

## Exploring the World Below 530 Kcs With a K3

As a 16 yr old high school senior in 1956/57, I worked part-time at a coastal marine station as a relief operator. 500 Kcs [600 m] was the “Holy Frequency,”<sup>1</sup> ... in addition to being the International Maritime Distress frequency, it was a calling frequency and basically the world's party line, and it was very busy, especially at night. Graduation and off to college and that was essentially my last contact with the Holy Frequency, until the KSYN3A arrived a couple of weeks ago.

As soon as I had it installed, and all the “wireless” behind the radio rack connected again, I noticed a real improvement in the sound of my QSK CW, both in the headphones and on the air in a second receiver. But, while promises of improved QSK and lower phase noise were an attraction, the big one for me was the fact that my K3 would now tune down as low as 100 KHz. I've had a Palomar LF/MF up-converter for a number of years with an IF in 80 meters, however the 80 meter bleed through was so high and it was so insensitive that since LORAN-C shut down<sup>2</sup> I had only heard two NDB's<sup>3</sup> over near the San Francisco Bay area. So, I began a quest to see what I could hear below 530 KHz.

The first night was disappointing. I have a flag pole not quite 8 meters tall out on the corner of our deck and a single wire from its base into the shack, so I plugged that into ANT 2, [selected ANT 2 ☉], waited for the sun to set, and heard nothing ... not even noise from the thunderstorms over the Sierra Nevada. A kindly member of the E-list told me he thought I needed the KXV3 and should connect the antenna to the RX ANT jack. I have a P3, ergo a KXV3, so I did this, tapped RX ANT on the front panel, and signals!! While the Holy Frequency is eerily quiet, there is still a lot of “stuff” down there.

**Highway Service Radio:** 530 KHz [and a number of other frequencies in the AM broadcast band] is home to low power signals announcing highway conditions, giving instructions for parking at airports, and the like. They all run about 10 W, and the first night I managed to identify a half-dozen, including one at Sacramento Intl Airport, and one just up the Interstate from us. [http://www.mwlist.org/ul\\_login.php?sprache=en](http://www.mwlist.org/ul_login.php?sprache=en) is a great site to ID VLF/LF/MF stations world-wide. You don't need to register, just click on “MWList quick and easy,” choose your area, and start picking frequencies.

**Non-Directional Beacons:** I thought these had disappeared but there are a bunch of them still on the air. Basically, they're just a low power AM transmitter usually plate modulated with a 1 KHz tone. All they do is transmit continuously, sending a code [call sign] over and over. They are identified at <http://dxinfocentre.com/> and you'll find them in the 300 – 400 KHz range. The two I had heard with the Palomar [LV – Livermore CA and CC – Concord CA] are now very strong on the K3, and I've logged almost 2 dozen in a couple of evenings. You can spot an NDB on the P3, the Morse is about 5 WPM and you can read it off the sidebands if you run a 25 KHz span.

There are a few NDB's that are really two transmitters 1 KHz apart. In an AM receiver, they heterodyne to produce a 1 KHz tone. Only one is keyed, the other is just a carrier. NDB's just sit there and transmit 2 or 3 letters/numbers, over and over, forever. Consequently, as they age, their signal quality deteriorates and some put harmonics into 160. The two transmitter ones are a particular problem if the one making the harmonics is the unkeyed one.

**Differential GPS Beacons:** GPS transmits two signals. The P-R-code on L1 repeats every 100 ms and was a gift to the world from the US Department of Defense. It was intended to provide position accuracy in the 100 - 150 m range. The P-R code on L2 repeats every 7 days and is usually encrypted. It provides the high-accuracy positioning for the military ... who have the encryption keys. It turned out that the L1 signal was significantly more accurate than planned, so for awhile, the US DoD would perturb the atomic clocks on the satellites to reduce the achievable accuracy. It was called Selective Availability.

To get around SA, the US Coast Guard [and others] began putting radio stations at carefully surveyed locations that would compare their known position to their GPS position, and broadcast the error. A DGPS receiver receives this broadcast, subtracts the error from its GPS position and if it is within a reasonable distance from the DGPS transmitter, it can refine its position to within 10 – 20 meters or even less, depending on the satellite configuration and how close it is to the DGPS transmitter. These DGPS beacons transmit continuously in the range 284 – 458 KHz, using 100 baud Minimum Shift Keying.<sup>4</sup> You will find a list at <http://dxinfocentre.com> and

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1 Technically, it still is, and when discussing the Holy Frequency, those of us who remember it use the most reverent “Kcs”  
2 The LORAN-C station over in Middletown CA saturated the Palomar's front end and was all I could hear, everywhere  
3 Non-Directional Beacon  
4 A handful use 200 baud MSK, they'll appear a little wider on the P3

there are some free software packages that will decode it. I haven't done that yet, all they transmit is data which wouldn't make any sense to me.

There are 8 DGPS stations in California, I've found all of them, they have a characteristic signature on the P3 and once you've seen it you can find all of them. The one in Lincoln is about 40 km from me and it and the one in Chico are very strong here day and night. Some time ago, they gave up on Selective Availability, but the DGPS broadcasts continue and provide highly accurate positioning.

**Amateur WSPR [475 KHz]:** I knew that there were hams with experimental licenses transmitting just below the Holy Frequency, so I listened for CW. I might have heard one signal, very weak, but not what I expected. Again, another member of the E-List pointed me at WSPR<sup>5</sup>, I installed it, parked USB on 474.2 KHz and let it run all night. Next AM, I found I had decoded five different stations [multiple times all night] ranging from a few hundred to several thousand km from me. All of the SNR's were negative, some at -30 dB or so. Next night, with a different antenna, I logged the five plus two more.

I've never actually heard the signals of course. The SNR is referenced to a SSB bandwidth, so I've listened with CW bandwidths but still haven't heard them. I've been told that if an op notices an SNR around -6 or so, they'll sometimes switch to CW. The software will automatically upload your logged stations to <http://wspnet.org/drupal/wspnet/spots> where there's a database, a mapping facility, and a lot more.

**NAVTEX:** NAVTEX is a teletype-like system for distribution of maritime information. Nearly all the stations are on 518 KHz and they transmit in 10 min time slots according to a schedule. The world is divided into 21 NAVAREA's and the stations within each NAVAREA rotate through the schedule. The North American Pacific Coast is NAVAREA 12. At night, I can get very good copy on stations from SoCal up into British Columbia. NAVTEX is 100 baud 170 Hz shift binary frequency shift keying using SITOR-B formats and the CCIR 476 character set. I think AMTOR-FEC will decode it ... maybe.

I found a really cool free program called YaND ["Yet another NAVTEX Decoder"]. You can download it from <http://www.ndblist.info/datamodes>. It has a lot of really great features, including a complete, world-wide NAVTEX schedule. NAVTEX on 518 KHz should be in English world-wide. 490 KHz is a secondary frequency used in some parts of the world [not the US and Canada] that may be in another national language. With all this maritime information, and the HF WEFAX from NMC, all I need now is a boat. ☺

**137 KHz:** Wayne has made it clear that K3 MF sensitivity declines steadily below 300 KHz and it will take strong signals to be heard down there. Undeterred, but with realistic expectation levels ... hams have had authorization to transmit beacons and experiment on a tiny slice at 137 KHz for some time with very restricted ERP's. WSPR is used there too – so what's to lose, I'll try. However so far, I haven't logged any transmissions there in several nights of monitoring. There may not be any on the air out here on the NA frontier, or they may just be too weak. My noise also starts to rise below 200 KHz, reaching well over S9 around 137 KHz so I'm keeping my expectations reigned in for this frequency range, but we'll see. Stay tuned.

**426 & 500 Kcs:** KSM, the newer station at the historic site of KPH at Point Reyes CA often fires up with 5 KW on 426 KHz on Saturday afternoons [Pacific time]. A lot of time they will transmit press at 25 WPM or so. They're less than 200 km from me and are very strong. Occasionally, one of the museum ships will call in on the Holy Frequency. When one of the "Radio Anniversaries" comes around, I'll listen for the Jeremiah O'Brien moored at San Francisco.

**Antennas:** Active antennas work well [e.g. Pixel Loop or Clifton Labs active E-field probe], however my flag pole with the single wire feedline also works well. It's on the deck railing with the base about 2 m off the ground. I've tried my low band sloping-V, however I get some AM broadcast mixing, probably from "rusty-bolt" syndrome. I have a GAP Titan on the roof, I'm currently using just the center conductor of the PL-259 and it is working well.

There are a lot more signals I haven't identified yet. A couple drift around slowly and I suspect they're from an SMPS. Most are clearly intentional, often seem to have phase shift keying, and some appear for awhile and then shut off. I've been an HF SWL on and off for a long time. Now I've got a whole new territory to explore.

73,

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5 <http://physics.princeton.edu/pulsar/k1jt/>