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CROWN FM
TWO TUNER**Manufacturer's Specifications****Usable Sensitivity:** Mono, 9.31 dBf.**Fifty-dB Quieting Sensitivity:** Mono, 11.2 dBf; stereo, 36.0 dBf.**S/N:** Mono, 80 dB; stereo, 75 dB.**Hum and Noise:** 75 dB.**THD at 1 kHz:** Mono, 0.05%; stereo, 0.05%.**Capture Ratio:** 1.5 dB.**Selectivity:** 75 dB.**Frequency Response:** 30 Hz to 15 kHz, ± 0.5 dB.**Image, I.f. and Spurious Response****Rejection:** Greater than 114 dB.**AM Suppression:** 80 dB.**R.f. Intermodulation:** 65 dB.**SCA and Subcarrier Product Rejection:** 70 dB.**Stereo Separation:** 60 dB at 1 kHz, 45 dB at 10 kHz.**Power Requirements:** 120 V, 50/60 Hz, 10 watts.**Dimensions:** 19 in. (48.26 cm) W x 1 $\frac{1}{4}$ in. (4.44 cm) H x 11 $\frac{3}{4}$ in. (29.84 cm) D.**Weight:** 9 $\frac{1}{2}$ lbs. (4.27 kg).**Price:** \$699.00.

Crown International audio equipment has always impressed me as having a professional air while retaining a highly practical and intelligent layout which will not intimidate the less technically oriented music lover who simply wants to assemble a superb home sound system. Crown's new FM Two tuner maintains this tradition. Having learned a

bit about its design and circuit innovations, I am impressed with the reasonableness of its suggested price and its outstanding performance. The performance, by the way, stands out not so much in typical use under optimum r.f. signal input conditions, but in situations where incoming signals are less than ideal.

It's almost as though this tuner is able to eliminate some of the undesired and undefined forms of distortion which elude measurement.

The slim-looking tuner is rack-mountable but is less than two inches high. Control layout, beginning at the left, includes a power switch and associated LED indicator, push-buttons for 75/25 microsecond de-emphasis selection, stereo noise filter activation, fixed level interstation muting, and selection of stereo/mono and dim/bright display. The display area at the center of the panel not only incorporates a digital frequency readout but also includes a five-segment signal-strength display and a stereo indicator light. When turning on the unit, the last station tuned prior to shutting off power will appear on the display. While U.S. versions of the FM Two tune in increments of 200 kHz, it is able, with minor modifications, to tune and display increments of 50 kHz to accommodate European FM radio practice.

To the right of the display are additional buttons, including a Scan Lock button which provides either push-by-push and rapid up/down frequency selection or automatic scanning action. In the latter case (with this button depressed), touching the nearby up or down buttons causes the unit to scan and sample each station strong enough to defeat the internal muting threshold point. When a desired program is encountered, the button is released by the user and the scanning ceases. To the right of the up/down buttons are a memory program switch which functions in conjunction with the six preset buttons nearby that store favorite station frequencies for instant recall. When the memory switch is depressed, the user has approximately five seconds to "enter" a desired station frequency into one of the six available memory slots. When a frequency is recalled using the preset buttons, a green indicator light above the button illuminates. Memories are retained indefinitely so long as the power cord is plugged into a source of power; in the event of a power failure or inadvertent disconnection of the tuner from an active a.c. outlet, memories will be retained for five days.

The rear panel of the FM Two is equipped with separate left- and-right-channel output level controls, associated output jacks, and a 75-ohm coaxial antenna terminal. If the user insists upon using 300-ohm (twin-lead) transmission line from antenna to tuner, a separate balun transformer (supplied as an accessory with the tuner) would have to be employed.

Circuit Highlights

The FM Two is a crystal controlled *dual conversion* tuner featuring a pulse-count digital detector circuit which eliminates detector alignment problems. Overmodulation, often a problem with ratio detectors or discriminators (and frequently encountered in FM broadcasting these days), is easily accommodated by this type of detection circuitry. The new cascode J-FET front-end design contains no fewer than seven tuned circuits and is highly immune to r.f. intermodulation without sacrificing basic r.f. sensitivity. Constant group-delay (linear phase) ceramic filters are used in the i.f. section, and the first i.f. stage has been designed to improve selectivity by avoiding premature limiting.

Measurements

The graphs of Fig. 1 show the mono and stereo quieting and 1-kHz harmonic distortion characteristics of this tuner.

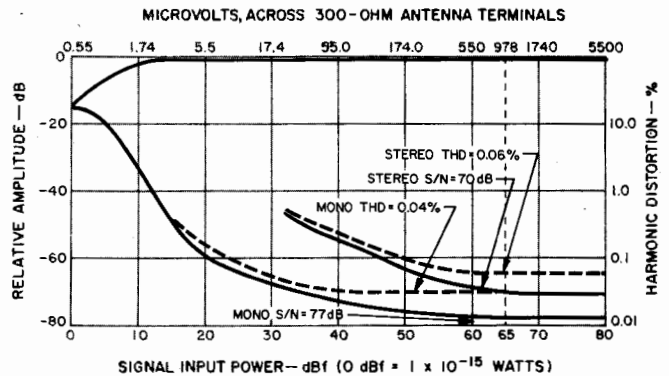


Fig. 1—Mono and stereo quieting and distortion characteristics, FM section, Crown FM Two tuner.

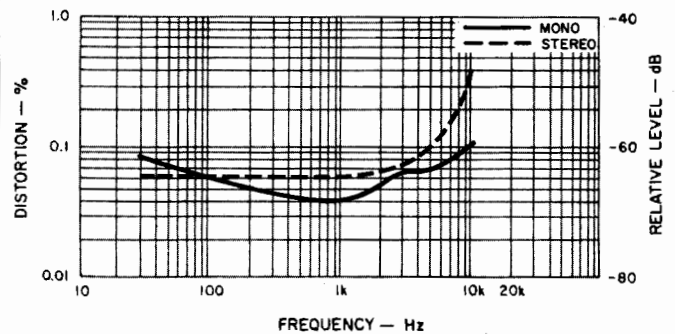


Fig. 2—Distortion vs. frequency, Crown FM Two tuner.

Usable sensitivity in mono measured just under 10 dBf (0.9 μ V, referred to 75-ohm input impedance), while 50-dB quieting for mono was a very low 11.2 dBf, exactly as claimed by Crown. In stereo, usable sensitivity was limited not by the r.f. circuitry but by the factory-set mono/stereo switching arrangement, which does not swing over to stereo until signal strength is around 30 dBf. By the time that switching does occur, signal-to-noise is almost 50 dB, so I would have preferred the tuner to have "allowed" stereophonic listening even if the signal were a bit weaker—especially since there is the option of activating the stereo noise filter.

S/N ratio for mono at 65 dBf was 77 dB, while for stereo, at the same strong signal level, it measured 70 dB. Mono THD, for a 1-kHz signal, measured only 0.04%; even more amazingly, in stereo the THD reading was only a slightly higher 0.06%. Harmonic distortion at other test frequencies are shown for both mono and stereo operation in Fig. 2.

I couldn't quite equal the 60 dB of stereo FM separation claimed for the FM Two, but that may well have been due to

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The FM Two's performance stands out not so much in typical use but in situations where incoming signals are less than ideal.

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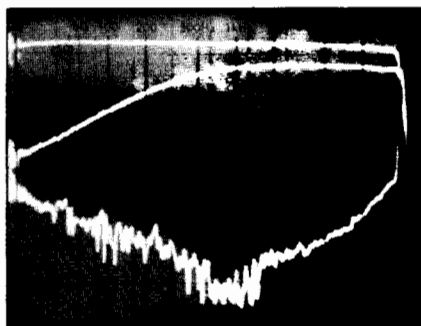


Fig. 3—Upper trace, frequency response (20 Hz to 20 kHz); middle trace, separation with the

noise filter activated; bottom trace, separation without the use of the noise filter.

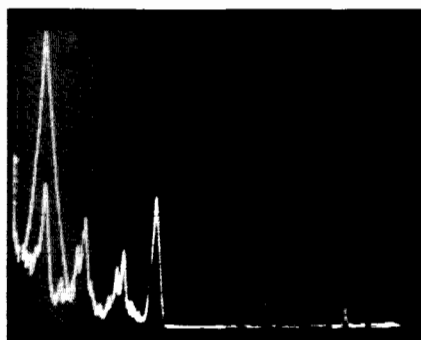


Fig. 4—Crosstalk characteristics.

the limitations of my FM signal generator. As things were, I measured 56 dB of separation at 1 kHz and 42 dB at 10 kHz. Frequency response is shown in the upper trace of Fig. 3 (from 20 Hz to 20 kHz sweep), while the lower trace shows separation without the noise filter used, and the middle trace shows what happens to separation when the noise filter is activated. Loss of separation is rather extreme under such circumstances, decreasing to less than 10 dB over much of the audio band. During the listening tests, however, I rarely found use of this filter advantageous since any signal received in stereo was strong enough to push the background noise down to tolerable levels.

Using a 5-kHz modulating signal, I measured the crosstalk and harmonic distortion components that show up in the unmodulated channel's output; these results are depicted in Fig. 4.

Capture ratio measured 1.2 dB as opposed to 1.5 dB claimed, selectivity measured 80 dB against 75 dB claimed, and r.f. IM was down nearly 75 dB as against 65 dB claimed. I.f., image, and spurious rejection were all too low for the test equipment to verify (in excess of 100 dB

down). Frequency response was within 0.3 dB of flat from 30 Hz to 15 kHz. AM suppression was excellent, which accounts in part for this tuner's resistance to the multipath effects I often encounter when tuning to some stations in my location (some 20 miles from mid-Manhattan).

Use and Listening Tests

There is a kind of transparency to the sound reproduced by the Crown FM Two. It's almost as though this tuner is able to eliminate some of the undesired and undefined forms of distortion which elude test bench measurements but which we all know exist in the "real world" of FM—away from the test bench. I've been informed that the independent consultant Crown used in the initial design of this fine tuner: was none other than Larry Schotz, formerly of Draco Labs. Anyone who remembers the very first frequency synthesized tuner which was designed by Mr. Schotz a few years ago (and which was about three years ahead of its time) will realize that the Crown FM Two is not just another tuner: It's a superior product in just about every way. Crown is to be commended not only for asking this fine engineer to work with them in its design and production, but for letting him incorporate the circuitry in what is, after all, not all that costly a tuner by today's standards. *Leonard Feldman*

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