A TELEVISION RECEIVER ESPECIALLY DESIGNED FOR CATV

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We welcome the opportunity to participate in a discussion of what we at RCA consider one of the key growth markets in our industry - a market in which we are deeply involved.

There is an accelerating expansion underway in operating cable television systems and we firmly believe there is a great potential in this market for color TV sets with built-in cable capability. This belief has been supported by our market studies and contacts with the MSO's. Your Companies have strongly encouraged the offering of this type of TV receiver.

Our Company, I am happy to say, is in step with the cable TV trend, and is responding to your requests, and the accompanying consumer demand for TV receivers specially designed to provide maximum enjoyment from Cable Television.

As you know the number of cable households in this country by the end of last year had risen to approximately seven million households - a very significant growth over the figure of just ten years ago.

In our efforts to intelligently examine the future of the cable TV market, we have participated in studies by the prestigious Stanford Research Institute and we expect to make continued use of their services to keep abreast of the anticipated growth rate of cable TV.

A Stanford Research Institute forecast indicates the number of cable TV households in the next five years will nearly double to approximately fourteen and a half million households - or about 21 percent of all TV households.

In other words, just five short years from now it is entirely possible that one in every five U.S. TV households will be linked to a cable system. And that will be the national average. In many areas, the percentage will probably be much higher.

It is pretty hard to ignore a market segment which may involve one-fifth of the total TV market in five years. My company has no intention of letting such a market go unsatisfied, but more about what steps we have taken in a moment.

There can be no denying that cable TV is growing fast. All of us here today know what has brought about that growth in the past - basically the desire on the part of the public for better TV reception.

In the future the motivating force will go beyond that to include the appeal of additional channels of entertainment and ultimately a broad range of consumer services.

The real key to the growth rate of cable TV in the months and years ahead will depend upon what happens in the top 100 markets. This is where the prime action is - involving by 1975 more than 85 percent of all the television households in the nation!

We are all well aware of the possible effects - I should say probable effects - of the FCC directive that any cable operator entering one of these key markets must provide a minimum of twenty channels for entertainment or other cable TV material and that all existing systems in these top 100 markets must comply similarly under the FCC timetable.

It seems natural that the cable system operator will move to use these extra channels. This will lead to further growth in the number of subscribers as the public realizes the added advantages of cable TV and the cable operator uses the extra programming as the incentive to increase his penetration.

With this growth new requirements will be placed on the TV set itself and will lead to new design considerations for TV receivers.

Now let me tell you a little about what my own firm has done in the area of cable television.

Two years ago, we introduced a 75-ohm connector which makes connection to a cable very easy in the home with no set adaptation required.

This was followed last year by the RCA CableGuard shielded Tuning system. Since May, 1972, all RCA 21-inch and 25-inch (diagonal) solid state XL-100 color TV sets have been equipped with this metal-encased VHF tuner, which was designed to help prevent local on-air broadcast signals from interferring with the cable TV picture. It also serves to block out interference caused by electrical appliances - both your own and your neighbor's.

This year we are introducing CableColor, a series of XL-100 solid state color TV receivers specially designed to take full advantage of cable TV's benefits. To help us determine the consumer attitude and interest in a special cable TV set, we conducted a market survey among subscribers and non-subscribers in New York City. Each respondent was given an explanation and demonstration of three sets, identical in appearance, with one set connected to the master antenna system, the second connected to cable through a converter, and the third set with built-in cable tuner, also, connected to the cable. Among the respondents who said they would buy a 23" screen size, or larger, set in the next 12 months, 71% or almost three quarters said they would pay a premium to get the new cable tuning feature, and 66% said they wanted both the built-in cable tuner and remote control. A strong indication that this is what the consumer wants - in lieu of a separate cable tuner. In planning for the growth of cable and its potential to provide new consumer services, we must ask ourselves will it be confusion coupled with inconvenience for the consumer? Or, will it be planned? Will the new requirements be incorporated and integrated into the present system for the consumer's convenience? We believe both the cable operator and the TV set manufacturer must approach the market with the consumer's viewpoint uppermost. And that CableColor is a major step in that direction.

We will cover the technical details of these advanced sets in the second portion of this presentation, but permit me to cover briefly the key features:

The new RCA ready-for-cable XL-100 color sets provide 24-channel VHF tuning directly through the set itself. There is no need for a black box or supplemental tuner on top the TV console.

There is complete antenna and cable compatibility. By means of a switch on the back of the set, the user can easily select the mode of reception, either cable or antenna. When set for "antenna mode" you can receive up to 12 VHF and 12 UHF channels with full parity. When the switch is changed to "cable mode" you can receive up to 24 cable channels. Think what this means! Now a family can buy a color set with the assurance that it's ready for the future. If their market has cable, they are ready immediately for single or dual cable use, and up to 24 channels. If their market does not have cable yet, they have a full featured RCA color set which is immediately ready when cable arrives. If they move - and one out of five American families do every year - their CableColor set is ready to adapt to their new locality, either cable or antenna.

If the cable channel frequency in your area should change, or you move to an area with different cable frequencies, you can, by a quick and simple adjustment of the controls located behind the door on the front of the set, change to the new frequencies.

Because all 24 channels are tuned through the TV set itself, there is no loss of the automatic fine tuning feature anywhere along the way. Every Channel can be fine tuned automatically.

By the same token all of the new RCA cable TV sets, except one manual version, are equipped with RCA's Signal Sensor remote control. With the wireless hand unit, you can electronically change all 24 channels, whether set for antenna or cable reception, adjust volume, and turn the set on or off. The increase in the number of channels available, will create more channel switching, and increase the consumer desire for remote control. We believe it will be a major subscriber benefit.

We have carried forward an active program with our distributors and through them with retailers to fully inform them of the cable television marketing opportunity. We have provided our distributors a complete program for their own use in preparing for the new market and spreading the word of cable TV.

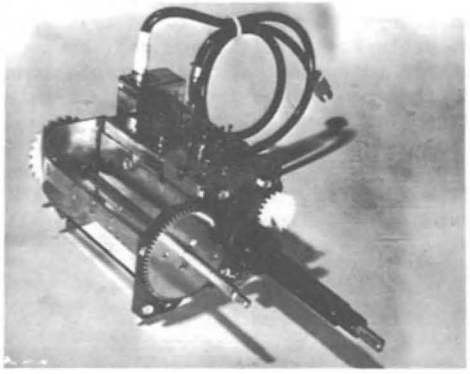
Most importantly from your viewpoint, we encourage them to meet and become involved with the management of cable systems in their area as soon and as extensively as possible. Training assistance is made available, including such things as a little fact book about cable television - and a handbook for the cable technician. (slides) We urge all cable TV system operators to seek out RCA's distributors in turn. The end result can be only to our mutual advantage.

Now, permit me to present the RCA series of cable television sets...five basic models in a variety of cabinet styles and finishes...all ready to maximize your enjoyment from cable television. The optional retail prices range from $675 to $795 and these sets will be available in RCA retail outlets starting in September.

RECEIVER DESCRIPTION

A 24 channel tuning system was chosen after weighing the following factors:

1. Results of market studies and MSO interviews.
2. Industrial design and circuit design considerations.
3. Wireless remote control capability.
4. Compatibility with broadcast and CATV systems.
5. Compatibility with single and dual cable systems.



KRK 211

FULLY SHIELDED VHF SWITCH TUNER (CHANNEL 2 THRU 13) WITH 24 POSITION DETENT MEANS

The three tuners incorporated are shown in the photographs. The KRK 211 is a completely shielded mechanically switched VHF tuner with means to convert from 13 to 24 detent positions. It is used in the broadcast and cable mode.

The KRK 194 is a UHF varactor tuner used in the broadcast mode.

The KRK 212 is a double conversion cable varactor tuner which tunes from channel 2 thru channel N. (54 to 246 MHz)

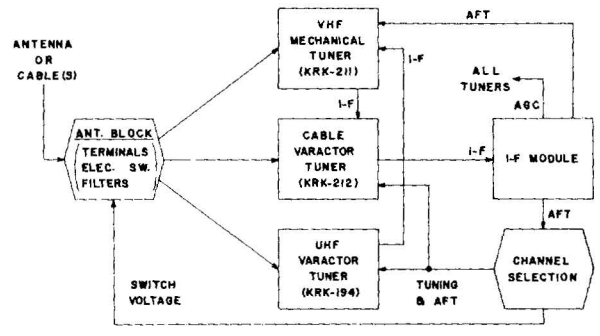
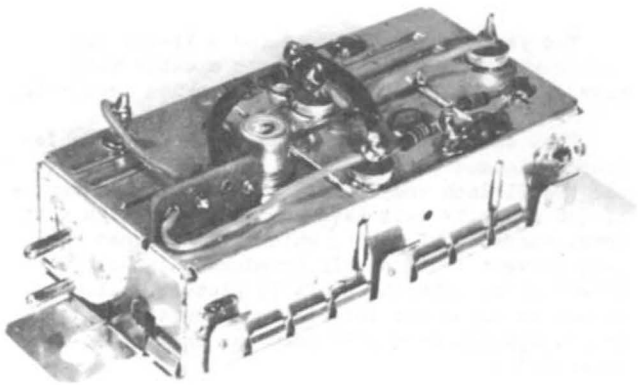
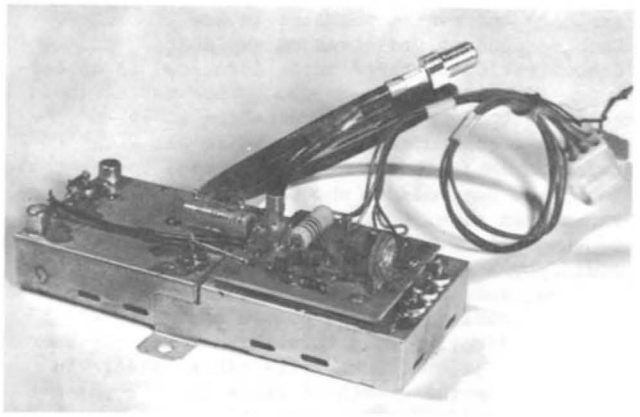


FIG. 1 ANTENNA & CABLE TV TUNING SYSTEM



KRK 194

UHF VARACTOR TUNER (CHANNEL 14 THRU 83)



KRK 212

CABLE VARACTOR TUNER (54 THRU 246 MHz)

Figure 1 is a functional block diagram of the overall tuning system consisting of the signal input circuitry which includes eletronic switching and filtering ahead of the two varactor tuners and one mechanical switch tuner. The KRK 211 tuner is similar in construction and circuitry to our 13 position shielded tuner used since 1972 in our XL100 21" and 25" models. The shielding effectively eliminates co-channel interference in areas such as Manhattan where conventional tuners are hopelessly overloaded by the strong ambient co-channel fields of the 7 local stations. A novel gearing means is used to make possible 24 position signal knob channel selection in the cable or antenna mode. As the detent shaft is rotated from 2 thru 13, these channels are selected in the conventional manner. Then as the shaft is turned past 2 or 13, the KRK 211 internal switches remain fixed and 12 adjustable voltages are selected in turn to supply tuning voltages to one of the 2 varactor tuners. The mode of operation, cable or antenna,

is selected by means of a slide switch located on the terminal block at the back of the receiver.

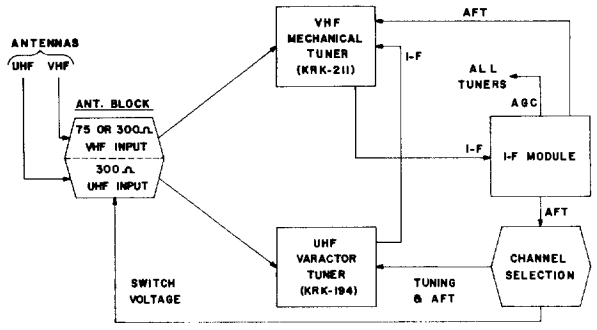


FIG. 2 ANTENNA MODE

Figure 2 is a functional block diagram of the tuning system in the antenna mode. Full parity between VHF and UHF is achieved for manual or remote control operation by the use of the KRK 194 varactor UHF tuner. Inserts are provided so that the correct channel number can be indicated.

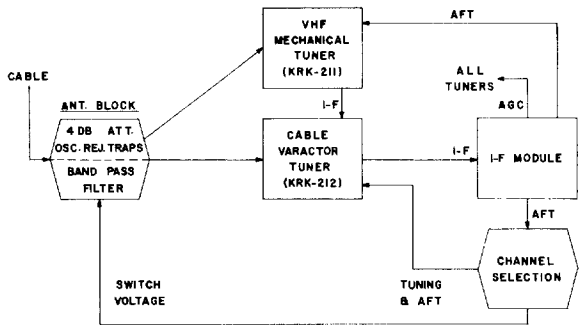


FIG. 3 SINGLE CABLE MODE

Figure 3 is a functional block diagram of the tuning system in the signal broadband cable mode. Circuitry in front of the tuners is used to protect the cable system from local oscillator leakage, assure adequate termination of the cable system and reduce intermodulation distortion products in the cable varactor tuner when tuned to the mid or super channels. The combination of this filtering with the circuitry and shielding designed into the KRK 211 tuner reduces the local oscillator leadage to a negligable level. The KRK 212 varactor tuner is energized in the same manner as the UHF varactor tuner in the previous example.

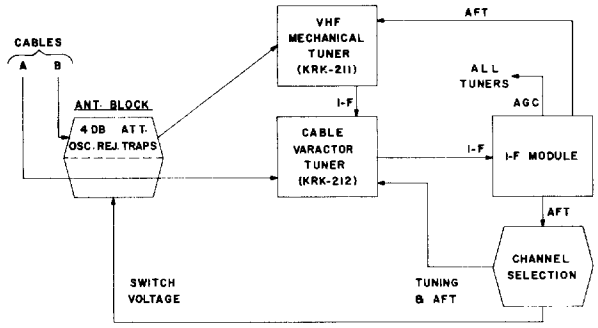


FIG. 4 DUAL CABLE MODE

Figure 4 is a functional block diagram of the tuning system in the dual cable (A/B) mode for systems where each cable supplies up to 12 channels on the FCC assigned broadcast frequencies. In the diagram cable B is fed through the built in attenuator to the mechanical VHF tuner. Cable A is fed directly to the cable varactor tuner which receives its tuning voltage from one of the 12 adjustable switched sources as in previous examples. In this mode no A/B switch is required and if the set is so equipped full remote control of all 24 channels is available.

PERFORMANCE CHARACTERISTICS

Since the broadcast performance of this special receiver is the same as other XL100 solid state color receivers in our line, we will address ourselves here to the characteristcs of concern to the cable operator and cable viewer. Of the TV receiver characteristics most often mentioned by cable interests, the following five are generally considered the most critical.

1. Immunity to direct pickup of off the air co-channel interference.
2. Local oscillator leakage into the cable system.
3. Image rejection.
4. Adjacent channel rejection.
5. Noise figure.

Sample No.	Equivalent Input* Channel 3	Equivalent Input* Channel 12
1	-40.9 DBMV	-40.9
2	-37.7	-33.2
3	-32.4	-38.4
4	-36.5	-32.8
5	-46.0	-40.4
6	-37.1	-38.1
7	-30.0	-46.0
8	-35.4	-37.1
9	-48.0	-35.4
10	-36.2	-37.1

* Equivalent Input Signal DBMV (75 ohm)

FIGURE 5

Figure 5 shows the equivalent input signal across 75 ohms expressed in DBMV induced by a 0.5 volt/meter field into 10 mass produced tuners as used in this receiver. The results of extensive field measurements by RCA and others show that it is extremely rare to find signal levels at receiving locations which equal or exceed 0.5 volts/meter. Also it has been demonstrated that with coherent signals a 40 DB desired to undesired ratio will not result in perceivable interference with normal picture content.

Our field tests show that with the order of immunity shown in Figure 5 there will be no complaints of co-channel interference where the leakage is not directly into the cable system itself.

LOCAL OSCILLATOR LEAKAGE

Channel	Channel Affected	Level In MicroVolts
2 (101MHz)	FM	Less than 10
3 (107MHz)	FM	" " "
4 (113MHz)	--	
5 (123MHz)	A	Less than 10
6 (129MHz)	B	" " "
7 (221MHz)	J	Less than 20
8 (227MHz)	K	" " "
9 (233MHz)	L	" " "
10 (239MHz)	M	" " "
11 (245MHz)	N	" " "
12 (251MHz)	O	" " "
13 (257MHz)	P	" " "

FIGURE 6

Figure 6 shows the local oscillator frequencies, the channel with which it could interfere and the typical level into a 75 ohm load. As can be seen, it is 14 DB below the maximum value of 100 uv usually suggested as a limit.

IMAGE RELATIONSHIPS AMONG CHANNELS

Channel	Freq. Band	Image Channel	Rej.
2	54 - 60 MHz	E	70-DB
3	60 - 66	F	82-DB
4	66 - 72	G	86-DB
5	76 - 82	I	87-DB
6	82 - 88	7	85
A	120 - 126	13	65-DB Min
B	126 - 132	J	"
C	132 - 138	K	"
D	138 - 144	L	"
E	144 - 150	M	"
F	150 - 156	N	"
G	156 - 162	O	"
H	162 - 168	P	"
I	168 - 174	Q	"

FIGURE 7

Figure 7 shows the image relationships among the channels and the desired signal to undesired signal ratio for equal input signals that are typical for this receiver.

The adjacent channel performance is a function of the IF selectivity except in the case of channels 5 and 6 where mixer beats are troublesome. The adjacent channel pix and sound carriers are greater than 60 DB down in the IF passband and improved mixer performance as related to mixer beats has been incorporated to reduce the most troublesome beat (channel 6 pix in channel 5) to an acceptable level. In a critical subjective test it was determined that with channels 7 and 9 10 DB above channel 8 no adjacent channel interference was perceivable on channel 8 even with the channel 8 pix carrier shifted ± 50 KHz.

NOISE FIGURE

ANTENNA MODE	NOISE FIGURE
CHANNEL 2 THRU 13	4 to 6 DB
CHANNEL 14 THRU 83	9 to 12 DB
CABLE MODE	
CHANNEL 2 THRU N (54 to 246 MHz)	9 to 14 DB

FIGURE 8

There may be a question as to why the noise figure in the antenna mode on channel 2 thru 13 is better than the same channels in the cable mode. Since the input VSWR becomes very high off channel when input selectivity ahead of the RF amplifier is used, we have found it necessary to switch in a pad ahead of the KRK 211 in the cable mode. The KRK 212 cable converter noise

figure is typical of most dual conversion tuners with a balanced mixer.

To sum up, we are confident that this first introduction of a special cable/broadcast TV receiver will more than fill the requirements for reception on almost all of current and proposed CATV systems. We encourage you to look at one of these receivers on your systems when the receivers become available in the third quarter of 1973.

I would like to acknowledge the contributions of Messrs. D. J. Carlson, G. W. Carter, J. B. George, W. Howell and A. J. Schick, and others, who contributed to the design of this cable receiver.