Radio to Computer Interface Audio Conditioning Project

This project allows automatic level control of audio going to and from any bridging systems, be it from a computer or even a radio repeater adjusting the audio from large variation in levels.

The project became obvious as a must for any EchoLink system where the operator wishes to setup an RF link interface, providing good even audio quality levels.

Many complain about the audio quality of EchoLink, is not the fault of the protocol but that of users that neglect to adjust, both the frequency response and audio levels.

EchoLink uses VOPI (Voice Over IP) this was developed for telephony, has the same audio bandwidth for radio of 300 Hz to 3000 Hz. many confuse this as an analog mode, its not, its a digital mode, where different codec's exist, their application vary according to the required quality of signal transmission over a digital network.
https://en.wikipedia.org/wiki/Voice_over_IP

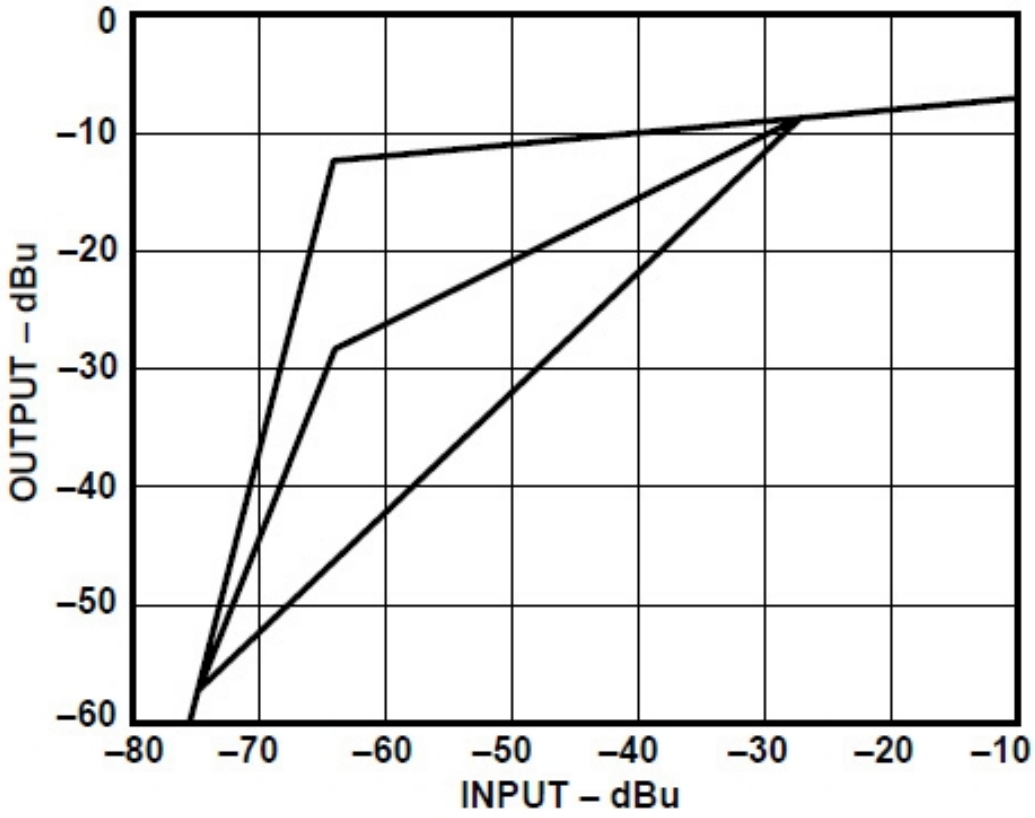
Echolink uses the same CODEC as IRLP, so if anyone claims that IRLP or any other mode has better audio quality, they have no idea at what they are talking about.
https://sites.google.com/a/vkradio.com/www/interoperate.
With all digital modes, the original audio level is what determines how well or how good it comes out of the other end plus the actual number of bitts used for the encoding and decoding, the more bits used the better the audio quality.
No matter of the number of bits used, if the Audio into the system is overdriven or over compressed or low in level or distorted, that is how it will come out at the other end, it will sound bad.

EchoLink signals can arrive from several sources, mobile phone, computer or a radio all will have differing levels and bandwidth, the later is not a real issue; however the EchoLink setting for limiting frequencies below 300 Hz should be turned on
in the SetUp.
Radios connected via their microphone input will by virtue of the audio conditioning circuitry with in the radio, will limit the response from 300 to 3000 Hz.
However levels will remain a large issue contributing to the resulting audio quality.

What I designed, utilizes the properties of a specialty audio IC, it expands (Lifts low levels) Compresses (Lowers levels above a set point) Limits the peaks (Allowing more average audio) making the result louder with no distortion .This device is the SSM2165 by Linear Devices.

This device with the selection of a resistor value can have a compression ratio of up to 15:1 and as low as 1:1 (No compression)
Even when the compression is set to 1:1 the ability to expand and limit the peaks is retained. Peak limiting in many telephony applications allows to raise the average voice level (That part of the complex waive that carries intelligence).

Expansion Compression limiting curves

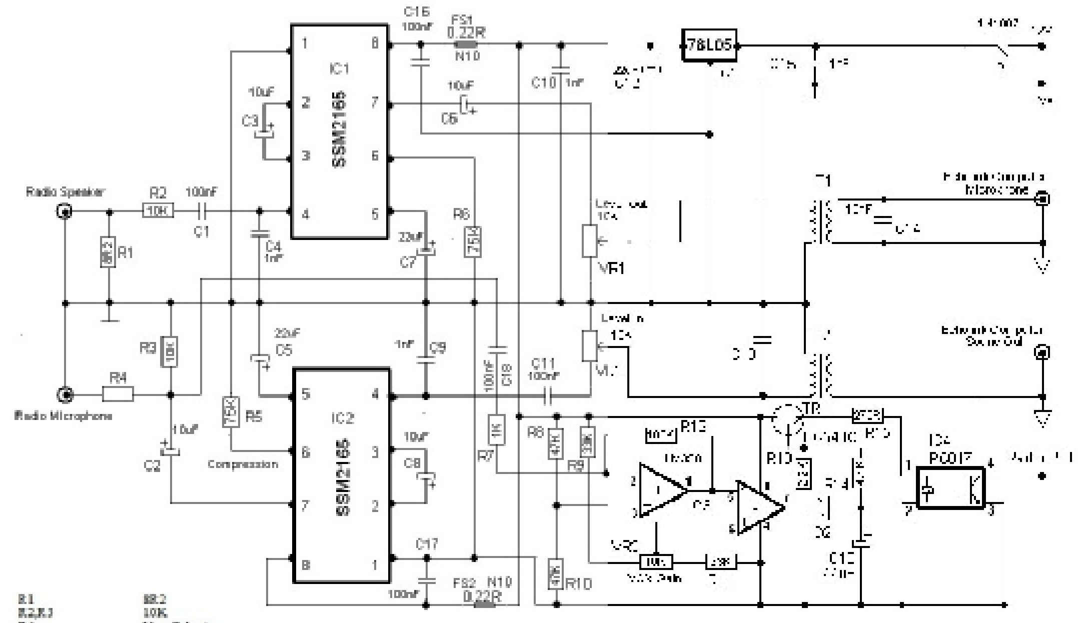


To condition the signal in both directions, this project uses two devices, thus both the RX and TX are level conditioned or equalized to provide the best possible audio quality.
It further provides isolation to eliminate any possible earth loops, and incorporates a VOX to key up the radio TX based upon signals from the EchoLink.
This VOX has a very fast switch on time with just enough hold time.

IC3 an LM358 in conjunction with TR1 and IC4 provides the VOX operation
IC1 is the Radio RX path that is fed to EchoLink (Computer Sound card Audio IN
via T1. VR1 allows to set the maximum allowed level into EchoLink.
The Audio coming from EchoLink (Computer Sound Out) is isolated by T2 and processed by IC2 then fed to the Radio microphone input.
The VOX audio sensing is done by C18 and fed to the IC3, this Audio is the conditioned audio where the audio is equalized, thus the VOX action is very reliable, will not suffer from low level drop out, once on it will remain on during any TX audio from EchLink.
TX VOX hold is controlled by C18, should this hold time be too short (Unlikely) the value can be raised, or if too long, reduced accordingly.
R5 sets the compression ratio of IC2 and R6 that of IC1
the ratio is defined by the value of the resistor where 200 K equates to 15:1, with pin 6 to ground, the compression will be 1:1
The selected value set the compression ratio to approximately 6:1, this was selected to provide the best lift of low level signals without excessive breathing in the compression mechanism.

This project is in development, these notes are intended for evaluation; however the design is sound and can be implemented with very small changes to cater for equipment parameter variations.

R1	8R2	C1,C11,C16,C17	100nF
R2,R3	10K	C2,C3,C6,C8,C14	10uF
R4	User Select	C4,C9,C15,C10	1nF
R5,R6	75K	C5,C7,C12	22uF
R7	1K	C13	User Selected
R8,R10	47K	C18	47uF
R9,R11	33K		
R12	100K	T1,T2	1:1 600 Ohm
R13	2.2K	(eBay)	
R14	4.7K		
R15	270R	IC1,IC2	SSM2165
VR1, VR2,VR2,	10K 10 Turn	IC3	LM358
Trim Pot		IC4	PC817 Opto
		IC5	78L05
FS1,FS2 N10 R.22R		TR1	BC548C



R1	8R2
R2,R3	10K
R4	User Select
R5,R6	75K
R7	1K
R8,R10	47K
R9,R11	33K
R12	100K
R13	2.2K
R14	4.7K
R15	270R
VR1,VR2,VR2,	10K 10 Turn Trim Pot
FS1,FS2 N10 R.22K	
C1,C11,C16,C17	100nF
C2,C3,C6,C8,C14	10uF
C4,C9,C15,C10	1nF
C5,C7,C12	22uF
C13	User Selected
C18	47uF
T1,T2	1:1 600 Ohm (eBay)
IC1,IC2	SSM2165
IC3	LM358
IC4	PC817 Opto
IC5	78L05
TR1	BC548C

Title
Compressor/Expander/ Peak Limiter ...
Author
File
.../Desktop/Audio Compressor...
Document
Revision
Date
Sheets