HCJB on Low Power

by

Jerry Berg

As Longfellow might have put it, "hardly a man is now alive who remembers that famous day and year" when HCJB was a low-power station. During its heyday it was hard to think of HCJB as ever having been a low-power operation–its strong signal made it one of the first stations a new shortwave listener would come across. But for roughly the first six years following its Christmas Day, 1931 startup, HCJB operated with around 250 watts, graduating to 1 kw. only in 1937, and staying at that power until Easter Sunday, March 24, 1940, when it inaugurated a 10 kw. transmitter, relatively high power for a private religious station back then. Much bigger increases were to come: to 50 kw. in 1956, 100 in 1967, 500 in 1982.

That first broadcast was a modest affair. As one author put it, "The 250-watt transmitter was installed inside a sheep shed and two eucalyptus poles served as antenna towers."[1]

I. 11 meters

Notwithstanding its usual high power, over HCJB's history there would be at least three opportunities to hear it at low power. One was during the five year period from late 1979 to late 1984, when the station used an amateur transmitter to relay its programs on a 26 MHZ. channel. They announced the plan in the May 1980 issue of *ANDEX International,* the bulletin of the station's listeners' club.

11-METER TESTS

How much power does a radio transmitter need to reach its audience? This is a difficult question to answer. There are so many factors involved that no specific answer can be given. We are living in a day when most international shortwave broadcasters are seeking to increase their power and 500-kilowatt transmitters are common place. At the same time, radio amateurs are still talking with each other over long distances with only a few watts of power. In fact, many hams like to intentionally reduce their power to an extremely low value just to prove what they can do. This is known as QRP operation.

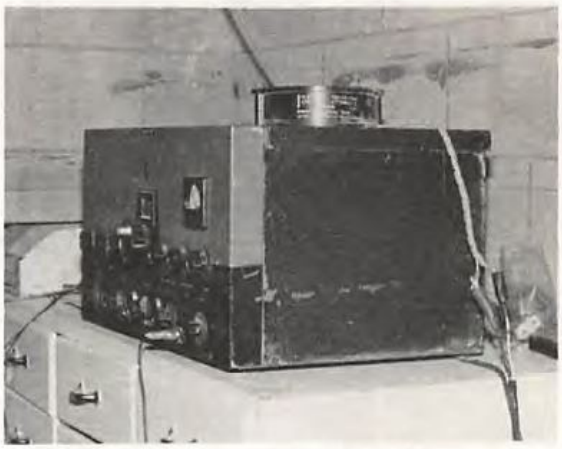
HCJB has recently inaugurated a low-powered service on 26,020 kHz, in the 11-meter band. This is an experimental frequency and is not listed in our program schedules. Nor is it mentioned in our station identifications. A variety of programs is carried on this frequency. Many of the programs are in English. The transmitter operates continuously around the clock.

The transmitter used for this unusual service is an old Johnson Viking II which is capable of about 100-watts output. This particular model was a very popular amateur transmitter about thirty years ago when hams used AM for their contacts rather than SSB. During the first few months of these experiments the antenna was a simple dipole about thirty feet in the air and running from east to west. This has now been changed to a five-element quad antenna which gives an improvement in effective power in the direction the beam is pointed. The new antenna is rotated during the day to give best reception in the area of the world where predictions indicate propagation will be optimum. John Stanley, of our HCJB engineering staff, conceived the idea of putting this old trans-

[1]Valter Aguiar, Sounds from the Equator–HCJB, Quito, Ecuador," *Monitoring Times,* June 1997, pg. 24.

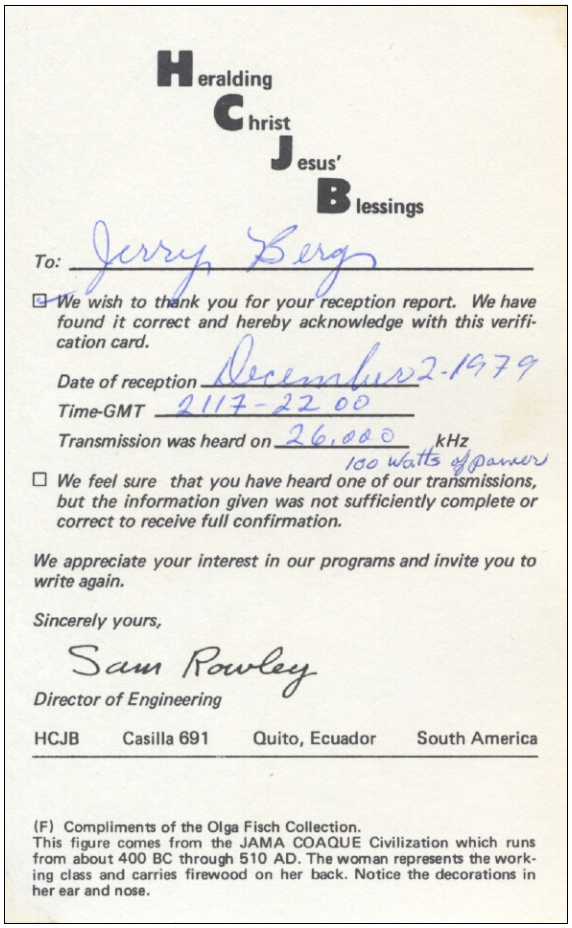
mitter to use in this novel way. The small transmitter is installed in a little storeroom. It makes quite a contrast to the equipment operating in the main transmitter room, which houses the 50 and 100-kW transmitters!

The 11-meter band is not as crowded as the lower-frequency bands. After trying a frequency of 26,000 kHz, a shift was made to the present frequency of 26,020 where we have encountered no interference. This frequency should make an interesting challenge for DXers who want to look for a low-powered station. One of the first reports received was from that well-known DXer, Arthur Cushen, of New Zealand. Since then reports have been received from many parts of the world. Take a look for this new frequency and send us your reception report. We'll be looking for it!



Old ham transmitter used on 11 meters

As pointed out above, as of May 1980 the experiment had already been in progress for some months on 26,000 kHz., soon changed to 26,020. The 26,000 transmissions resulted in the QSL below, verifying 100-watt reception on December 2, 1979. (Signal quality during that reception was fair at best, with deep fades.)



Heralding
Christ
Jesus'
Blessings

To: Jerry Berg

☒ We wish to thank you for your reception report. We have found it correct and hereby acknowledge with this verification card.

Date of reception December 2-1979

Time-GMT 2117-2200

Transmission was heard on 26,000 kHz
100 watts of power

☐ We feel sure that you have heard one of our transmissions, but the information given was not sufficiently complete or correct to receive full confirmation.

We appreciate your interest in our programs and invite you to write again.

Sincerely yours,

Sam Rowley

Director of Engineering

HCJB Casilla 691 Quito, Ecuador South America

(F) Compliments of the Olga Fisch Collection.
This figure comes from the JAMA COAQUE Civilization which runs from about 400 BC through 510 AD. The woman represents the working class and carries firewood on her back. Notice the decorations in her ear and nose.

The propagation forecast in the August-September 1981 issue of *ANDEX* encouraged readers to check the 11 meter channel, which was by then at even lower power:

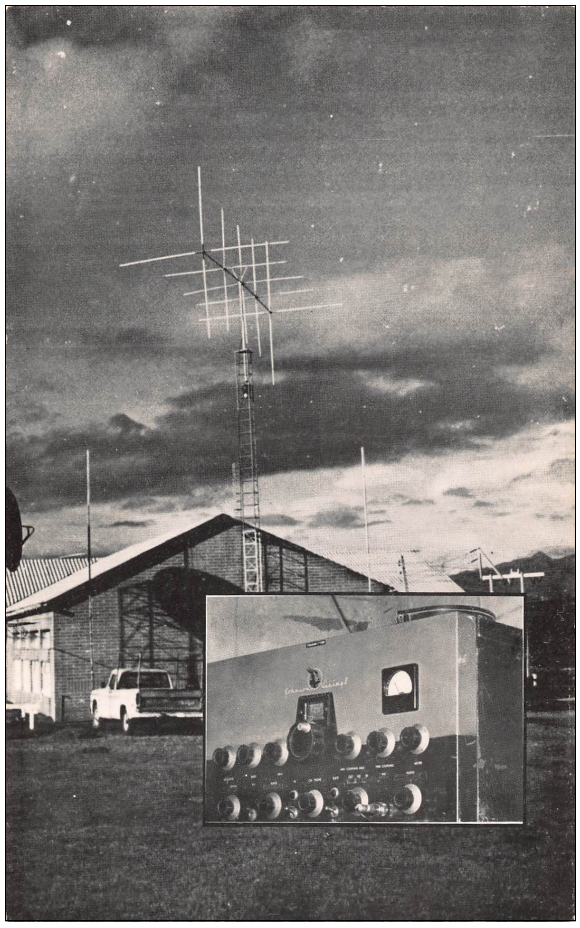
BELOW 30 MHZ: Below 30 MHz are many interesting catches. The *10 meter amateur band* will be hot many hours each day with excellent DX signals. The *27 MHz Citizens Band* will be full of skip signals from all over. The *11 meter Broadcast Band* will have strong signals. Now is the time to confirm HCJB on 26.020 MHz if you haven't before. Now using a low gain omni-directional antenna and about 60 watts, this has got to be international broadcasting's lowest powered signal. Can you log it?

A slight adjustment of the 26,020 kHz. channel was announced in the June-July 1982 *ANDEX.*

Although it was listed as operating on 26020 kHz, many sharp-eared DXers discovered that HCJB's 11 meter transmission (100 watts) was actually about 1 kHz higher, on 26021. This was because the 11 meter project never was officially presented to station management for approval and therefore, had no budget. All work done to put it on the air was done after hours and except for electrical power (and not much of that), no expenses resulted.

The home-made crystal was off frequency and resisted efforts to pull it down to exactly 26020. However, after receiving "QSL cards" from several government monitors in Canada and the U.S.A. about the off frequency operation, we finally dug up some funds and ordered a crystal. So now, HCJB's 11 meters, THE WORLD'S LOWEST POWERED INTERNATIONAL STATION really is on . . . . . 26020 kHz.

In 1980, its instincts well tuned to the wishes of the shortwave listening community, HCJB issued a special QSL card for reports on the 11 meter transmissions.



Heralding
Christ
Jesus'
Blessings

To: John C Herkimer

☑ We wish to thank you for your reception report on 11 meters, 26020 kHz. We have found it correct and hereby acknowledge with this verification card.

Date of reception 6th November 1980

Time-GMT 0045

☐ We feel sure that you have heard one of our transmissions, but the information given was not sufficiently complete or correct to receive full confirmation.

☐ We do not feel you have heard HCJB. Enclosed please find information that will help you find us on the dial.

We appreciate your interest in our programs and invite you to write again.

Sincerely yours,

Thomas D. Fulgham

Director of Communications

HCJB Casilla 691 Quito, Ecuador South America

The background photo shows the North end of HCJB's transmitter building where the 5 element Qubical Quad antenna is mounted with steerable capabilities. The insert shows the Johnson Viking II (100 watts input) transmitter used to transmit on 26020 kHz. Signals are beamed to Europe (1100-1900 GMT), Eastern NORTH AMERICA (1900-2200 GMT), Western NORTH AMERICA and JAPAN (2200-0300 GMT) and SOUTH PACIFIC (0300-1100 GMT). HCJB wishes you the best in enjoyable listening.

Sadly, in the October-November 1984 *ANDEX* (below left), readers were informed that the venerable Viking transmitter had given up the ghost. Donations of suitable replacement equipment were requested, and a reminder was published in the February-March 1985 issue (below right).

OLD WORKHORSE DIES: As the DX world knows, for several years HCJB has been using an old "ham" transmitter on 26,020 kHz for worldwide DX coverage when the ionosphere permits. A recent move of the transmitter to HCJB's FM site at more than 12,000 feet above sea level proved too much for the old workhorse. After only a few weeks, the transmitter refused to function any more.

Does any ANDEX member have a transmitter he could donate to the cause of QRP DX on 11 meters? It could be anything from 10 to 1000 watts, usable on 10 or 11 meters, AM or SSB. We could also consider putting a SSB transmitter on 13 meters.

Please write concerning any offers, and we will let you know how to ship the gear. We might even pay shipping. But write first to our Fearless Forecaster, John Stanley, so that he can evaluate the equipment. The best way to write would be to use an airform and send it to John Stanley, HCJB, Casilla 691, Quito, Ecuador.

Here is your chance to be famous. Let your old transmitter be "born again" on 26,020 kHz.

ANY MORE 11-METER TRANSMITTER OFFERS? In the October ANDEX, we told of the need for another transmitter that HCJB could use on 26,020 kHz--our 11-meter frequency. The old transmitter is broken beyond repair. We have received some offers from ANDEX members and will be responding to you soon when a final decision is made as to which transmitter will serve us best.

But another life for HCJB's 11 meter broadcasts was not to be, and so ended this interesting low-power "hobby" project of one of the world's most powerful shortwave stations. The 26,020 kHz., 100-watt channel had appeared in the WRTHs of 1981-1984 (shown mistakenly as 1 kw. in 1981).

An interesting footnote to the Viking II transmissions: Although it operated mainly from Pifo, it was moved to HCJB's Mount Pichincha mediumwave facility not long before October 1984, and transmitted from there before becoming inoperative (see "pink" paragraph at left above). Under NASWA station- and country-counting rules, the short-term Viking II Pichincha transmissions would count as a different station from the Viking II Pifo transmissions.

II. Single Sideband

By the 1980s, HCJB had become a technological leader among shortwave broadcasters, even establishing its own Global Technology Center in Elkhart, Indiana in 1986, conducting research and building transmitters there. So it is no surprise that in the December-January 1981-82 issue of *ANDEX* (below), the station inquired of its reader-listeners what they thought of the idea of HCJB transmitting in single sideband.

REQUEST FROM ENGINEERING

Radio Station HCJB is considering adding a small transmitter which would operate in the single sideband mode. Some people feel that we should use the upper sideband with suppressed carrier and operate on 21480 kHz in the 13 meter band.

To determine if the HCJB listeners will be able to tune in to the SSB broadcasts, please send a note and answer the following:

1. Is your receiver equipped to receive SSB mode?
2. What bands or frequencies does your receiver cover?

Write to: Herb Kinard
Engineering Department
Radio HCJB
Casilla 691
Quito, Ecuador

He will appreciate hearing from you.

The main purposes of SSB, a mode already in wide use among amateur radio operators at the time, was to achieve the same signal quality with much less power, and much less bandwidth, thus reducing the costs of operation, and reducing the needed spectrum space, which was under increasing pressure; and also to reduce what was called selective fading. In single sideband, no carrier, and only one sideband (rather than two), is transmitted, and the receiver inserts a substitute carrier as it translates the signal. A receiver with special circuitry and high stability was necessary. Would shortwave listeners be willing to spend the money for these more advanced, more costly receivers? And would they accept the careful tuning that was necessary to get good SSB reception? Shortwave was not terribly user friendly to begin with. The station layed out the issues in the August-September 1984 *ANDEX* (next page).

Notwithstanding its advanced capabilities in shortwave technology, HCJB was not among the early experimenters in the use of SSB for international broadcasting. Some stations had used it for limited forms of specialized broadcasting, e.g. Iceland, Radio Kiribati, and Galei Zahal (Israel), as well as some other armed forces-connected stations. The early experimenters among the bigger shortwave stations were Radio Netherlands and the BBC (both had tested SSB in the 1960s); Sweden, Switzerland and Norway in the 1970s, and Japan, Austria, and Radio for Peace International (Costa Rica) in the 1980s.

FEARLESS FORECAST: SSB

By John Stanley

In 1979, officials from most of the world's countries met in Geneva, Switzerland, for WARC '79 (World Administrative Radio Conference). The purpose of this conference was a re-examination of the radio frequency allocations as well as the rules governing their use.

The ham bands were expanded at that time with the addition of three new bands. One of these, the 30-meter band, is now in use. Hams from many countries can be heard on the frequencies between 10.1 and 10.15 MHz using CW and RTTY modes of transmission. Other frequencies near 18 and 24 MHz will eventually become available.

WARC '79 also agreed to add some 780 kHz worth of new frequencies to the international shortwave broadcast bands subject to implementation at another conference set for early 1984 and a third in 1986.

January of this year saw the convening of a five-week conference on shortwave broadcasting to continue the discussion of issues not resolved in 1979. One of the issues discussed was the use of single sideband in the broadcast bands. One of the countries promoting use of SSB sooner rather than later is Mexico. However, most of the Latin American countries prefer a delay in going to single sideband. As a compromise, WARC '84 proposed a changeover to SSB over a 20-year period beginning in 1986, assuming the 1986 WARC agrees.

Those favoring SSB usually cite the spectrum-saving aspect. Experience with SSB on the ham bands has shown that two or three stations can occupy the same bandwidth that would be taken by a single AM station. Hence, conversion to SSB would allow twice as many stations to broadcast simultaneously.

A second factor is the power savings since the carrier power which makes up perhaps 75 percent of a typical AM signal is not transmitted and neither is one sideband (a useful, but redundant portion). Hence, 87 percent or so of the power is saved. With rising power costs, the savings looks good to the broadcaster.

Put another way, the station could have an effective increase in power output of eight times for the same power cost. It is this second factor, incidentally, that motivated most hams to convert to SSB. After all, when it comes to saving money for myself or spectrum for someone else, most of us are more interested in the former.

Perhaps this factor explains why the NBVM system (Narrow Band Voice Modulation) which was developed for ham use some six years ago has not proven popular. It saved bandwidth, but that helps the other guy, not the one using the system. In other words, successful adoption of such a system assumes that most people are unselfish. This has not been observed to be the case. Many who praise the unselfishness of Jesus or Mahatma Ghandi are not too willing to practice it themselves.

On the broadcast bands, SSB has a third advantage. It eliminates the envelope distortion that accompanies selective fading. Selective fading was an aggravation on the hambands, but usually a request for a repeat got the message through even on AM.

A listener, on the other hand, can't say, "How was that?" or "Please repeat." when an important word is destroyed in a newscast. And what selective fading does to music is really a pity. SSB could do a lot to solve this problem...could...I said, not necessarily will. SSB can introduce a distortion of its own that makes selective fading seem mild by comparison.

Which brings us to the problems with SSB...and it has some. In the first place, although it saves power at the transmitter, it does so at the expense of complexity. An SSB transmitter requires considerably more complex circuitry than AM, and that circuitry must be maintained. For vast numbers of transmitters located in remote locations and far from knowledgeable technicians, that could be a problem.

SSB transmitters ARE expensive, but that is really a small part of the problem. For every broadcast transmitter in the world, there are many thousands of receivers, and SSB RECEIVERS are expensive. Considering how many of them there are, this is the really costly part of going to SSB.

Yes, it is relatively simple to add a beat frequency oscillator or BFO to a cheap receiver, but this approach to SSB won't do. To get the advantages that SSB really offers, we must have frequency stability which means a synthesized receiver or a phase-locked detector which automatically follows a drifting signal, sort of like AFC or FM, or better, both frequency synthesis and the phase-locked detector.

With that we would have a receiver that is as easy to tune as AM and provides better fidelity. But we also have a receiver in the $500 (USA dollars) price class. And we have just lost 98 percent of our audience.

With over one billion receivers in the world, most of them in the under $100 class and many in the under $20 class, we just can't afford to go to SSB, until someone gets the above mentioned $500 receiver down to about $50. This may not be as difficult as it sounds. The $1000 calculator watch has dropped below $30 in five years. Some of the same technology is applicable to radios.

It will happen. However, it is my judgment that very little was done at WARC '84 to make it happen. Let us see what happens at WARC '86.

HCJB joined the SSB club on June 18, 1990, when it brought into use two Siemens SSB transmitters. The station explained its plan as follows:

ANDEX INTERNATIONAL

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August-September 1990

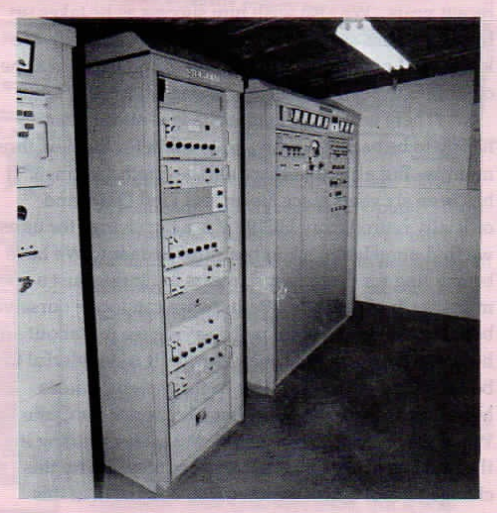
Inside:

HCJB Begins SSB Broadcasts

Something new has been added recently at HCJB that should be of great interest to DXers and shortwave listeners. For many years single-sideband transmission has been the preferred mode for transmitting voice by radio amateurs and many point-to-point circuits. Single-sideband has many advantages over standard AM transmission. Now HCJB is broadcasting some of its programs using SSB (single-sideband). On Monday, June 18, tests began with two SSB transmitters. Some of the frequencies used included 25,950, 21,470, 17,790, and 15,155 kHz.

Before going any further, perhaps we should explain how SSB works and how it differs from standard AM broadcasting. An ordinary AM signal consists of a powerful carrier and two sidebands. However, the sidebands carry all of the program information. In a sense the carrier power is wasted, but it is needed by an ordinary receiver to give an undistorted audio sound. Both sidebands carry the same program information so only one is really needed. A great deal of power can be saved by transmitting only one sideband and no carrier. Also, a single-sideband signal takes up only half the space of a standard AM signal in the radio spectrum. If all shortwave broadcasting were done using SSB it would be possible to fit twice as many stations in the same portion of any band with greatly r educed interference. All DXers would benefit from that improvement! In fact, a 30 kw SSB transmitter will give about the same effectiveness as a 100 kw AM transmitter. The economic advantages of SSB should be evident.

The major disadvantage of SSB broadcasting is that ordinary AM receivers will not work satisfactorily. Special receivers are needed and they are much more expensive at present. The receiver must generate a substitute carrier to replace the one not transmitted. This must be exactly the same as the carrier frequency that has been eliminated at the transmitter. While this may sound simple, it is really quite difficult in practice. It requires a very stable receiver since any drift in frequency, either at the transmitter or receiver, will cause serious distortion. Tuning is much more critical.



One of HCJB's SSB transmitters

Recently four SSB transmitters became available to HCJB at very low cost. Thre e are now in Ecuador. The fourth is being used in Italy. The transmitters were obtained from the Swiss PTT which operates the Swiss Radio International station in Schwartzenberg. These transmitters were used to communicate with aircraft while in flight. Since much of that communication is now done by satellite, the load on these transmitters has been greatly reduced. Of seven transmitters that were installed in 1970, four were no longer in service.

Although these transmitters were built in the 1960s by Siemens in Germany, their advanced design is considered quite modern even today. They

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are capable of unattended operation with automatic tuning to any frequency between 3 and 30 MHz. They will operate as pure SSB transmitters or as AM units with controllable amounts of carrier added. In fact, we understand that the transmitter in Italy is being used as an AM broadcaster. The peak power of these units is rated at 30 kw. On many receivers the audio from a 30 kw SSB transmitter will sound louder than if it were coming from a 100 kw AM station.

The early single-sideband tests at HCJB were made using the upper sideband and with carrier added in amounts ranging from 5 to 50 percent. Listening tests in Quito resulted in a decision to operate with 20 percent carrier for the time being on regular transmissions. By the time this issue of ANDEX International reaches you, programming should be on a 24- hour basis, using two frequencies. These will probably be 25,950 and 21,458 kHz. Of the three transmitters now in Ecuador, only two are being prepared for regular operation. The third will serve as a source of spare parts.

The antennas currently in use for SSB broadcasts include an unterminated rhombic and a ground plane. The rhombic is bi-directional and can be used on frequencies between 15 and 26 MHz. It provides a good signal gain to Europe and the South Pacific. The ground plane is non-directional and can be used only on 11 meters, usually 25,950 kHz. In the future other antennas and frequencies may be added depending on the results of these early tests and listener response.

At present, with 20 percent carrier insertion, listeners who have only regular AM capability will notice considerable distortion. Speech should be understandable while music suffers bad distortion.

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With a conventional SSB receiver, such as is currently used by most amateur radio operators, speech will be undistorted, but the frequency response will be limited. Music will be distorted unless the receiver is tuned precisely. Most of the better quality receivers currently used by DXers fall into this same category and will give similar results since they are designed to receive SSB and CW signals. However, results will probably vary greatly from one make or model to another. The low-priced shortwave receivers, millions of which are used daily around the world, will give very poor results. The best reception will be obtained by using a receiver having synchronous detection (phase locked loop capability), but this is a recent development and few are in use. Probably the most popular receiver with this facility is the Sony ICF-2010. In some countries this model is known as the ICF-2001D. This Sony receiver will provide high quality reception of both speech and music. The audio bandwidth is 6 kHz, so with proper receiving equipment audio quality will rival or exceed the better AM shortwave transmitters, especially when there is noticeable fading on the received signal.

Here is where you as a DXer can help. Your reception reports on these SSB transmitters will be of great assistance in evaluating the future of SSB broadcasting on the international shortwave broadcasting bands. They will also be of assistance to our HCJB engineers as they continue experimenting with this new technology. We believe it is time that this new technology were more widely used. When sending in your reception reports, be sure to give details on the receiver you are using and the audio quality obtained with various types of tuning.

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We wish to cooperate with manufacturers as they develop better and cheaper receivers which will take advantage of the benefits of SSB broadcasting. DXers and DX clubs can give valuable help as they determine which present receivers do the best job in receiving SSB signals. This new method of transmitting can only reach its full potential when good phase locked loop receivers are produced at a reasonable and competitive price. With the present rapid increase in technology, such a breakthrough could come sooner than we expect! Even then, it will take years to replace the millions of cheap transistor shortwave receivers now in use in every part of the world.

HCJB is currently building several shortwave transmitters at its engineering facility in Elkhart, Ind., in the United States. These new transmitters, and others built recently, are all SSB compatible. Obviously they will be used as standard AM transmitters until such time as SSB broadcasting becomes common place. In the meant ime, the two HCJB SSB transmitters will be used to augment the regular program service from Quito. Scheduling and frequencies may change as time goes on. Other antennas may be installed to reach different target areas. Keep listening to "DX Party Line" and watch your ANDEX bulletins for any changes as our engineers continue to investigate the future potential for SSB as an international broadcasting mode.

We look forward to many HCJB SSB reception reports as you, our ANDEX members, s end them in. We want to hear from each of you. Y our reports will be very valuable.

The exact progression of HCJB's use of single sideband is not entirely clear. The first frequencies in use, in 1990, were 21455 and 25950 kHz., and at least one of the channels was operating 24 hours. The WRTH listed these as 30 kw., although that was probably meant to reflect the transmitters' capability rather than their actual operating power. In late 1992, the actual SSB power in use was said to be 10 kw., and the station started using technology that permitted it to feed two SSB transmissions into one antenna simultaneously (see November-December 1992 *ANDEX*, p. 3). Circa 1993-94, 17490 kHz. replaced 25950, and other frequencies were used from time to time as well. At one point consideration was given to using 21455 for English 24 hours, but that plan never came to fruition.

Toward the end of 1994 it was learned that, at that time, 21455 was using a very modest 1.5 kw. The beam was 35/225 degrees, to Europe and the South Pacific. Specially-designed "21455" QSLs were issued, with power penned in as 1.5 kw. The station had apparently obtained additional SSB equipment, as the QSLs indicated that the transmitter being used was a Gates model (see QSL below).

HCJB WORLD RADIO

To: Richard McVicar

This confirms your report of HCJB's transmissions on 21455 kHz in the 13 meter band.

Date September 23, 1994 * first tests w/ Gates xmttr.
Time 1800 UTC
Mode USB

The transmitter used was a Gates HFL-10K *with a power of* 1500 *watts through a* rhombic *antenna directed* 35 & 225 *degrees. HCJB's shortwave transmitters and antennas are located at Pifo, Ecuador.*

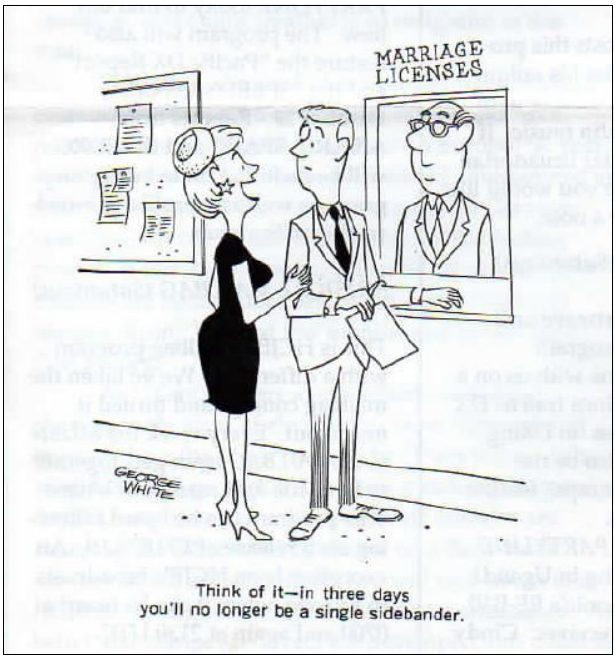
73 and God bless,

Frequency Manager

HERALDING CHRIST JESUS' BLESSINGS

In the summer of 1995 it appeared that, due to budgetary restrictions, HCJB's SSB frequencies would close down as of September 1 of that year. But the transmissions continued, and the power on 21455 was reduced to 500 watts.

In those days, the WRTH also reflected the use of low power on HCJB's SSB channels. Save for 2002, when 21455 was shown (seemingly incorrectly) as 100 kw., the "back of the book" shortwave frequency list showed the channel as 1.5 kw. in 1996, 500 watts in 1997-99, and 1 kw. in 2000-2008. The entries in the handbook's country listings were a little ambiguous, in some years (2001-2008) indicating that there were two 20-25 kw. SSB transmitters in addition to two at 1 kw.



ANDEX, August-September 1990

III. And there again at 1 kw.

The year 2009 saw the end of shortwave broadcasting by HCJB from its Ecuador facility, save for one local channel, 6050 kHz. The frequency came into use at 50 kw. in 2001, dropping to 10 kw. circa 2009 (and possibly 8 kw. three years later). In 2017, power was reduced further, to 1 kw. The transmitter is still on the air, operating from Pichincha since 2008, according to an HCJB engineer. It is operated as "Vozandes" by Vozandes Media, which is apparently associated with but not part of HCJB itself.

Thanks to John Herkimer and Rich McVicar for their QSLs. Rich worked in the HCJB English service from 1990 to 1996, where he hosted "DX Partyline" and "The Latest Catch" among other on-air duties He was ANDEX Director from 1990 to 1994, and HCJB Frequency Manager from 1994 to 1996, and always a good friend of SWLs.

July 10, 2022