While we're on the subject of slow scan TV (see previous article), here's another "Food for Thought" proposal on changing the way SSTV operators exchange signal reports.

SSTV Reports Using the P Scale

BY LARRY PETERSON,* WA9TT

Analog Slow Scan Television (SSTV) is quite popular. Most HF activity occurs on 14.230 MHz USB, the International SSTV calling frequency. SSTV is a visual means of communications. Hams habitually give signal reports. This mode begs a *visually-based* signal report. The RSV reporting system, adopted from other modes, is commonly used. RSV parallels the RST reports given for CW contacts or RS for SSB QSOs.

RSV denotes:
- **R**eadability of the template words
- **S**trength of the transmission
- **V**ideo quality

R=5 is perfectly readable. S=9 is an extremely strong signal. V=5 is perfectly viewable.

In a mode dominated by the *image*, a numerical RSV report leaves much to be desired. Typical RSV reports are 595, 575, or 555. However, the person sending a picture cannot visualize just how the transmission was received, based on the report.

In the rush to start an SSTV QSO, hams need to perform these steps:

- Figure out the callsign of a station sending CQ.
- Select a picture from many choices for a reply.
- Overlay a suitable template (containing callsign and other text).

Thus, with little time for thought, the information conveyed by that RSV signal report is typically poor.

The Problems with RSV

There are numerous problems with an RSV report.

- SSTV images arrive with noise lines. They are *im*perfectly viewable, yet hams nearly always give a '5' to the most important part of the signal report, i.e., V=5.
- Any ham seeking a meaningful report has difficulty grasping how well the signal was received. What exactly does 575 mean? One cannot 'picture' the quality of that transmitted image.
- On 20 meters, at best only a couple percent of 'images received' are perfectly viewable without any apparent noise lines.
- The most common report given is 595, even though it often means little. In this regard, signal reporting is more of a ritual.
- With seconds to spare before one replies to a CQ, there is practically no time to provide a meaningful signal report.

An Alternative Solution

When describing SSTV image quality, one should look for a simple, easy-to-assess description of any received image,

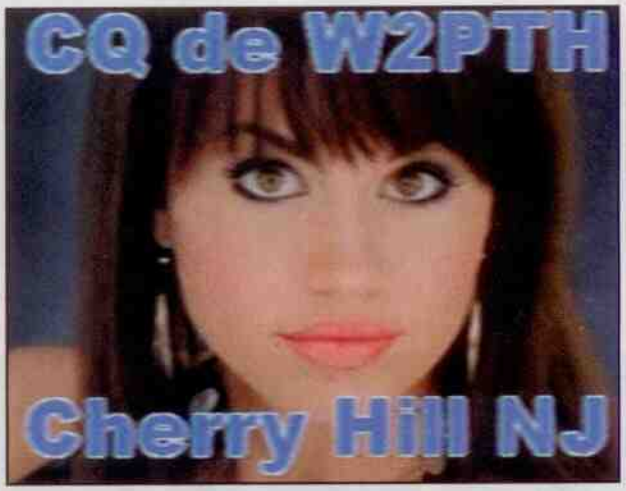

Figure 1. P5: Broadcast quality

Figure 2. P4: Good, some noise

*Email: <larry@wa9tt.com>

Figure 3. P3: Usable, but noisy

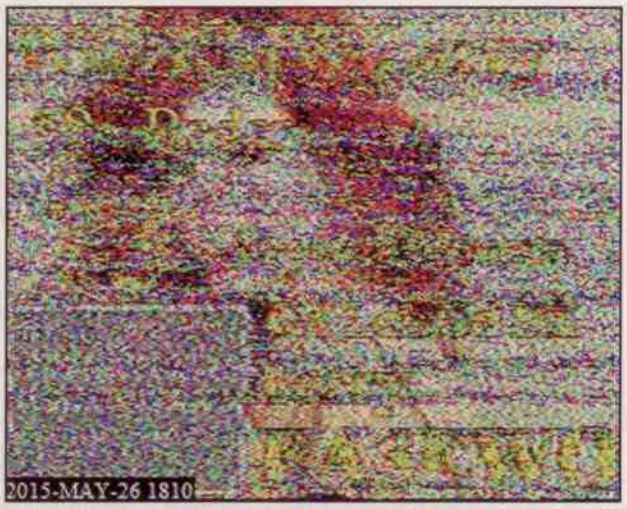

Figure 5. P1: Text is barely visible

Figure 4. P2: Barely usable, noisy

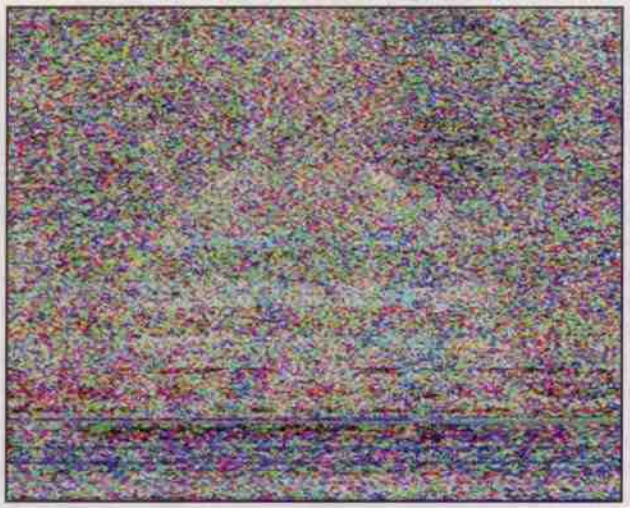

Figure 6. P0: Unusable

given degradation that occurs from a radio transmission. This degradation from the originally transmitted signal arises in many ways:

- Losses due to signal attenuation affects the signal-to-noise ratio, including QRM from other SSTV signals and sometimes SSB interference.
- Noise and distortions from soundcards.
- The analog-to-digital processing capabilities of the SSTV modulation/demodulation inherent in the software.

In some VHF/UHF Fast Scan TV (or amateur TV) circles, the concept of a *P-unit* is used to describe the quality of the video transmission. The literature on this is scant. Nonetheless, one can build on this concept to describe an SSTV picture.

Based on several studies conducted by this author, a P system may be readily applied to describe SSTV image quality. This may be expressed through a six-level scale, from P5 to P0, as follows:

- **P5** is a broadcast quality with minimal distortion. *Figure 1* offers an example from W2PTH. SSTV images with such high quality are rare.
- Occasionally, one receives a **P4** image, which is good but has some noise lines (*Figure 2*).
- Many of the signals received on 20 meters are **P3** quality: Usable, but noisy (*Figure 3*). Often, hams will give even these images a 595 RSV signal report. Does this not illustrate how meaningless the RSV system, when applied to describe SSTV images, has become?
- Furthermore, **P2** images often occur. These images are quite noisy and barely usable (*Figure 4*).
- The final two P-levels illustrate very poor signal reception. **P1** represents an image where one can barely see the text (*Figure 5*). A QSO might be completed only for hams who are familiar with one another's style of image presentation or callsign.
- **P0** is a completely unusable signal (*Figure 6*).

Using the P rating system makes it possible to picture in one's mind the quality of the image transmitted to some distant station. In other words, the P-signal report will actually be meaningful to hams who are accustomed to communicating with SSTV images!

The Research

The first step in assessing image quality is to find some objective measurement. One convenient research approach with SSTV is to transmit an image, then observe the picture quality on some SSTV cam. An SSTV cam is a web posting of the image as received at a distant station.

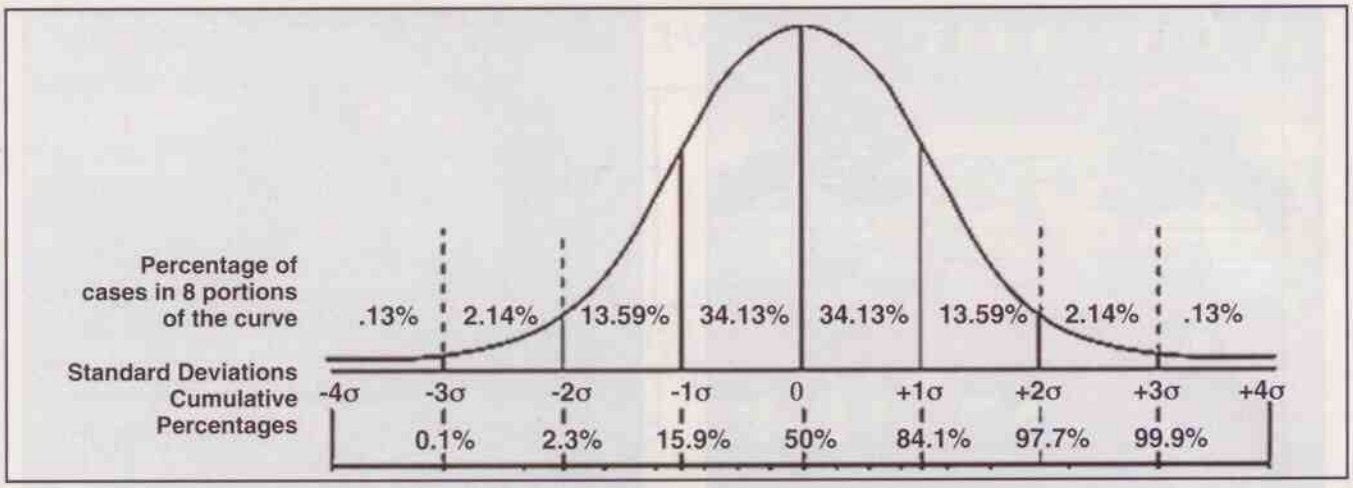

Figure 7. Cumulative standard distribution curve

The quality of a received SSTV picture may be determined by comparing the transmitted original, pixel-by-pixel, for identical matches in RGB color space with the image displayed on a remote SSTV cam in JPG format.

If a ham received an image perfectly, there would be a 100% match of the pixels. However, with analog transmissions, this will never happen. Considerable image degradation occurs as soon as the software, e.g., MMSSTV, readies the image for transmission. Losses are magnified when the signal encounters path loss as it moves through the ionosphere.

ImageMagick is powerful software that can compare two images pixel-by-pixel, e.g., a 320- x 256-pixel JPG image from an SSTV transmission. This is a total of 81,920 pixels in many SSTV pictures. The ratio of matches to the total is expressed as a percentage. This may be viewed as a *measure of picture quality* received.

A 'fuzz' adjustment is available in ImageMagick. Fuzz is used to match colors, which are *close* to the target colors in RGB space. Colors within this zone (color temperature region) are considered equal and indistinguishable by the human eye. Fuzz may be expressed in absolute intensity units, or as is done for SSTV image comparisons, expressed as a percentage of maximum possible intensity value of each pixel. Without a 'fuzz' adjustment, i.e. fuzz=0, there will be virtually no pixel matches with the original image.

Quality	Standard Deviation	P Signal	Description
100-97.7%	Greater than 2σ	5	Broadcast quality
97.7-84.1%	1σ to 2σ	4	Good, some noise
84.1-50%	0 to 1σ	3	Usable, noisy
50-15.9%	-1σ to 0	2	Barely use, noisy
15.9-2.3%	-2σ to -1σ	1	Barely see text
2.3-0%	Less than -2σ	0	Unusable

Table 1. P signals for major standard deviation segments

Several different empirical studies were conducted with approximately 200 images to measure the picture quality of received images as percentages of the originals. Many SSTV cams are in operation around North America. These cams immediately post received transmissions on the web. For SSTV research, this makes it very easy to obtain source information for study.

One needs to find some way to categorize the picture quality percentages. This can be accomplished by utilizing a normal statistical distribution curve and

Figure 8. P3 image with 65.05% pixel match to original

Figure 9. P2 with 25.78% pixel match

adopting the percentages from major standard deviation breakpoints as illustrated in *Figure 7*.

An approach was developed for relating broader ranges of picture quality measurements to P-signal levels. Through repeated trials and observations, this quality-percentage to P-signal relationship holds up well for a 10% fuzz factor setting in ImageMagick. *Table 1* summarizes six P-signal levels fitted to the empirical data, which can help improve and standardize analog SSTV image transmission quality reporting.

For example, VE6PW received several transmissions on 20 meters from WB9KMW at a distance of 1,250 miles. The *Figure 8* image scores a 65.05% picture quality. That is, 65.05% of the pixels in the picture received by VE6PW match the original from WB9KMW, with a 10% fuzz allowance for near-color matches. This can be adequately described as a P3 signal, i.e., usable but noisy.

Two other measurements were obtained via VE6PW reception. The image in *Figure 9* scores 25.78% for a P2 rating, or barely usable and noisy. *Figure 10* is even poorer. This image scores 7.64% picture quality for a P1 rating, or barely visible text.

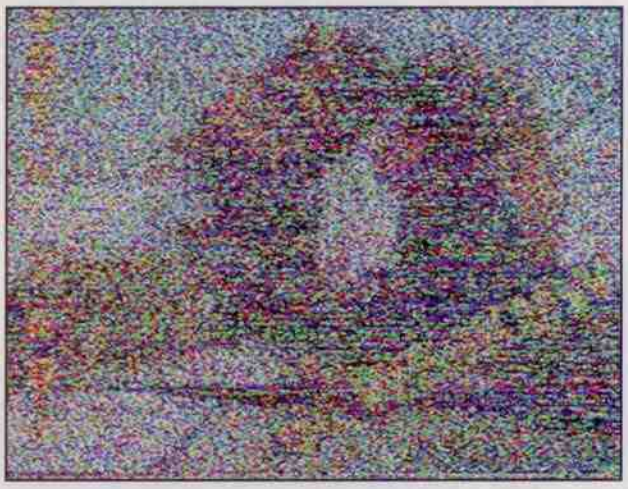

Figure 10. P1 with 7.64% pixel match

P-scale in Operation

More SSTV-active hams are beginning to adopt the P-rating system as a simple, superior way to describe their received visual images. A convenient summary of this may be found in the SSTV 20-meter section of the <http://www.wb9kmw.com> ham website. Additionally, a broad collection of SSTV cams from North America, Europe and elsewhere is displayed.

For those who wish to conduct their own image studies, a web-based ImageMagick routine that was developed for this specific research may be found in the L&M section of the ham website.

Operating Tip

Many hams use MMSSTV software for SSTV reception and transmission. This is measurably superior software, and it is free. The logging function defaults to RSV values, but P-ratings can be easily added. Simply go to the Mmsstv.ini configuration settings file within the Ham>MMSSTV sub-directory on your computer. Open with Notepad and add P5, P4, etc. in the LogRST row near the top of this file, then save this file and restart the MMSSTV software.