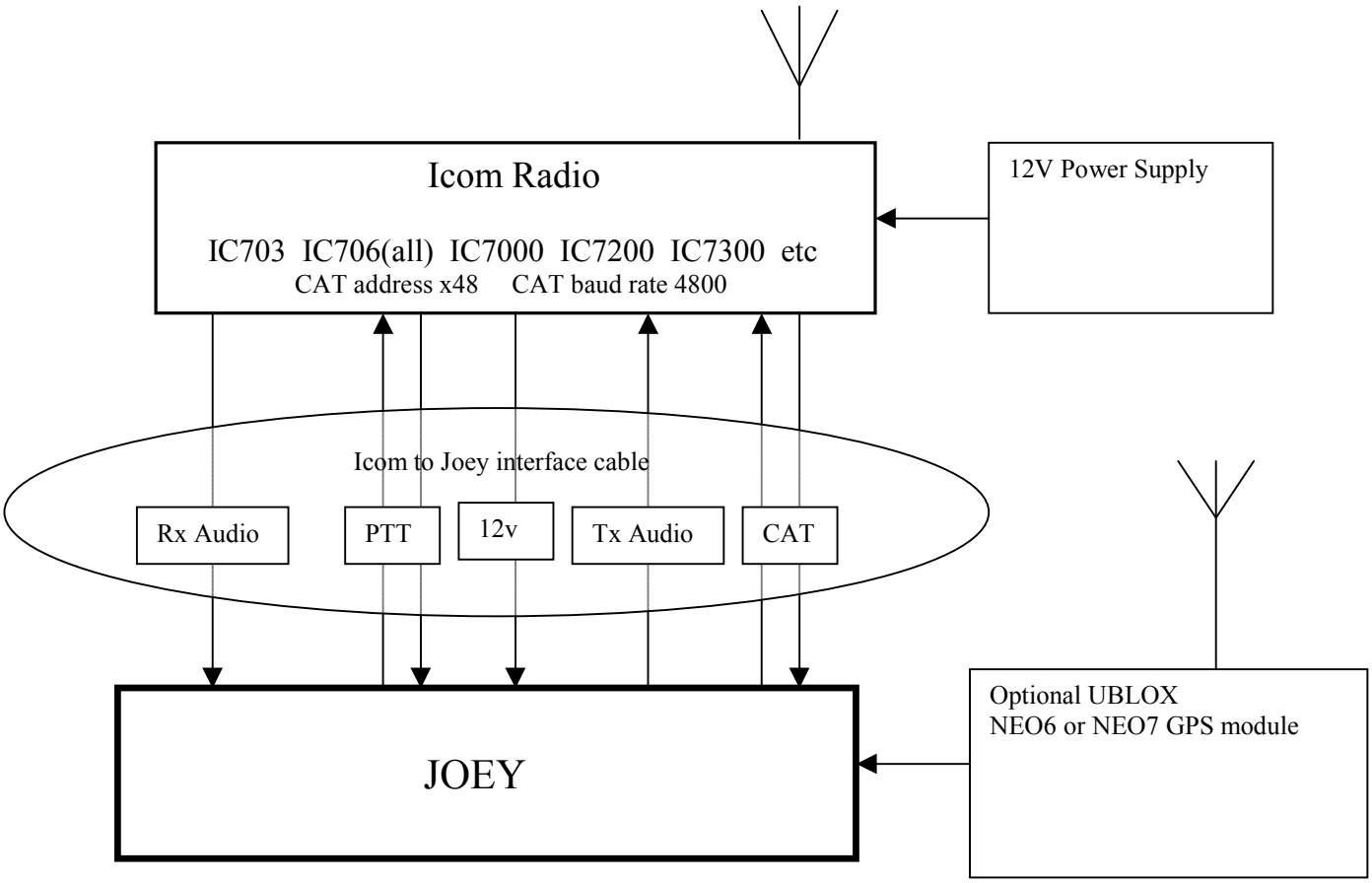
Options:
OPT 01 UBLOX NEO6 or NEO7 GPS
OPT 02 Hop sequence Encryption Key (Software upgrade)
OPT 03 GPS external antenna 3.3v active 28 dB gain.

Export Controls:
All units for **Export will have the maximum Hop Bandwidth limited to 50khz**.
Option 02 is not available on Export units.

Example IC706 connection points





JOEY MkI Pinouts 17/3/22

Joey Block Diagram