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## **LSI counter simplifies display for a-m/fm radio**

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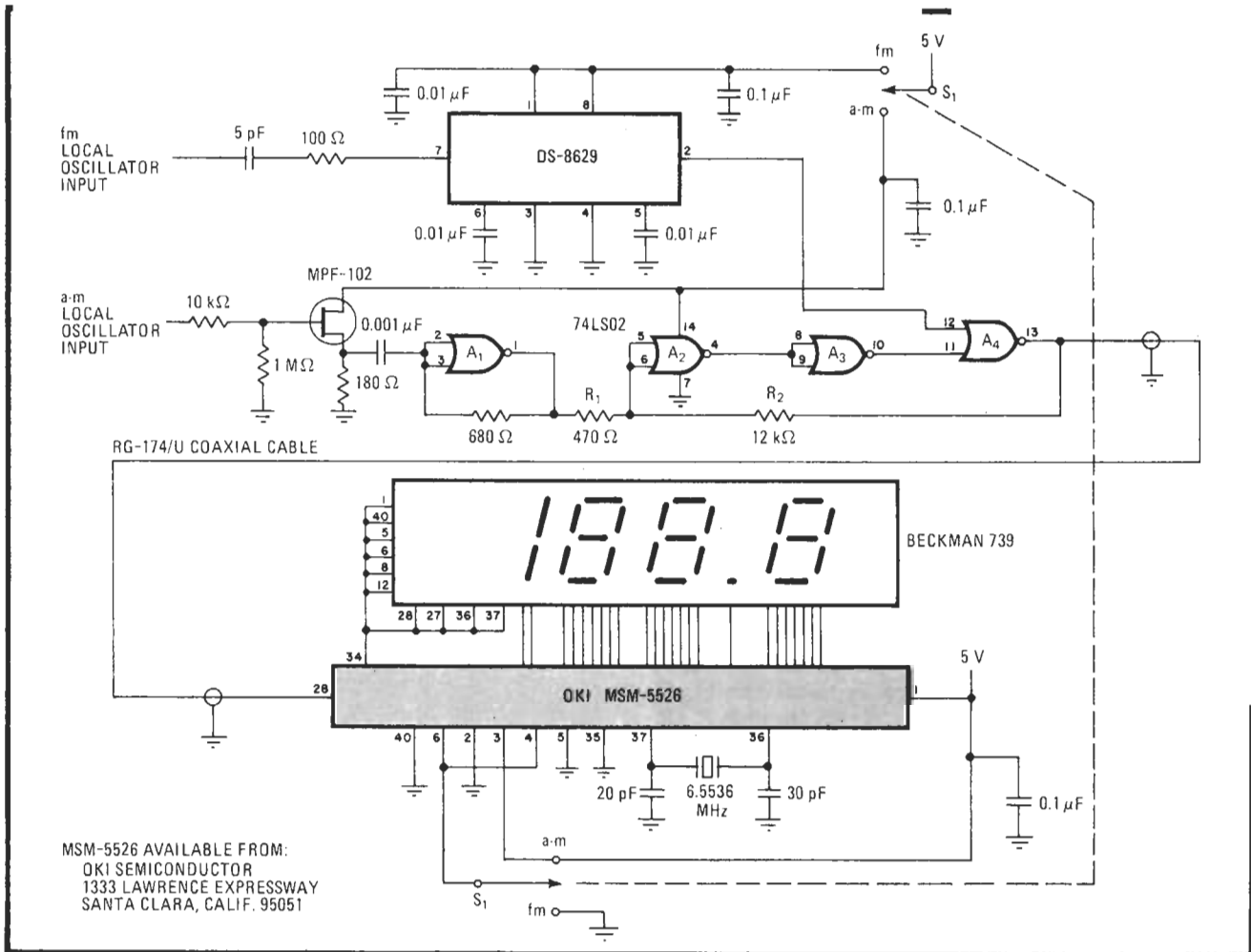
*Beckman Instruments Inc., Fullerton, Calif.*

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The design of a display providing a direct readout of any frequency tuned by an a-m/fm radio is made simple with

this circuit, which uses a large-scale integrated counter-driver to determine the frequency of the receiver's local oscillator. The counter is unique in that it contains circuitry that subtracts the receiver's intermediate frequency from the local oscillator frequency in order that the true channel frequency may be found. The combination of this counter, a one-chip prescaler, and a 3½-digit liquid-crystal display makes for a compact and relatively low-cost unit.

The circuit is housed in two separate modules, one containing the preamplifier, prescaler, and logic, and the



**i-f compensation.** MSI and LSI chips reduce cost and complexity of display for a-m/fm radio. MSM-5526 counter has circuitry for subtracting receiver's i-f frequency (see table) from radio's local oscillator input so that the true channel frequency may be displayed.

other the counter and LCD components. In this way, the first module can be mounted on the receiver's radio frequency assembly (keeping unwanted pickup to a minimum), and the other may be placed at any convenient spot for viewing.

In the a-m mode, signals are applied to the MPF-102 field-effect transistor. The input impedance of this stage is high, and consequently loading of the local oscillator is minimal. A<sub>1</sub> operates in its linear region and thus serves to amplify the local oscillator signal.

Schmitt trigger A<sub>2</sub>-A<sub>4</sub> squares up the signal to transistor-transistor-logic levels, then applies it to the MSM-5526 counter. R<sub>1</sub> and R<sub>2</sub> set the hysteresis of the trigger.

The MSM-5526 contains a read-only memory that may be programmed with any i-f value (see table). Also contained is the subtraction circuitry discussed previously, and the necessary decoders/drivers for presenting the 3½-digit Beckman LCD with the difference frequency in kilohertz. Generally, the local oscillator will always lie above the incoming frequency in the modern a-m receiver, as reflected in the table. The same condition holds true most of the time in fm receivers, but there is a provision for achieving a positive offset if one of the older receivers is being used. Note that if all programmable pins are set at logic 0, an i-f of 455 kHz for a-m

MSM-5526 INTERMEDIATE FREQUENCY OFFSET					
Display mode	Input-pin state				Offset (a-m in kHz, fm in MHz)
	2	3	4	5	
a-m (pin 6 high)	H	H	H	X	-452.5
	L	H	H	X	-454.5
	H	L	H	X	-456.5
	L	L	H	X	-465.5
	H	H	L	X	-467.5
	L	H	L	X	-469.5
fm (pin 6 low)	H	H	H	H	10.68
	L	H	H	H	10.71
	H	L	H	H	10.75
	L	L	H	H	10.79
	H	H	L	H	10.82
	L	H	L	H	-10.58
	H	L	L	H	-10.60
	L	L	L	H	-10.61
	H	H	H	L	-10.62
	L	H	H	L	-10.63
	H	L	H	L	-10.65
	L	L	H	L	-10.66
	H	H	L	L	-10.69
	L	H	L	L	-10.70
H	L	L	L	-10.72	
L	L	L	L	-10.73	