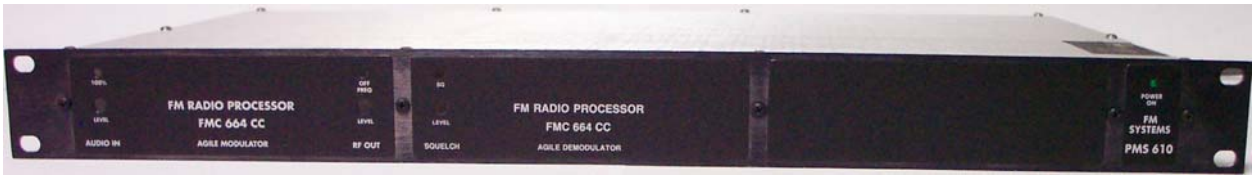
FMC664CC



FM BAND CONVERTER

INSTRUCTION BOOK
IB6225/6226-01

FM SYSTEMS, INC.
TEL:800-235-6960

FMC664CC
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1.0 GENERAL DESCRIPTION

1.1.0 The FMC664CC is a channel-for-channel FM-band converter with tunable input and output frequencies in the 88-108 MHz band. Offset output frequency capability in the A-1 and A-2 band (108-120 MHz) is available upon special request. Both the input and output frequencies are set with DIP switches which may be re-set in the field as needed.

1.2.0 Since the input and output power levels can differ greatly, the FMC664CC is composed of two separate modules that are housed in their own mainframes. Up to three FMC664CR receivers can fit in one PMS610 mainframe and up to three FMC664CT transmitters can fit in another PMS610 mainframe. Thus two mainframes will hold three FMC664CC converters, with one converter consisting of one FMC664CR receiver and one FMC664CT transmitter. The two boards are connected by an audio patch cable. Each mainframe is 1.75" high, so one group of three converters occupies 3.5" of vertical rack space.

1.3.0 The advantage obtained by demodulating to base-band, rather than the more conventional I.F. conversion is that undesired adjacent channels can easily be filtered out and will not be transmitted into the cable system, even when the adjacent channel is much stronger than the desired channel.

2.0 SPECIFICATIONS

2.1 INPUT (FMC664CR)

FREQUENCY BAND	88.1-107.9 MHz
CHANNEL BANDWIDTH	280 KHz
FREQUENCY STEPS	100 KH
RF LEVEL	-20 TO +20 dBmv
DEVIATION	+/- 75 KHz
MODULATION	STEREO MULTIPLEX

2.2 OUTPUT (FMC664CT)

FREQUENCY BAND	88.1-107.9 MHz
OUTPUT BANDWIDTH	80 KHz (AUDIO)
FREQUENCY STEPS	100 KHz
RF LEVEL	+10 TO +45 dBmv
DEVIATION	+/- 75 KHz
MODULATION	STEREO MULTIPLEX

3.0 FUNCTIONAL DESCRIPTION

3.1.0 The FMC664CC consists of two circuit boards. The FMC664CR receiver board that selects and demodulates the FM channel to be received, and the FMC664CT transmitter that re-modulates that signal into the FM broadcast band.

3.2.0 The FMC664CR receiver card consists of an RF pre-selector/local oscillator/mixer section, a phase-lock-loop L.O. frequency control section, an FM demodulator, a squelch control, a low-pass filter, and an on-board DC regulator.

3.2.1 The pre-selector/local oscillator/mixer consists of U2 and associated circuitry. The input signal is pre- selected by a varactor-tuned circuit with the frequency being under control of the DIP switches that operate the phase-lock-loop (PLL) system U10.

3.2.2 The local oscillator (L.O.) frequency is also set by the same DIP switches and PLL so that the pre-selection and conversion oscillator track to produce a constant 10.7 MHz I.F. frequency. A divide-by-ten circuit (U9) reduces the L.O. frequency to a frequency band that the PLL can receive.

3.2.3 The I.F. pass-band filter selects the desired channel while suppressing all other channel. This filter is 280 KHz wide at 10.7 MHz.

3.2.4 The demodulator (U3) converts the frequency modulated signal to a multiplexed stereo base-band signal consisting of the L + R channel occupying the first 15 KHz, a 19 KHz pilot channel, and a double-sideband-suppressed-carrier (DSBSC) L-R channel occupying the 23-53 KHz band.

3.2.5 An active filter (U4) removes noise components above 53KHz and is in turn wired to the output connector. Note that the stereo signal is demodulated to composite base-band, but not decoded to left and right channels, therefore the base-band audio output occupies 75 KHz instead of 15 KHz. Note that by passing 75 KHz, the converter will transmit the 67 KHz SCA that may reside on a stereo FM channel.

3.2.6 The PLL (U10) controls the receiver frequency by phase locking the L.O. to a quartz crystal. The common comparison frequency is 10 MHz, with the 10.24 MHz crystal being divided by 1024 in the PLL and the L.O. being divided to 10 KHz by selectable down-counters that are under control of the DIP switches. Tables in section 6 show the DIP switch positions for each receivable channel.

3.2.7 An on-board DC regulator (U1) assures stable operation of each channel card.

3.3.0 The FMC664CT transmitter card consists of a voltage-controlled oscillator (VCO) PLL frequency control system, RF buffer stage, an RF output stage, and an on-board regulator.

3.3.1 The voltage-controlled oscillator consist of Q1 and associated components. The frequency modulation is exerted by varicap D2 and the PLL frequency control is exerted through varicap D1.

3.3.2 The PLL frequency control system consists of U4 and associated components. The divide-by-ten, U3 circuit reduces the RF output frequency to the operating range of U4. The reference crystal, Y1 combined with the down-counter DIP switch settings determine the operating frequency of the transmitter. Tables in section 6 indicate the correct switch setting for each FM channel.

3.3.3 The RF buffer stage, Q2 isolates the VCO from the output stage.

3.3.4 The RF output stage, Q3, adjusts the RF power output by varying a gate voltage from the front panel. The output circuit is a directional coupler that permits several transmitters to be tandem connected without creating a mutual overload reducing third order products. Since the output is loop-connected, both output terminals must be used. The OUTPUT connector must lead toward the cable combiner and the INPUT connector must either have a 75 Ohm termination or be connected to the OUTPUT of another FMC664CT. The originating end of any chain of FMC664CT must always have a termination.

3.3.5 The on-board DC regulator insures that there will not be inter-action between the boards in any PMS610 mainframe.

4.0 INSTALLATION AND OPERATING INSTRUCTIONS

4.1.0 Installation. Remove receivers and transmitters from the shipping containers and examine for visible shipping damage. Contact shipper if damage is evident.

4.1.1 Fasten FMC664CT transmitter into the desired location in the rack. Place the FMC664CR directly below the transmitter that they are to be associated with, so that the short connecting cables that comes with each channel will Reach between the receivers and transmitters. Connect the RCA type patch cords from the FMC664CR OUTPUT to the FMC664CT INPUT. Connect all power cords to a 115VAC power source.

4.1.2 Connect the FM receiving antenna to the RF INPUT of the FMC664CR. If more than one FMC664CC is to be connected to the FM antenna, provide splitters with enough outputs so that each FMC664CC has its own tap. Insure that a signal level of at least 0 dBmv is available to each converter. A lower signal level than this will result in less than professional signal-to-noise ratio.

The taps can be arranged so that the stronger signals traverse the largest number of signal splitters, while the weakest signal to be received traverses only one signal splitter. A properly organized signal splitter "tree" will result in roughly similar signal power being delivered to each channel converter. If there are a large number of channels, or the FM signals are weak, either increase the size of the receiving antenna or provide an FM band Broad-band amplifier to bring up the signal level./ Insure that any amplifier provided for this purpose does not overload on high level local signals.

4.1.2 (cont.)

Such high level signals may be trapped down at the input of the amplifier to prevent overload on the strong channel while still providing sufficient gain for the weak channels.

4.1.3 Combine the output of the FMC664CT transmitters by "chaining" the three transmitters in a panel. The RF INPUT of the left-hand module (as seen from the back) must have a 75 Ohm termination. The RF OUTPUT of the left-hand module connects to the RF INPUT of the center module. The RF OUTPUT of the center module connects to the RF INPUT of the right-hand module. The RF OUTPUT of the right-hand transmitter module then connect to the head-end combiner, either directly or through a pre-combiner that connect all transmitters into a group.

4.1.4 Adjust the RF OUTPUT of each FMC664CT to the desired level on the cable system. This level is usually 10 to 15 dB below the level of the TV video carriers. The highest level, consistent with the system, line amplifier loading plan, should be used to deliver noise-free FM to the most distant subscribers on the system. If possible, operate -10 to -13 rather than -15dB to provide better FM service.

4.2.0 Operating Instructions. No special operating procedures are required other than to observe system levels occasionally at the same time that TV carrier levels are measured. Noise on a channel can be caused by either a low output level, causing the signal to be weak to the subscriber, or a low input signal due to insufficient receiving signal strength. Check the antenna, pre-amplifier (if any) and connections between the antenna and the input to the converter. The signal strength should be 0-dBmv or better. If it s -20 dBmv of lower, the channel signal-to-noise ratio will be significantly impaired.

5.1.0 Maintenance. No routine maintenance is required. If a unit fails in service, and it is determined that it is not caused by squelch setting signal failure or cable and connector defects, the unit should be returned to the factory for service. Since all units may be tuned to any channel, try tuning another unit to the failed channel to verify source of trouble.

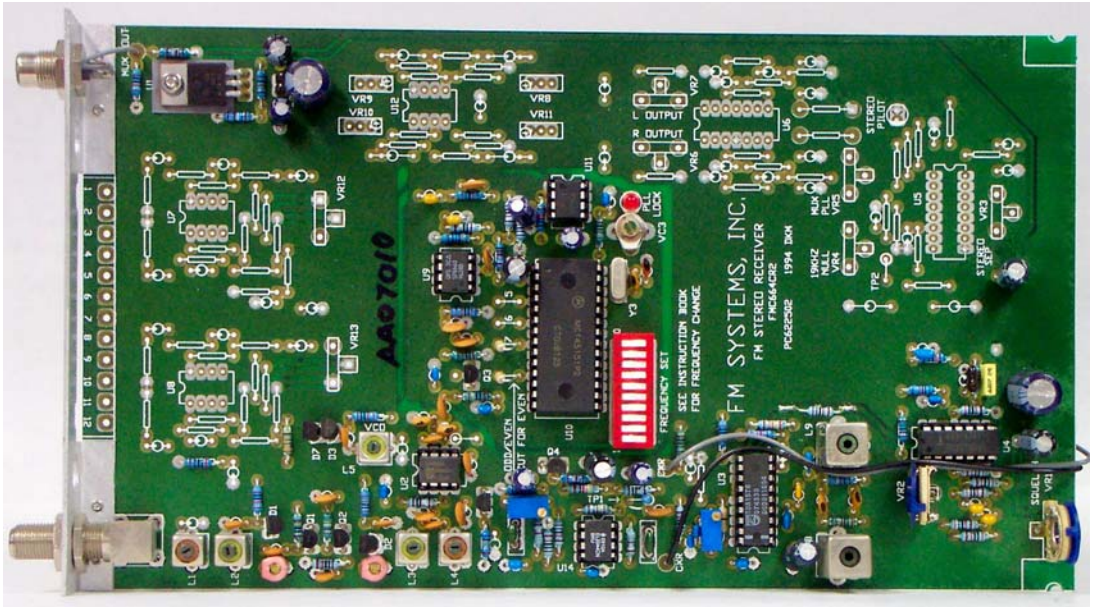
6.0 TUNING PROCEDURE

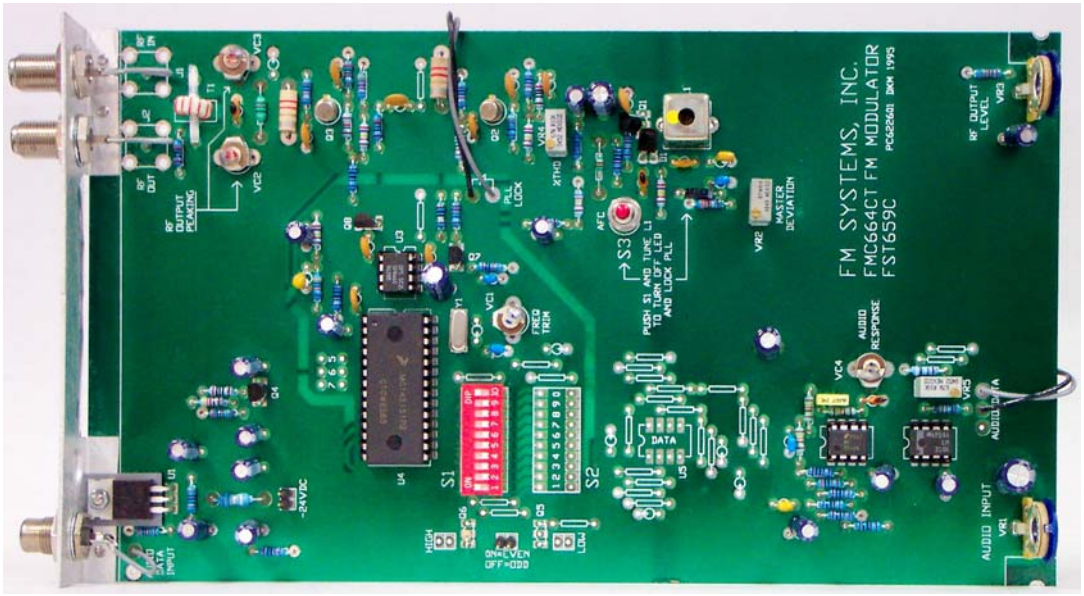
6.1.0 FMC664CR Receiver. The receiver is tuned by changing the L.O. frequency. The pre-selector tuning automatically tracks the L.O. tuning. The only operation needed to change the received frequency is to set the DIP switches to the new channel frequency according to Table B. Note that the receiver switch settings for any given channel are different than the transmitter because the L.O. of the receiver is 10.7 MHz higher than the transmitter frequency for the same channel.

6.2.0 FMC664CT Transmitter. The transmitter is tuned by

changing the master VCO tuning coil. The RF output power is then maximized on the carrier frequency by adjusting two variable capacitors. The output frequency is not affected by these two capacitors, only the output power.

6.2.1 To change the output frequency, take the converter off-line then set the dip switches according to Table A. Now depress and hold the momentary push button switch on the circuit board and adjust the TUNING COIL until the RED L.E.D. goes out. Tune the coil to the center of the L.E.D. out condition. Release the push button. The transmitter is now on frequency. Maximize the RF power output by tuning VC2 and VC3. Connect the converter to the cable head-end combiner and adjust the RF power output to the desired level with the front panel control.





RECEIVER DEMODULATOR TUNING TABLE B
10.7 L.O.100KHz STEPS

(X) MEANS NUMBER OF SWITCH IS UP, SPACE MEANS NUMBER IS DOWN.

FREQ. MHz	10	9	8	7	6	5	4	3	2	1
88.1	X	X				X	X			
88.3	X	X					X			
88.5	X	X					X			X
88.7	X	X					X	X		
88.9	X	X					X	X	X	
89.1	X	X				X				
89.3	X	X				X				X
89.5	X	X				X		X		
89.7	X	X				X		X	X	
89.9	X	X				X	X			
90.1	X	X				X	X			X
90.3	X	X				X	X	X		
90.5	X	X				X	X	X	X	
90.7	X	X			X					
90.9	X	X			X					X
91.1	X	X			X				X	
91.3	X	X			X				X	X
91.5	X	X			X			X		
91.7	X	X			X			X		X
91.9	X	X			X			X	X	
92.1	X	X			X			X	X	X
92.3	X	X			X	X				
92.5	X	X			X	X				X
92.7	X	X			X	X		X		
92.9	X	X			X	X		X	X	
93.1	X	X			X	X	X			
93.3	X	X			X	X	X			X
93.5	X	X			X	X	X	X		
93.7	X	X			X	X	X	X	X	
93.9	X	X		X						
94.1	X	X		X						X
94.3	X	X		X				X		
94.5	X	X		X				X	X	
94.7	X	X		X			X			
94.9	X	X		X			X			X
95.1	X	X		X			X	X		
95.3	X	X		X			X	X	X	
95.5	X	X		X		X				
95.7	X	X		X						X
95.9	X	X		X		X				

FREQ. MHz	10	9	8	7	6	5	4	3	2	1
96.1	X	X				X		X		X
96.3	X	X				X		X	X	
96.5	X	X				X		X	X	X
96.7	X	X				X		X	X	X
96.9	X	X				X		X	X	X
97.1	X	X				X	X			
97.3	X	X				X	X			X
97.5	X	X				X	X		X	
97.7	X	X				X	X		X	X
97.9	X	X				X	X	X		
98.1	X	X				X	X	X		X
98.3	X	X				X	X	X	X	
98.5	X	X				X	X	X	X	X
98.7	X	X				X	X	X		
98.9	X	X				X	X	X		X
99.1	X	X				X	X	X	X	
99.3	X	X				X	X	X	X	X
99.5	X	X				X	X	X	X	
99.7	X	X				X	X	X	X	X
99.9	X	X				X	X	X	X	X
100.1	X	X				X	X	X	X	X
100.3	X	X	X							
100.5	X	X	X							X
100.7	X	X	X						X	
100.9	X	X	X						X	X
101.1	X	X	X					X		
101.3	X	X	X					X		X
101.5	X	X	X					X	X	
101.7	X	X	X					X	X	X
101.9	X	X	X				X			
102.1	X	X	X				X			X
102.3	X	X	X				X		X	
102.5	X	X	X				X		X	X
102.7	X	X	X				X	X		
102.9	X	X	X				X	X		X
103.1	X	X	X				X	X	X	
103.3	X	X	X				X	X	X	X
103.5	X	X	X			X				
103.7	X	X	X			X				X
103.9	X	X	X			X			X	

RECEIVER DEMODULATOR TUNING TABLE B
10.7 L.O.100KHz STEPS

(X) MEANS NUMBER OF SWITCH IS UP, SPACE MEANS NUMBER IS DOWN.

FREQ. MHz	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
104.1		X	X	X		X			X	X
104.3		X	X	X		X		X		
104.5		X	X	X		X		X		X
104.7		X	X	X		X		X	X	
104.9		X	X	X		X		X	X	X
105.1		X	X	X		X	X			
105.3		X	X	X		X	X			X
105.5		X	X	X		X	X		X	
105.7		X	X	X		X	X		X	X
105.9		X	X	X		X	X	X		
106.1		X	X	X		X	X	X		X
106.3		X	X	X		X	X	X	X	
106.5		X	X	X		X	X	X	X	X
106.7		X	X	X	X					
106.9		X	X	X	X					X
107.1		X	X	X	X				X	
107.3		X	X	X	X				X	X
107.5		X	X	X	X			X		
107.7		X	X	X	X			X		X
107.9		X	X	X	X			X	X	
108.1		X	X	X	X			X	X	X
	10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**

MODULATOR TUNING TABLE A
10.240,1024, = 100KHz STEPS

(X) MEANS NUMBER OF SWITCH IS UP, SPACE MEANS NUMBER IS DOWN.

FREQ. MHz	10	9	8	7	6	5	4	3	2	1
88.1	X	X		X	X	X				
88.3	X	X		X	X	X				X
88.5	X	X		X	X	X		X		
88.7	X	X		X	X	X		X	X	
88.9	X	X		X	X	X	X			
89.1	X	X		X	X	X	X			X
89.3	X	X		X	X	X	X	X		
89.5	X	X		X	X	X	X	X	X	
89.7	X	X	X							
89.9	X	X	X							X
90.1	X	X	X					X		
90.3	X	X	X					X	X	
90.5	X	X	X				X			
90.7	X	X	X				X			X
90.9	X	X	X				X	X		
91.1	X	X	X				X	X	X	
91.3	X	X	X			X				
91.5	X	X	X			X				X
91.7	X	X	X			X		X		
91.9	X	X	X			X		X	X	
92.1	X	X	X			X	X			
92.3	X	X	X			X	X			X
92.5	X	X	X			X	X	X		
92.7	X	X	X			X	X	X	X	
92.9	X	X	X		X					
93.1	X	X	X		X					X
93.3	X	X	X		X			X		
93.5	X	X	X		X			X	X	
93.7	X	X	X		X		X			
93.9	X	X	X		X		X			X
94.1	X	X	X		X		X	X		
94.3	X	X	X		X		X	X	X	
94.5	X	X	X		X	X				
94.7	X	X	X		X	X				X
94.9	X	X	X		X	X		X		
95.1	X	X	X		X	X		X	X	
95.3	X	X	X		X	X	X			
95.5	X	X	X		X	X	X			X
95.7	X	X	X		X	X	X	X		
95.9	X	X	X		X	X	X	X	X	

FREQ. MHz	10	9	8	7	6	5	4	3	2	1
96.1		X	X	X	X					
96.3		X	X	X	X					X
96.5		X	X	X	X				X	
96.7		X	X	X	X				X	X
96.9		X	X	X	X			X		
97.1		X	X	X	X			X		X
97.3		X	X	X	X			X	X	
97.5		X	X	X	X			X	X	X
97.7		X	X	X	X		X			
97.9		X	X	X	X		X			X
98.1		X	X	X	X		X		X	
98.3		X	X	X	X		X		X	X
98.5		X	X	X	X		X	X		
98.7		X	X	X	X		X	X		X
98.9		X	X	X	X		X	X	X	
99.1		X	X	X	X		X	X	X	X
99.3		X	X	X	X	X				
99.5		X	X	X	X	X				X
99.7		X	X	X	X	X			X	
99.9		X	X	X	X	X			X	X
100.1		X	X	X	X	X		X		
100.3		X	X	X	X	X		X		X
100.5		X	X	X	X	X		X	X	
100.7		X	X	X	X	X		X	X	X
100.9		X	X	X	X	X	X			
101.1		X	X	X	X	X	X			X
101.3		X	X	X	X	X	X		X	
101.5		X	X	X	X	X	X		X	X
101.7		X	X	X	X	X	X	X		
101.9		X	X	X	X	X	X	X		X
102.1		X	X	X	X	X	X	X	X	
102.3		X	X	X	X	X	X	X	X	X
102.5	X									
102.7	X									X
102.9	X								X	
103.1	X								X	X
103.3	X							X		
103.5	X							X		X
103.7	X							X	X	
103.9	X							X	X	X

	10	9	8	7	6	5	4	3	2	1

	10	9	8	7	6	5	4	3	2	1

MODULATOR TUNING TABLE A
10.240, 1024, = 100KHz STEPS

(X) MEANS NUMBER OF SWITCH IS UP, SPACE MEANS NUMBER IS DOWN.

FREQ. MHz	10	9	8	7	6	5	4	3	2	1
104.1	X						X			
104.3	X						X			X
104.5	X						X		X	
104.7	X						X		X	X
104.9	X						X	X		
105.1	X						X	X		X
105.3	X						X	X	X	
105.5	X						X	X	X	X
105.7	X					X				
105.9	X					X				X
106.1	X					X			X	
106.3	X					X			X	X
106.5	X					X		X		
106.7	X					X		X		X
106.9	X					X		X	X	
107.1	X					X		X	X	X
107.3	X					X	X			
107.5	X					X	X			X
107.7	X					X	X		X	
107.9	X					X	X		X	X
108.1	X					X	X	X		
	10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**