

CERAMIC FILTERS

Marc Bergman

Alas the lowly ceramic filter. Poor stepchild to the exalted mechanical filter. Unable to cope with the narrow bandwidth needs of today's receivers. But wait. What's this? Someone leaping to their defense? Armed with thousands of dollars of specialized test equipment and computers, gifted with an uncommon flair for programming, I present my case for their defense.

Ceramic Filters

Advantages - small size and low cost

Disadvantages - relative frequency instability with temperature change

Material - ceramic compositions - lead zirconate-titanate or lead metaniobate

Manufacturing Process - mix ceramic paste with water - form into disc shape - dry discs - bake in oven - while in oven apply high voltage "poling" field to give material piezoelectric property - deposit silver electrodes on each side of disc - attach discs in a ladder arrangement - seal in metal case. Presto. You have one quality ceramic ladder filter.

One of the big problems in deciding which filter to use has been getting accurate information as to filter specification. Most ceramic filters are specified like this: 4KHz minimum at -6dB and 10KHz maximum at -60dB. What this means in the real world is that the filter will be about 5KHz wide at -6dB and about 9KHz wide at -60dB. The measured stopband attenuation of ceramic filters can also vary widely from the specifications.

With the help of several club members, I have gathered together a good number of ceramic filters. I feel the tests that I have run will provide us with an accurate picture of the current state of the art with regards to this type of filter. I have looked for different sources of the filters. A list of suppliers is provided at the end of the article. I have also charted the case and lead dimensions and have provided case drawings.

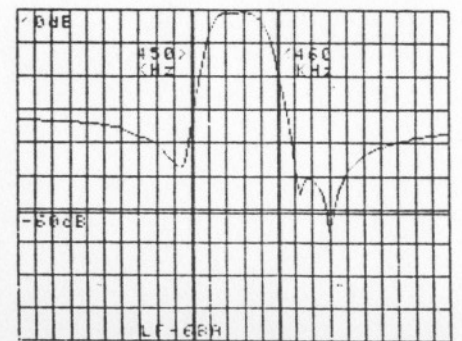
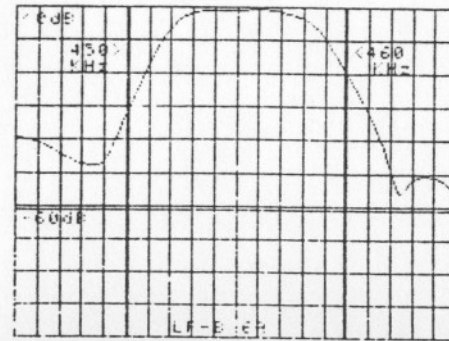
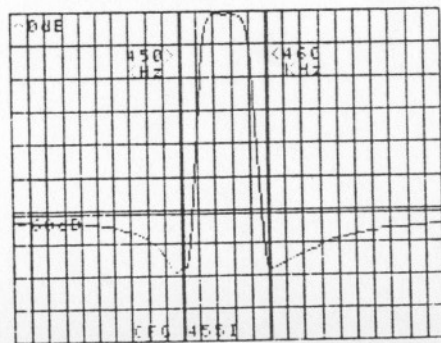
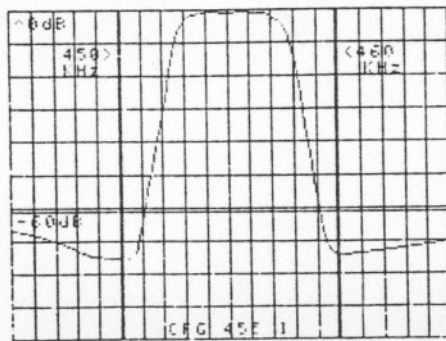
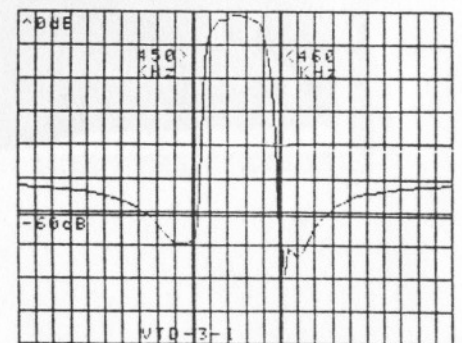
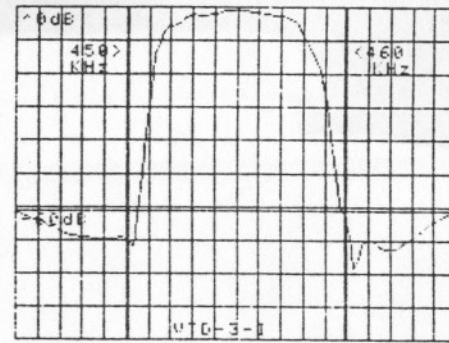
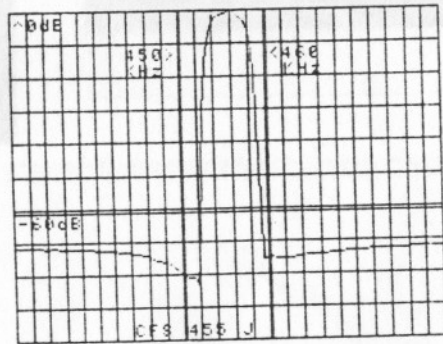
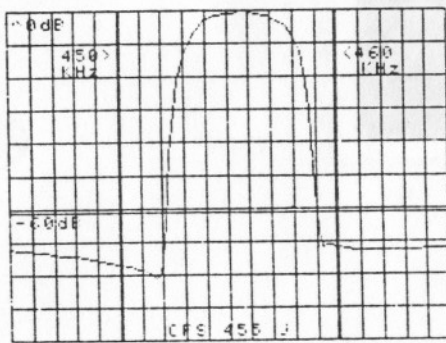
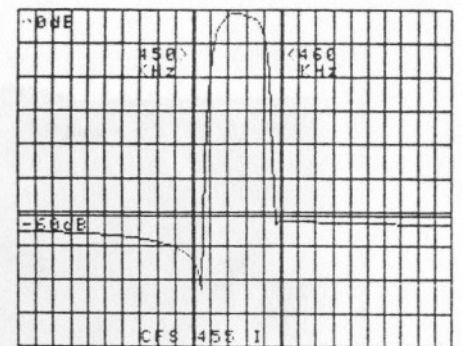
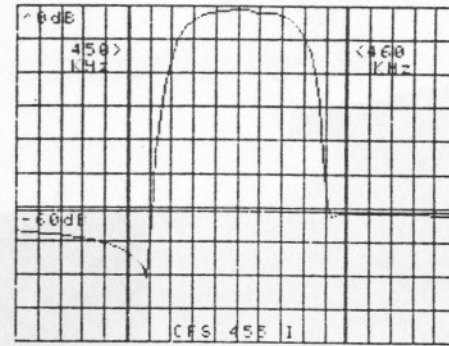
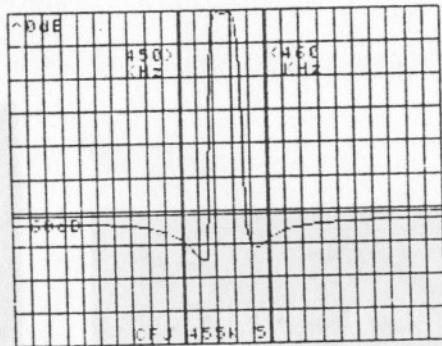
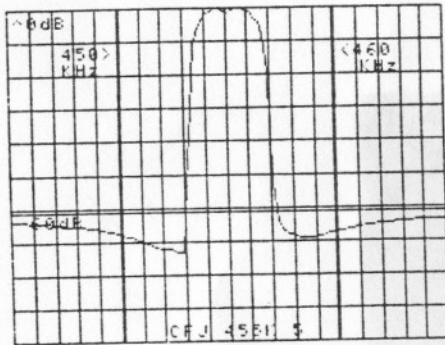
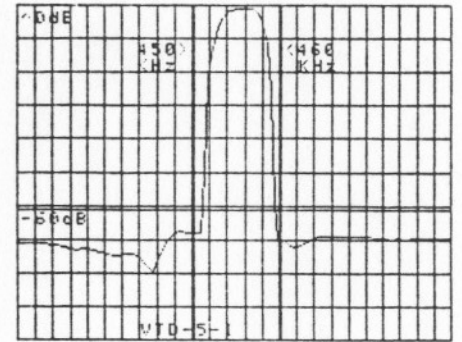
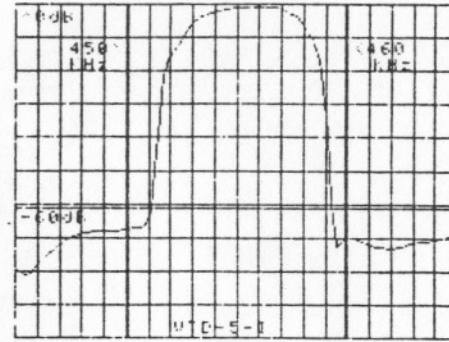
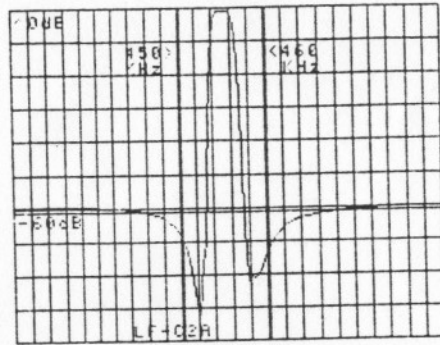
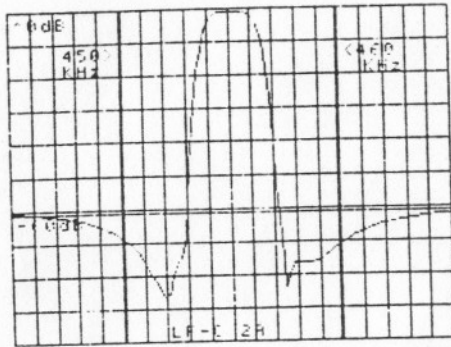
The tests I conducted are similar to my tests of mechanical filters. The same test equipment was used. The filters were mounted on a printed circuit board. Impedances were matched to the filter characteristics. I wrote a second program that shows a wider view of the filters response. I wrote a third program that tests two filters and plots their response on one graph. The filters are listed by their response at -6 dB. This doesn't mean that they are listed best to worse. The best filter isn't necessarily the narrowest one at the -6dB point. Didn't I tell you this in my mechanical filter article? The best filter for your use will depend on your particular application.

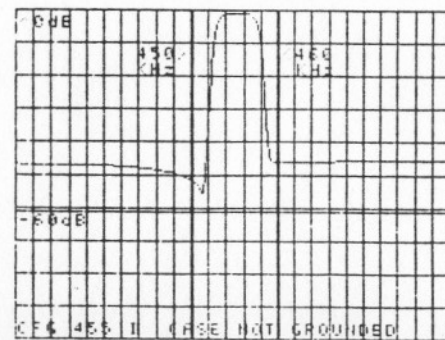
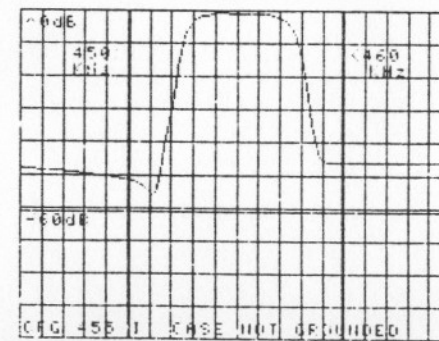
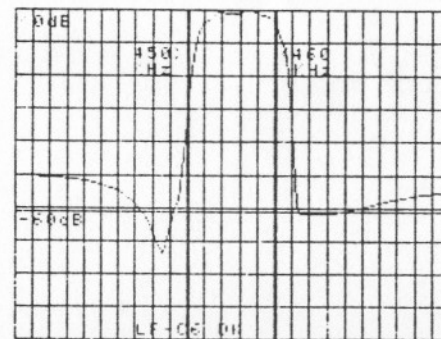
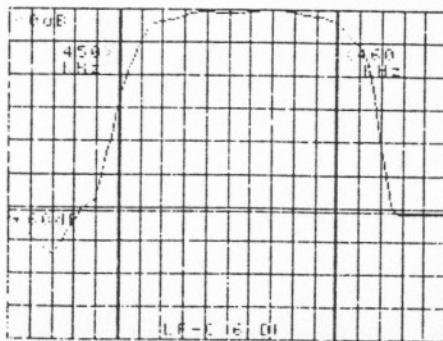
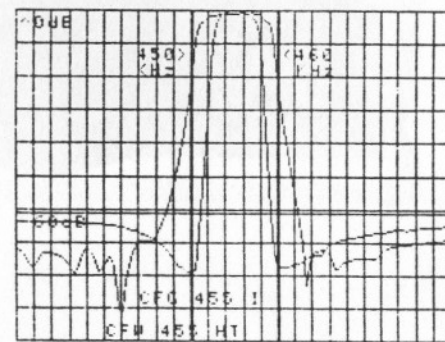
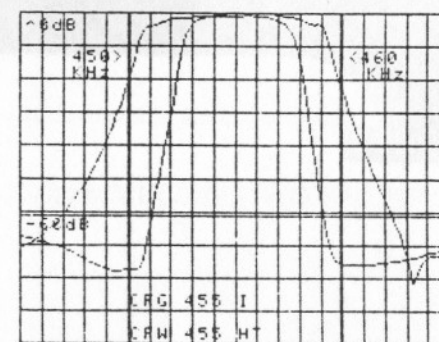
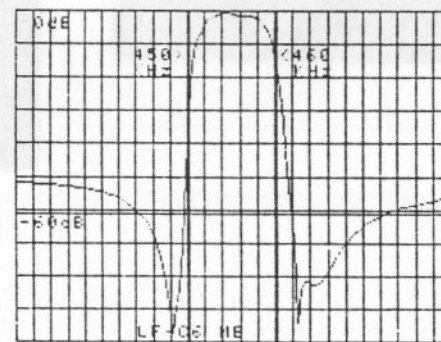
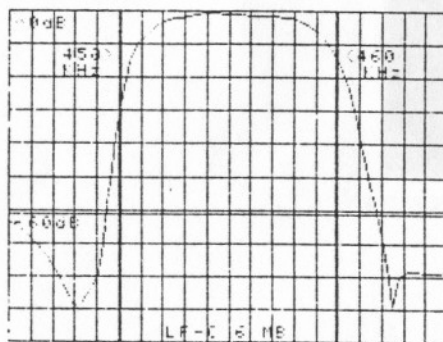
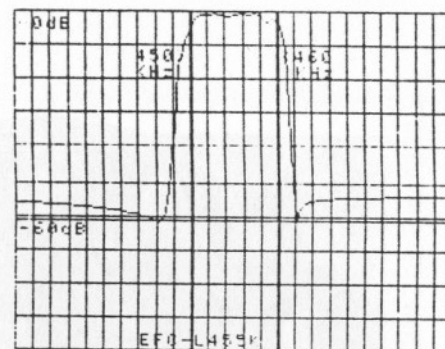
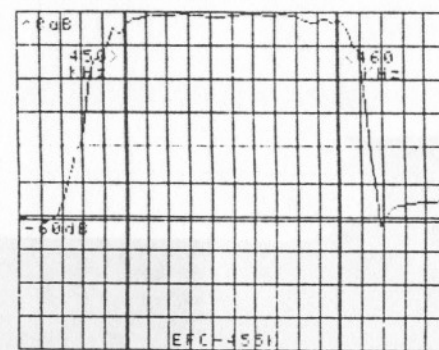
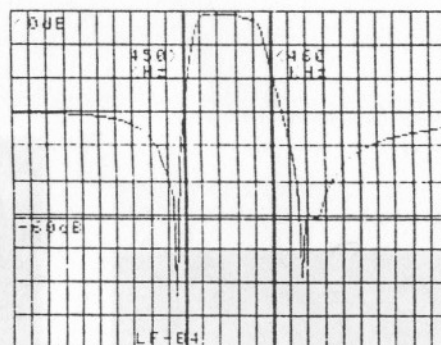
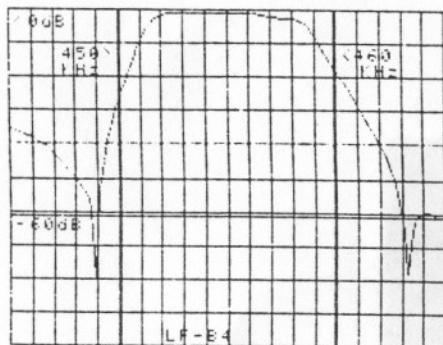
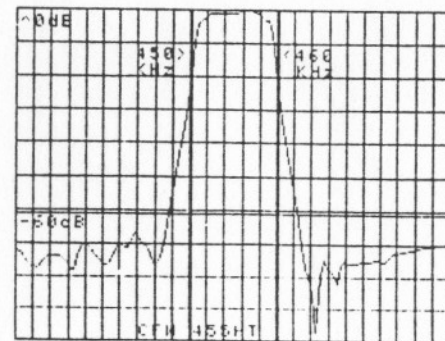
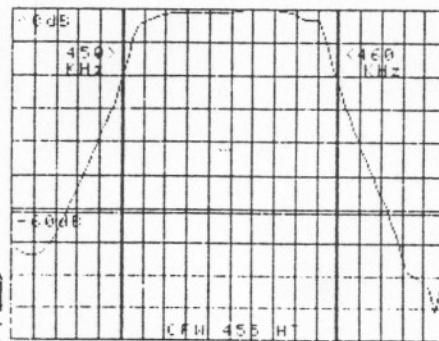
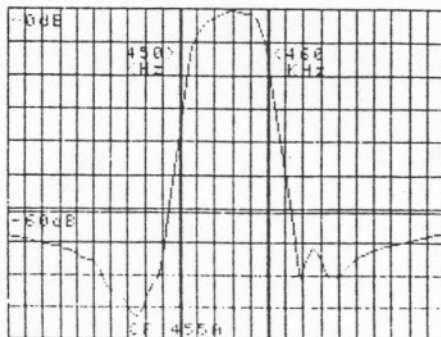
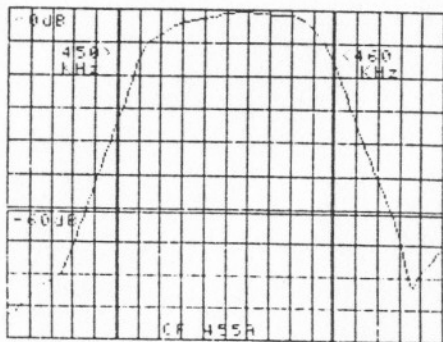
The first graph for each filter shows their response from 445KHz to 465KHz. The graph is divided horizontally in 1KHz divisions. The graph is divided vertically in 10 dB divisions. This gives a measurement range of 100 dB. Measurements are taken and plotted every .2KHz.

The second graph show the response from 430KHz to 480KHz. The graph is divided horizontally in 2KHz divisions. The graph is divided vertically in 10 dB divisions. Measurements are taken and plotted every .4KHz.

LP-C2A	NTK	This filter is part of a Gilfers mod for a Yaesu PR-7700. It was the narrowest filter tested. It may be a better choice for SSB than AM reception.
CFJ455K5	Murata	This is the narrow filter out of the ICOM R-70 and R-71A. It's a very good performer. It has an excellent shape factor. This allows it to have better audio response than the LP-C2A while it has the same ability to reject adjacent stations.
CPS455J	Murata	Gerry Thomas carries this filter. I can see why he likes it so much. It's wide enough for good audio response but is only 7.2KHz wide at -70dB. It had the best stopband. A good choice for over all performance.
CPG455I	?	This is the filter that Gerry Thomas used for his filter mod on the R-70. It not only is a very good performer, it is also very small. A good choice for portables.
VTD-5-1	Vernitron	I bought a number of these several years ago. It has good audio response and a good stopband but is huge compared with the CPG455I.
CPS455I	Murata	This is part of a Gilfers mod for a PR-7700. It has good audio response. The stopband may have been degraded because the filter came with extenders for mounting.
VTD-3-1	Vernitron	Gerry Thomas may still have some of these. I used this filter originally in my PRG-7. It's a fairly good performer.
LP-B 6A	Nippon	I bought this filter at MHz Electronics for \$2.90. It's the kind of filter that gives ceramic filters a bad name.
CP455A	Tokin	I also bought this filter at MHz. It cost \$5.00. At least it has a good stopband. It wouldn't be bad for casual listening.
LP-B4	Nippon	Another MHz \$2.90 wonder.
LP-C 6	NTK	The PRG-7 original filter. We have two examples here.
CPW455HT	Murata	Original wide filter for the ICOM R-70. Well it is wide. This filter does have a much better stopband than it's specs show.
EPC-L455K	Panasonic	I bought this filter for \$7.00 at MHz. Panasonic does make some very good filters such the EPC-L455K11AC or the EPC-L455K12AA. But I don't know who has them in small quantities.
G T Mod		These graphs show a before and after picture of the Gerry Thomas R-70 mod. The replacement filter, CPG455I, is much narrower. The original filter, CPW455HT, is much too wide for any DX purposes. I plan to make this mod when I buy a R-71A later this year.
CPG455I	Case not Grounded	I wanted to show the effects of not grounding the case. It worsens the stopband by about 20dB. Ground those cases!

T60-5-2





The graphs show that it is possible to get very good performance from ceramic filters. But it is also possible to get extremely poor performance. Some manufactures have supplied poor performing filters in otherwise good receivers. Cost is the most important factor in their choice of filters.

Your choice of filter depends on your use. For domestic stations I would look for a filter about 5KHz wide at -6dB and less than 10KHz wide at -60dB. These are measured specs from my tests not manufacture's specs. For foreign or split frequency stations these specifications should be narrower. The CPJ455K5 and CPS455J would be good choices. Narrower filters than these may require modifications to the audio section of the receiver. If your receiver has only one filter position your bet bet may be the CPG455I. This is the smallest quality filter I tested. It has good audio response and stopband, is narrow at -60dB, and is physically small.

If ceramic filters have a weakness it is in their stopband. The stopband on mechanical and crystal filters can be 20 to 30 dB lower. This advantage can be lost if the mechanical or crystal filters are not mounted using good engineering practices.

Most of the filters tested are available for under \$30 from the various suppliers. Spending a great deal more for mechanical filters or a filter mod may give you better selectivity but may also point out other problems in your receiver and put a big dent in your wallet. Refer to the different club publications for reviews of filter mods before spending any money.

Several questions remain unanswered concerning filter choice. How narrow is too narrow? Are there noticable benefits in a stopband below 60-70dB down? Are there problems with the sharp passband edges of mechanical filters? Do crystal filters have better strong signal handling capabilities? I plan to run some further tests to try and answer some of these questions.

I would like to thank Gerry Thomas, Dennis Kibbe, and Mike Barla for the use of their filters and their valuable comments in helping me prepare this article. I welcome any questions or comments concerning this article.

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Suppliers of Ceramic Filters

Filter Type

Cirkit Holdings PLC
Park Lane, Broxbourne,
Hertfordshire EN10 7NQ

CPS455J CPG455I
LP-B6A LP-B4
LP-C6 CPM455HT

Gilfers Shortwave
52 Park Ave.
Park Ridge, NJ 07656

LP-C2A CPS455I
LP-C6
Ceramic Filter Mod

Gerry Thomas
POB 2036
Pensacola, FL 32513

CPS455J CPG455I
VTD-3-1 CPM455J1 not tested
Ceramic Filter Mod

MHZ Electronics
3802 North 27th Ave.
Phoenix, AZ 85017

LP-B6 CP455A
LP-B4 CPM455HT
EPC-L455K

Radio West
3417 Purer Rd.
Escondido, CA 92027

Ceramic Filter Mod
Mechanical Filter Mod

Shortwave Horizons
6815 12 Ave.
Edmonton, AB T6K 3J6

Ceramic Filter Mod

Nancy Hardy
2301 Pacific Avenue
Aberdeen, WA 98520

WESTERN
DX ROUNDUP

All times are
Eastern Local

Phone for hot WDXR tips: (206)532-6827 till 10pm(PLT)

DEADLINES: Tuesdays

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FRG-7, Radio West loop
- (TRH) Tim Hall-350 G St. F-1-Chula Vista, CA 92010
ICF-2010, Radio West loop
(TRH-CA1) DX'ing from El Cajon, CA (15 mi. from home) w/Kenwood car rx
- (RHM) Roy H. Millar-13714 30th Ave. N.W.-Marysville, WA 98270
Airline 3980 w/Shotgun, Grundig 5077 w/SM-2
- (5P) Dale Toebe-2253 Kanealii Ave.-Honolulu, HI 96813
Sony ICF-6700W
(5P-HI1) DX'ing at Kailua Beach Park, Kailua, HI w/Sony ICF-6700W
- (bp) Bruce Fortzer-6546 19 Ave. NE-Seattle, WA 98115
HQ-180A, Racal RA-17, RCA R-8516, Radio West loop
(bp-WA1) DX'ing at O'Hare's CTG 10/19 w/Kenwood R-1000/SM-1
- (PT) Pete Taylor-2614 Jackson St.-San Francisco, CA 94115
- (RT) Rich Toebe-2388 American Ave.-Hayward, CA 94545
Grundig 3400, Radio West loop
- (RW) Robert Wien-1309 Dentwood Dr.-San Jose, CA 95118
GF Superadio, GE long-range portable, SM-2
- (ØW) John Wilkins-4385 Hoyt St. #205-Wheat Ridge, CO 80033
R-1000, 4' box loop

OF SPFCIAL INTERFST:

- 900 KSGA WA, Wenatchee 10/17 1017 call heard, but not much else thru difficult-to-null CJVI. Ex-KUEN. (RHM-WA)
- 1080 KWA1 HI, Honolulu 10/2 0703 back on air w/British-accented DJ "Prince of Wales," airing new wave/top 40 mx. Per later phone call, they returned 10/1 at 4:10pm local time (210EDT), after three months of being off due to vandalization & replacement of xmtr equip. They added a new slogan "Hitradio K-Wai." (5P-HI)
- 1210 KQTL AZ, Sahuarita new stn noted on the air 10/13 w/SS nx format. Good signal days, fair signal nights, easily nulled. Ment. that they will carry World Series in SS. Slogan is "Radio Que Tal." (AD-AZ)
+New stn is on. Heard w/fair signal MM 10/14 0250 w/SS program, Mexican mx, promo for School Lunch Week. EE ID by accented OM 0300. Slogan "Radio Que Tal" (Que tal? means "What's new?"), "La superpotencia Hispana con 10,000 w. sirviendo al sur de Arizona y al norte de Sonora," "Mas musica en su vida" (SS for MYL, maybe, hi.) New, AZ #43, stn #418. (TRH-CA)
+10/14 0324-0400+ good thru irritating "TT" on freq. (is KASY off freq?), o/u KRSV/KASY w/numerous IDs as "Radio Que Tal, legal ID on hour "This is KQTL, 1210, Sahuarita, Arizona," then back in SS. Not noted on 10/13, so probably 1st day of broadcast. Took me by surprise! Lively SS mx format. Sahuarita is a suburb of Tucson. 1210 is beginning to sound like 880, hi. (RW-CA)
- 1310 KDIA CA, Oakland 10/15 0900 stunned to hear these guys back on again! Just signed on for the first time, said that they were getting their act together but that things would sound better in the next few days, and vowed that "The Boss of the Bay is Back to Stay!" Too bad, there goes 1300-1320, hi. (RT-CA)
+Back on the air 10/15. 24 hours, same format "Urban Contemporary." (PT-CA)
- *****
540 KNAK UT, Delta 10/12 2100 s/off annct, annct'd 1kw. Poor in QRM. (ØW)
- 570 (KLAC) CA, Los Angeles off again MF 10/14 0604, TT's later. This SP seems to be getting regular. (TRH-CA)