Using the SGC 2020 DSP with Sound Card Modes

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Scope

This paper describes the use of Sound Card Modes with the SGC 2020 DSP transceiver. The interface used is the KK7UQ interface, and takes advantage of one of the unique features of this interface: level control potentiometers with knobs built into the interface for both receive and transmit level control.
The concepts described apply to most transceivers and interfaces, however, and this paper can be used as a general guide to operating sound card modes with a variety of transceivers and interfaces.

General Concept

The general concept of sound card modes is to use the PC and associated sound card to create a modulated audio signal. This signal is applied to a transceiver microphone input. The modulated audio is converted to RF and transmitted over the air by the transceiver and antenna. At the receiving site, the transceiver receives the signal and converts the RF back to the audio spectrum. The PC and associated sound card is used to decode the audio signal back to the data domain and present it on the PC screen.

The Basic Rules of Operation

There are two basic rules for good operation: First; the audio transmitted and received must be within the designed frequency spectrum of the transceiver. Second, the audio level must be such that the audio system must remain in linear operation to avoid distorted signals on the band.

The Operating Frequency Spectrum: Typically the audio system is set up for the voice spectrum i.e. under 2200 Hz. The filter characteristics of both transmit and receive are usually not flat over the range of 0 to 2200 Hz, in fact they are intentionally set to a passband which best matches human speech characteristics. An operating range of 1000 to 2000 Hz is fairly typical for ham transceivers. These parameters must be remembered when operating in a sound card mode to enhance operation of the combined software, PC, interface and transceiver.

Desired Audio Level: The audio level required to create a particular RF output will vary at different frequencies within the pass band of the transceiver, and will also vary from one band to another. This means that the audio level must be adjusted for the each setting within a particular band to optimize power output, and prevent distortion from over modulation. In practice this is easily done by monitoring the RF output of the rig, and tweaking a knob on the interface, or moving a slider on the PC screen. It will become second nature with a little use.

Settings on the Transceiver

The SGC 2020 transmitter should be set up as follows:

Frequency	14.070
Mode	USB
BW	2.2 KHz
ADSP	Off
RF level	Full On
Volume level	A comfortable listening level
RF Power	Set to 8 watts (this protects the rig if the drive level is too high)

Software

This paper describes the use of Digipan software for initial setup. See "References" at the end of this paper for links to other software. The basic procedure will also apply to other software applications available for ham use.

Transmit Operations

Initial Level Setup

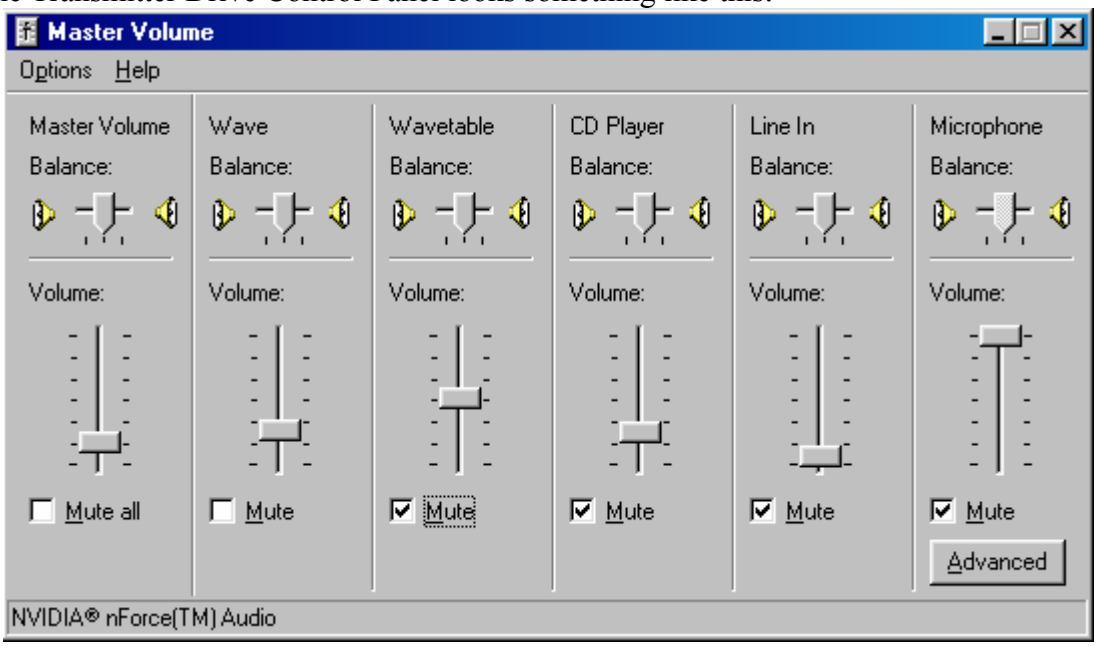
The levels from the sound card and interface must be adjusted to produce a desired output power from the rig.

PC Volume Setting: Start by using the standard Volume Control panels on the PC. For Windows 98, these are usually found at

Start/Programs/Accessories/Entertainment/Volume Control

they can also be called up when operating a particular application program such as Digipan by selecting *Configure/Transmitter Drive*.

The Transmitter Drive Control Panel looks something like this:



Note that all except the Wave control is muted. This is done to prevent any stray signal which might get into the sound card from RF or other sources from modulating the output. The sliders for Wave and the Master Volume control are set in the lower half of their range. This is a good starting point.

Interface Output Level Setting: Set the output drive level potentiometer on the interface to the minimum level i.e. full CCW.

Use Digipan to Generate An Adjustment Tone: Start the Digipan program. Click on the waterfall at the 1500 Hz point on the display. This sets the audio frequency to 1500 Hz. On the Digipan screen, select *Mode/Tune.* This will create a single frequency of 1500 Hz to modulate the rig. Monitor the power output level on the SGC 2020 front panel. The LED display indicates the output level. The goal is to create about a 5 watt output level for a continuous output signal. The display should show about 4 LED activated, like this:

Adjust the OutPut Level Control on the Interface: to produce the desired RF level when the knob is in the middle postion. It may be necessary to adjust the PC Volume Control slider up or down to get the 5 watt level when the knob is straight up. Once this level is obtained, all further adjustment of level will be done at the interface level. The PC volume control panel can be exited at this point.

Turn Off The Tune Signal by hitting OK on the mode panel. You are now set up for operation of the rig.

Why a 5 watt output for a 20 watt rig? The SGC 2020 is rated at 20 watts output for CW or SSB operation. This rating depends upon the signals applied having effective duty cycles of 40% or less. The rig is designed to dissipate the heat produced by about 8 watts on the average.

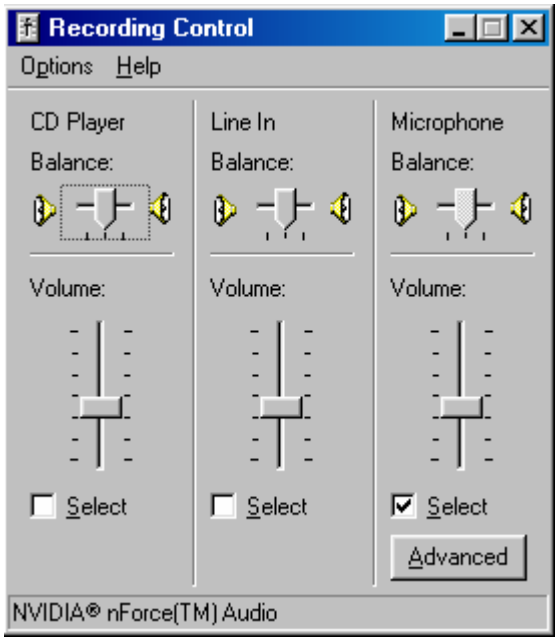
PSK31 operates at an 80% duty cycle in normal operation. If the peak output is set at 5 watts, the average output is on the order of 4 watts, well within the operating range of the rig. The rig setup specified a setting of 8 watts for maximum RF output. Shooting for an output level of 5 watts means that the system operates in the linear portion of the audio system for clean signal output. It also allows for some error in setting the output level and still staying within an acceptable operating range.

Other Modes: Other modes which can be operated at this basic setting include MFSK16, SSTV, Helleschreiber, Throb, and other modes. One sound card mode is different: CW. CW can be operated at the full rated output of the SGC 2020, 20 watts. The mode is also changed to CW instead of USB. The keying of the rig is done via the interface PTT control. A good program to operate CW with the sound card and SGC 2020 is MixW.

Receiving Operations

Setting the Level Controls for Receive

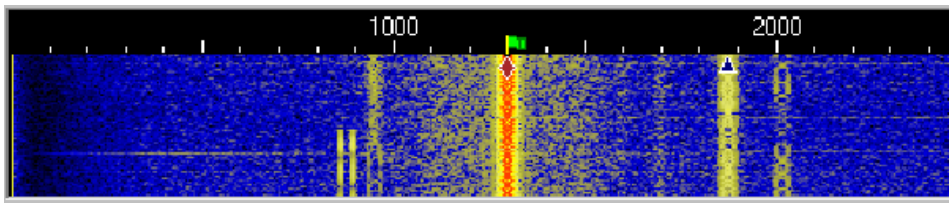
PC Level Setting: use the PC Recording Control panel to adjust the basic input level. This is invoked by the Digipan *Configure/Waterfall Drive* the panel looks something like this:



This setting assumes that the Sound Card Microphone jack is used for receive input. If you use Line In, then Select that channel instead. The slider is set to about ½ level.

Waterfall Display: the waterfall display of Digipan shows the signals in the audio spectrum, referenced to the audio frequency offset from the USB transceiver setting. The

example below shows signals in the range of 800 to 2000 Hz on the waterfall. The Receive Level Potentiometer on the interface should be adjusted so that the non signal portion of the display is dark blue, and the signals are yellow. A red level on a signal means that it is very strong and is near to the overload point on receive.



QSO with Signals in the 1000 to 2000 Hz range: You may see signals through out the entire range of the display. If you want to conduct a QSO with one of them, be sure that the signal is within the range of 1000 to 2000 Hz. If necessary, adjust the base frequency on the SGC 2020 to move the signal within this range. The reason that this is done, is that the transmit output filter is optimized for this range, and the receive filter is also optimized in this area.

ADSP Operation: the SGC 2020 has a very effective ADSP system for receive. For some of the modes, such as BPSK and QPSK, it should be turned off, since it tends to reduce or remove the signal! It can be used effectively on MFSK since the signal moves around a bit, but when in idle, the idle tone drops out because the notch filter of the ADSP removes it. Operation shows that for weak signals, the ADSP does improve copy on MFSK in spite of this. For CW operation, use the ADSP, it improves copy as well. A summary of modes vs. ADSP is:

Use ADSP for SSTV, MFSK16, Throb, CW, RTTY
Do not use ADSP for BPSK31 or QPSK31.

CW Operation: CW operation can be done using the sound card and USB mode to create the tones for CW. A better approach is to use the CW mode on the rig, and set up the program to key the rig using the PTT control of the interface. MixW was tested with excellent results on CW with this kind of setup. The ADSP improves operation on receive. In this case, run at the full rated CW power of 20 watts.

Ready for Operation

"Getting Started with Digipan" for details on setting up the software with macros and hints for good operation in PSK31 mode. This and other papers can be found at
www.waypt.com/users/~discobay/hamfest.htm

References

Below are references for software and hardware suitable for Sound Card operation with the SGC 2020. For further information about the SGC2020 see

www.sgcworld.com.

Software:

Digipan	www.digipan.net/
Hamscope	www.qsl.net/hamscope/
IZ8BLY	iz8bly.sysonline.it/
MixW	www.mixw.net/
MMSSTV	www.qsl.net/mmhamsoft/mmsstv/
MMTTY	www.qsl.net/mmhamsoft/mmtty/
WinPSK	www.qsl.net/ae4jy/
WinWarbler	www.qsl.net/winwarbler/
W1SQLPKS	www.w1sql.com/
Zakanaka	www.qsl.net/kc4elo/

Hardware:

KK7UQ Interface	www.waypt.com/users/~discobay/
Buxcom Rascal	www.packetradio.com/psk31.htm
Rigblaster	www.westmountainradio.com
Tigertronics SL-1	www.tigertronics.com
MFJ	www.mfjenterprises.com