P9CFM-25
Technical Data for FCC Certification
Active Devices and Function List

Stereo Coder PCB #654-Z0001

DEVICE	TYPE	FUNCTION
PMLL4148	Diode	Small Signal Switching
BYV27-200	Diode	200V Fast Recovery
1N4004	Diode	Rectifier
PN2222A	Transistor	Small Signal
PN2907A	Transistor	Small Signal
79L05	IC	-5V Regulator
78L05	IC	+5V Regulator
78L12	IC	+12V Regulator
LM2575-HVT	IC	Step-down Voltage Regulator
LM339N	IC	Quad Comparator
74HC04N	IC	Hex Inverter
74HC74N	IC	Dual Positive Edge Trigger
74HC4002N	IC	Dual 4 I/P NOR Gate
74HC4520E	IC	4-Bit Binary Counter
74HC4015E	IC	Shift Regulator
74HC4316N	IC	Quad Analog Switcher
74HC32N	IC	Quad 2 I/P OR Gate
LF353N	IC	Dual Op Amp
TL071CP	IC	Single Op Amp
NE571N	IC	Comparator/Limiter
	Crystal	4.256MHz

Power Amplifier PCB #654-Z0029

DEVICE	TYPE	FUNCTION
PMLL4148	Diode	Small Signal Switching
BYV28-200	Diode	200V Fast Recovery Rectifier
MRF136Y	Transistor	30W MOSFET
MRF134	Transistor	5W MOSFET
LM2576T	IC	Adj Voltage Switching Regulator
MAV11	IC	RF Amplifier

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Synthesizer PCB #980507A1

DEVICE	TYPE	FUNCTION
BB405B	Diode	Variable Capacitance
1N4004	Diode	Rectifier
PMLL4148	Diode	Small Signal Switching
BB809	Diode	Variable Capacitance
BF245B	Transistor	Small Signal JFET
BC550C	Transistor	Small Signal
PN2222A	Transistor	Small Signal
PN2907A	Transistor	Small Signal
74HC32N	IC	Quad 2 I/P OR Gate
74HC08N	IC	Quad 2 I/P AND Gate
74HC132N	IC	Quad 2 I/P Schmitt Trigger
74HC4059N	IC	Programmable Counter
74HC4075E	IC	Triple 3 I/P OR Gate
74HC7046AN	IC	PLL
7815	IC	+15V Regulator
7805	IC	+5V Regulator
TL072CP	IC	Dual Op Amp
U893BSE	IC	Pre-scaler
MSA0866	IC	RF Amplifier
	Crystal	10MHz TCXO

Control PCB #980508A1

DEVICE	TYPE	FUNCTION
BAT83/85	Diode	Schottky Rectifier
1N4148	Diode	Small Signal Switching
1N4004	Diode	Rectifier
PMLL4148	Diode	Small Signal Switching
BVY27-200	Diode	200V Fast Recovery
BVY10-60	Diode	60V Fast Recovery
PN2222A	Transistor	Small Signal
PN2907A	Transistor	Small Signal
2N5551	Transistor	HV Amplifier

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Control PCB #980508A1 (cont'd)

DEVICE	TYPE	FUNCTION
7812	IC	+12V Regulator
LM358M	IC	Dual Op Amp
LM2575-HVT	IC	Step-down Voltage Regulator
79L12	IC	-12V Regulator
TL064CN	IC	Quad Op Amp
TL072CP	IC	Dual Op Amp

Front Panel PCB #989892A1

DEVICE	TYPE	FUNCTION
BAT83/85	Diode	Schottky Rectifier
PMLL4148	Diode	Small Signal Switching
PN2222A	Transistor	Small Signal
74HC4052N	IC	4 Channel Analog Multiplier
4510BE	IC	BCD Counter
7812	IC	+12V Regulator
LM3914	IC	Linear Bargraph Display Driver
LM3916	IC	VU Display Driver
TL064CN	IC	Quad Op Amp
TDA1591V3	IC	Stereo Decoder
78L05	IC	+5V Regulator

DOCUMENT No.
862-Z0122

FACTORY SET-UP TEST SPECIFICATION FOR 25W FM EXCITER FM-25

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FM–25 PTS

1 PART 1 : INTRODUCTION

The objective of this specification is to outline the electrical tests required for the production testing of the FM-25 FM Exciter.

2 PART 2 : PRODUCTION TEST REQUIREMENTS

2.1 General

This section details the tests to be carried out on the Exciter Unit. Correct anti-static handling procedures are to be followed when handling PCBs.

2.2 Test Equipment

A. Oscilloscope 100MHz

B. Digital Multimeter (DMM)

C. Frequency counter HP 5384A or similar

D. RF Power Meter

E. Bird RF Attenuator 100 W, 20 dB

F. R & S Modulation Analyzer FAM/FMAB

G. R & S Audio Analyzer UPA 3

H. R & S Stereo Encoder MSC 2

J. HP Spectrum Analyzer 8590B or similar

K. Exciter test

L. PSU 0-30 V, 3A

M. Mismatched load

N. R & S Stereo Decoder MSDC 2

O. Remote Frequency Selection Test Box

Connect Exciter under test to the test equipment as shown in Figure 1. The DC Power Supply should be adjusted to +24 V ± 0,1 V with the current limit set to 1 A.

2.3 Preparation

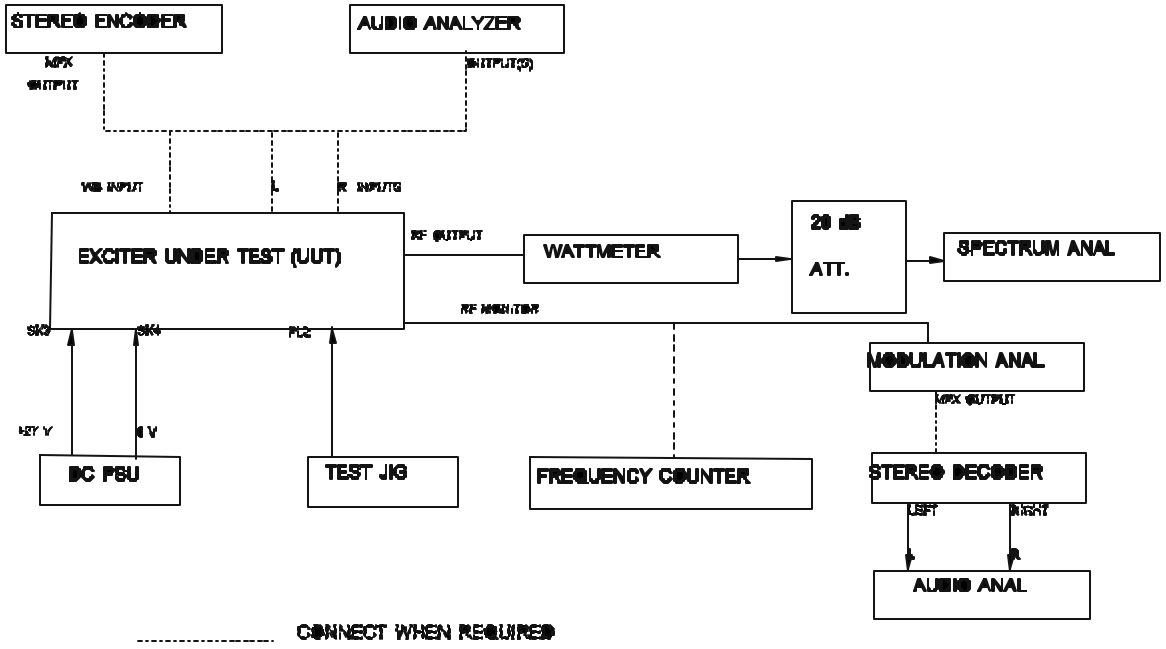

Figure 1. Test Setup

2.3.1 Mechanical and Visual Inspection

Carry out mechanical and visual inspection as follows:

1. Check the connectors for looseness and alignment
2. Visually inspect the components and their spacing from the PCB
3. Record results in the Test Result Sheet (TRS).

2.3.2 Electrical Testing

Initialisation

1. Adjust preset pot (PWR ADJ) on UUT front panel fully counter-clockwise.
2. Set synth frequency to 88 MHz using internal switches on synthesiser PCB.
3. Ensure RF ENABLE switch is OFF on test jig.

2.4 RF Power/Frequency/Spectrum

2.4.1 Switch ON Sequence

a. Switch Exciter ON/OFF switch to ON and ensure the following:

The PLL LOCK LED, EXT DC and Remote PLL is ON after approximately three seconds. The RF ENABLE and RF FAULT LEDs are OFF.

Record results in TRS.

2.4.2. a. Set current limit on DC power supply to 3 A.

b. Select RF ENABLE on test jig.

c. Observing the front panel of Exciter unit, ensure RF ENABLE LED is ON.

d. Ensure RF power output on Wattmeter is < 2 W.

e. Record result in TRS.

2.4.3. a. Set up spectrum analyser as follows:

Centre frequency	:	**300 MHz**
Span	:	**600 MHz**
Bandwidth (BW)	:	**30 kHz**
Sweep	:	**500 mS**

The amplitude depends on the frequency used. Use the MARKER and DELTA MARKER to do the measurements.

b. Adjust PWR ADJ preset, clockwise to obtain an RF Power reading on the Wattmeter of 25 W ± 1 W.

c. Observe the spectrum on the Spectrum Analyzer and ensure no spurious signals or harmonics exist at a level of < -60 dBc.

d. Maximum power at 88, 98, and 108 MHz

e. Minimum power at 88, 98, and 108 MHz

f. Harmonics and spurious at 88, 98 and 108 MHz

g. Frequency accuracy at 88 MHz.

h. Adjust rotary switches, on the Synthesiser PCB to configured frequency.

i. Record the Results for Frequency accuracy and power output at configured Frequency.

2.5 **Calibration of Meter Functions**

2.5.1 **RF PA Current Setting (Meter)**

a. Switch RF ENABLE on test jig to ON.

b. Set RF Power output to 25 W ± 1 W via R27 on the front panel.

c. Measure the voltage across the 0.1-ohm resistor (R30 on PA module) and note the DC reading.

d. Select PA CURRENT on UUT front panel meter switch.

e. Adjust R52 for a bargraph reading of 10 x reading of c. above. For example, if a reading of 0.15 V was obtained, adjust R52 for a bargraph display of 1.5 A (Scale 4 A).

Record Calibration of the PA Current meter (< 2 A).

2.5.2 **RF PA Forward and Reflected Power (Meter)**

a. Select FWD Power on UUT front panel meter switch.

b. Switch RF ENABLE on test jig to ON.

b. Set RF Power to 25 W ± 1 W on Wattmeter and adjust R55 (FWD METER) to set bargraph reading to 25 W (±1 bar).

c. Switch RF ENABLE on test jig to OFF and connect a mismatch load to output.

d. Select RFL Power on Meter

e. Switch test jig RF ENABLE to ON and set Wattmeter to read reflected power

f. Adjust preset R62 (REFL Meter) so that bargraph (4 W scale) reads 2.4W, to correspond with the external wattmeter.

g. Adjust R24 (REFL ALARM CAL) on the Control PCB for the VSWR LED on the front panel to illuminate.

h. Increase the mismatch on the output until the reflected power is approx. 4.0W, adjust R32 on the Control PCB to trip the UUT, ensure that the unit recycles before reducing the mismatch, the unit should operate as normal, once the mismatch has been reduced.

Switch the RF enable OFF and remove mismatch load, connect a 50R load.
Record operation of forward, reflected calibration and trip in TRS.

2.5.3 **RF Fault Alarm Calibration**

a. Switch RF ENABLE to OFF on test jig and connect 50 ohm load/attenuator to the external Wattmeter output.

b. Switch RF ENABLE to ON, on test jig and set RF power (forward) to 16 W ± 1 W on external Wattmeter.

c. Adjust preset R10 (FWD ALARM CAL) on the control PCB, so that UUT front panel RF FAULT LED lights up. (Adjust RF power level to check operation of RF FAULT LED. The LED should switch ON at 16 W ± 1 W).

d. Ensure that RF FAULT LED on test jig also operates at 16 W ± 1 W.

Record result of RF Fault Alarm calibration in TRS.

2.6 **A.M. Non-synch Noise**

a. Switch RF ENABLE to ON, on test jig.

b. Adjust RF output power to 25 W ± 1 W.

c. Connect the modulation analyzer to the output of the RF Attenuator. The modulation analyzer settings are as follows:

Select : A.M. : **ON**
De-emph : **OFF**
Auto : **ON**
Detector : **RMS**
Filter : **HPF:30 Hz; LPF:200 kHz**

d. On Modulation Analyser select also the following:

100.REF.dB

Note reading in centre window (dB)

This reading should be < -55 dB

Record results of non-synch AM noise in TRS.

2.7 **Modulation Tests**

2.7.1 **Modulation Setup**

a. Set Audio Analyzer output to the W/B input of Exciter.

b. Set Audio Analyzer level to 3.5Vp-p (30 ohms source) and frequency to 400 Hz.

c. Switch RF ENABLE to ON, on test jig and set RF output power to 25

W ± 1 W.

d. Set Modulation Analyzer as follows:

FM : **ON**
De-emph : **OFF**
Auto : **ON**
Detector : **P+P / 2**
Filter : **30 Hz/200 kHz**
Relative : **OFF**

e. Observe reading on modulation analyzer for deviation and adjust R80 (MPX LEVEL ADJ) for a reading of 75 kHz ± 0,2 kHz. (R115 Deviation adjust, on front panel set fully CW).

Observe the reading on the VU meters on the front panel, adjust R28(RIGHT),R37(LEFT) to calibrate the reading, 75kHz should read 0 on the VU meter.

Record results of deviation calibration operation:

Deviation Bargraph: SET
Wideband Deviation: 75 kHz ± 1 kHz

2.7.2 **Aux W/B Setup**

a. Disconnect Audio Analyzer from W/B Input of Exciter and connect to Aux W/B input of Exciter.

b. Set Audio Analyzer frequency to 400 Hz and the level to 3.5Vp-p with 30 ohms source impedance.

c. Adjust R82 (AUX1 ADJ), R84 (AUX2 ADJ) to set modulation on the modulation analyzer to 7.5 kHz ± 0,1 kHz.

Record operation of Aux W/B inputs in TRS.

2.7.3 **S/N Ratio**

a. Switch test jig RF ENABLE to ON to obtain 25 W ± 1 W RF output power.

b. Set Modulation Analyzer as follows:

FM : **ON**
De-emph : **ON (75 µS)**
Auto : **ON**
Detector : **p+p / 2**
Filter : **30 Hz/20 kHz**
Relative : **OFF**

c. Remove W/B inputs to Exciter and select 75 REF dB on the

modulation analyzer. (This provides a 75 kHz peak reference). Select RMS and read Noise Level on the modulation analyzer (note value). The level must be
< -72 dB.
Record result of S/N Ratio in TRS.

2.7.4 **Wideband Distortion**

a. Connect Audio Analyzer output to W/B Input. Set level to 3.5Vp-p and frequency to 400 Hz with 30 ohms source impedance.

b. Observe deviation on the modulation analyzer. Note that the settings on the modulation analyzer are:

FM : **ON**
De-emph : **OFF**
Auto : **ON**
Detector : **p+p / 2**
Filter : **30 Hz/20 kHz**
Relative : **OFF**

The deviation should read 75 kHz ± 1 kHz.

c. Select 'Distortion' on the modulation analyzer and note distortion reading on Modulation Analyzer. This should be< 0.25%.

Record result of wideband distortion in TRS.

2.8 **Stereo Exciter Tests**

2.8.1 **General**

This test must be carried out with the Exciter set to its Configuration Frequency. The Exciter Deviation must be set to 75 kHz peak with 3.5Vp-p input to the W/B input (Test Frequency 400 Hz).

The deviation reading must be 75 kHz ± 0.1 kHz and this provides the reference for the Stereo Encoder.

The modulation analyzer settings for the above are:

FM : **ON**
De-emph : **OFF**
Auto : **ON**
Detector : **p+p / 2**
Filter : **30 Hz/20 kHz**
Relative : **OFF**

2.8.2 **Stereo Exciter Tests for Mono Operation**

This section must be completed if the Stereo Encoder option is fitted. (The Stereo Encoder has been tested at sub-assembly level).

2.8.2.1 **Mono Operation**

a. Connect test equipment according to Figure 1. The Audio Analyzer output (600 ohms) must be connected to the "LEFT" input cannon connector and the U-link must be connected between the MPX output and W/B input on Exciter back panel.

b. Set Audio Analyzer output to +10 dBm/400 Hz and monitor the deviation on the modulation analyzer.

FM : **ON**
De-emph : **OFF**
Auto : **On**
Detector : **p+p / 2**
Filter : **30 Hz/200 kHz**
Relative : **OFF**

Select MONO and RF ENABLE on the test jig.

c. Adjust RF output power to 25 W ± 1 W via PWR ADJ control on UUT front panel. The deviation on the modulation analyzer must be 75 kHz ± 0.2 kHz. (Fine adjustment of this value can be made via preset R96 (MONO LEVEL) on the Stereo Encoder PCB).
Record operation in TRS.

c. Adjust Audio Analyzer frequency to 15 kHz. The deviation on the Mod Analyzer must be 75 kHz ± 2.5 kHz.

d. Record value of Audio response.

e. Ensure STEREO LED (on Exciter front panel and test jig), is OFF

2.8.2 **Stereo Operation**

a. Test Setup

Connect the output of modulation analyzer (Stereo MPX output on rear panel) to Stereo Decoder input.

The modulation analyzer settings are:

FM : **ON**
De-emph : **OFF**
Auto : **ON**

Detector : **p+p / 2**
Filter : **30 Hz/200 kHz**
Relative : **OFF**

b. Pilot Deviation

Disconnect left input to Exciter and select STEREO on test jig. The deviation on the modulation analyzer must be 7.5 kHz ± 0.5 kHz. Fine adjustments can be made via preset R70 (PILOT LEVEL) on Stereo Encoder PCB. Record level in TRS.

c. Stereo Left and Right Equalization

Connect left **and** right inputs to Audio Analyzer outputs (30 ohms) at +10 dBm at 400 Hz.

NOTE: The deviation reading on the Modulation Analyzer should be approximately 75 kHz.

Select L+R on the stereo decoder and set a +6 dBm reference (with de-emph off). Select Left-Right (L-R) on Stereo Decoder and observe reading on meter. This must be < -40 dB with respect to above +6 dBm reference. Fine adjustment can be made via right level R168 (RIGHT LEVEL), and R123 (LEFT LEVEL) on Stereo Encoder PCB. (This ensures the left and right balance).

Record level of mono into stereo on TRS. (This must be <-40 dB.)

d. Stereo Separation (Right into Left)

Adjust audio input for 10dBm and a source impednce of 30 ohms.

Select LEFT on the stereo decoder and set reference to +6 dBm. Remove left input on Exciter and measure the separation of right into left on stereo decoder with respect to +6 dBm reference. Record result of right into left (R-L) separation which should be <-45 dB. Adjust R63 and R67 to optimise the reading.

e. Stereo Separation (Left into Right)

Select RIGHT on the stereo decoder and reconnect LEFT input to Exciter. Set +6 dBm reference on stereo decoder. Disconnect RIGHT input to Exciter and measure the separation of left into right on stereo decoder with respect to +6 dBm reference. Record result of left into right (L-R) separation which should be < -45 dB. Repeat measurement at audio frequencies of 100 Hz and 15 kHz and record results (< -45 dB) in TRS.

f. Right Channel Audio Response

Re-connect right input to Exciter and set +6 dBm reference on stereo decoder with 1 kHz input frequency. Set input frequency to 15 kHz and ensure that the level on the stereo decoder is +6 dBm±

0.5 dB. Record result of audio response (± 0.5 dB) in TRS.

g. Repeat step f. for the LEFT channel as well

h. Pre-emphasis Operation

Set Left and Right inputs to Exciter to +0 dBm at 2116 Hz. Set 0 dBm reference on stereo decoder left channel and then select pre-emph on Exciter rear panel. The left and right channels on the stereo decoder must read +3 dBm ± 0.3 dB, and the PRE-EMPH LED on the frontpanel must light up.

i. Stereo Indicator

Ensure STEREO indicators on Exciter front panel and test jig, are ON.

j. Stereo S/N Ratio

Disconnect RIGHT input and set LEFT input to +10 dBm at 400 Hz on Audio Analyzer. Set pre-emph switch to OFF. Set +6 dBm reference on Stereo Decoder (LEFT). Remove Left Input to Exciter. Select de-emphasis, switch on stereo decoder and measure residual level on stereo decoder. This level must be < -65 dB w.r.t. +6 dBm. Record level of NOISE (< -66 dB). Set de-emphasis to ON. on stereo decoder.

k. Pilot Frequency

Connect counter to Exciter PILOT OUTPUT on back panel. Record frequency of pilot (19 kHz ± 1 Hz) in TRS.

l. Audio Distortion

Connect Left output of Audio Analyzer to Exciter LEFT input with level at +6 dBm at 1 kHz. Monitor Left output of stereo decoder with Audio Analyzer and measure the total harmonic distortion T.H.D. Record (T.H.D.) at frequencies of 1 kHz, 5 kHz, and 15 kHz (< 0.25%) in TRS.

Repeat above test with RIGHT input only and monitor the right output of Stereo Decoder. Record T.H.D. at frequencies of 1 kHz, 5 kHz, and 15 kHz (< 0.25%) in TRS.