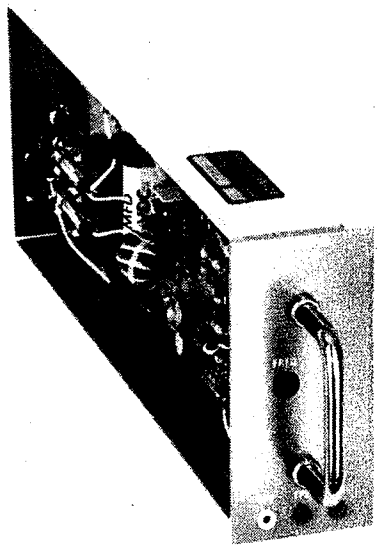
SERVICE INSTRUCTION

NAPE12 & NAPE12/1

RF DRIVER MODULE



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LIST OF EFFECTIVE PAGES

The list of effective pages lists the status of all pages in this manual. Pages of the original issue are identified by a zero in the Change No. column. Pages subsequently changed are identified by the date of the change number. On a changed page, the text affected by the latest change is indicated by a vertical bar in the margin opposite the changed material.

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INTRODUCTION

1. The NAPE12 rf driver module contains the rf oscillator and rf drive stage for Nautel's AMPFET series of transmitters. There are minor variations of the rf driver module to accommodate the different power levels of their associated transmitters. The variation that is applicable to a specific transmitter is identified in the instruction manual for that transmitter. The variations are identified by a (/#) after the NAPE12 identifier. Trouble shooting and repair of the module is performed on a work bench independent of it's associated transmitter. This document provides the information required for a competent technician to understand the operation of the electrical circuits and the procedures to restore defective modules to a serviceable status; using tools and test equipment normally available at an AM radio station workshop. An alternative to procedures provided in this document is to utilize Nautel's module exchange/repair service facilities.

FACTORY EXCHANGE/REPAIR SERVICE

2. Nautel provides a factory, module exchange/repair service for users of Nautel's AMPFET series of transmitters. Users who do not have repair facilities or who are not able to repair a module may utilize this service for a nominal fee.

MECHANICAL CONFIGURATION

3. The NAPE12 rf driver utilizes a formed, metal box as the module chassis. An electrical connector and a guide pin are installed on the rear of the module and a stamped panel containing a handle, three test points and a frequency adjustment access hole is installed on the front. The remaining electrical components are installed on removeable assemblies. The rf oscillator components are mounted on a printed circuit board (A2) and are interconnected by the circuit board's printed pattern. Extenal wiring is connected by soldering to standoff terminals on the circuit board. The rf drive components are mounted on standoff terminals on a metal plate (A1). Electrical interconnection of the rf drive components, where applicable, and between the assemblies is by wiring which is soldered to the standoff terminals. Refer to figure 4 for the assembly detail of the rf driver module.

THEORY OF OPERATION

4. The NAPE12 rf driver module generates the rf carrier frequency and provides the rf drive for its associated transmitter. Refer to figure 3 for the electrical schematic.

4.1 RF CARRIER OSCILLATOR: Transistor A2Q1, crystal A2Y1 and their associated components form an extremely stable, crystal contolled oscillator at two (frequencies above 1.0 MHz) or four (frequencies below 1.0 MHz) times the rf carrier frequency. The desired stability of ±5ppm over the operating temperature range (0°C to 50°C) is ensured by selecting a crystal frequency which is between 2.0 MHz and 4.0 MHz. Transistor A2Q2 and it's associated compents form a buffer amplifier which provides a buffered rf oscillator output to the frequency divider. When a ground potential 'rf drive enable' signal is applied to P1-1, dual 'D' flip-flop A2U1 divides the oscillator rf output by two or by four, dependent on which link is installed, and provides a square wave at the rf carrier frequency to the complimentary emitter-follower formed by transistors A2Q3 and A2Q4. When the 'rf drive enable' (ground) signal is removed, flip-flop A2U1A is maintained in it's reset state; the rf oscillator's output will not be divided and the rf oscillator's output will be effectively inhibited. The output of complimentary emitter-follower A2Q3/A2Q4 is applied thru capacitor A2C7 to rf drive input transformer A1T1 and thru resistor A2R11 to test point TP1 on the front panel. Variable capacitor A2C4, which is accessible thru the front panel, provides oscillator fine tuning. When an 'inhibit' (ground) signal is applied to P1-6, flip-flop A2U1A is maintained in its reset state; the rf oscillator's output will not be divided and its output will be effectively inhibited.

4.2 RF DRIVE: The rf drive input, which is a square wave at the carrier frequency, is applied to transformer A1T1. Transformer A1T1 is a 1:1 coupling transformer that has two sets of identical secondary windings. One end of each secondary winding is connected to the gate and the other end to the source of a power MOSFET (A1Q1 and A1Q2). Power MOSFETs A1Q1 and A1Q2 are connected in a push-pull configuration with the phasing of their inputs determining which one is turned on. When the gate of A1Q2 goes positive, the gate of A1Q1 will go negative. A1Q2 will turn on and A1Q1 will be turned off. When A1Q2 is turned on, -72 volts dc is applied thru fuse A1F2, resistor A1R1, inductor A1L2, resistor A1R3, the source/drain junction of power MOSFET A1Q2 to the 'rf drive' output at P1-3. During the next half cycle, the gate of A1Q1 will go positive and the gate of A1Q2 will go negative, causing A1Q1 to turn on and A1Q2 to turn off. A ground will be applied to P1-3 thru the drain/source junction of A1Q1. The resultant 'rf drive' output on P1-3 will be a 72 volt peak-to-peak square wave at the rf carrier frequency. Transient suppression and decoupling of the -72 volts dc is provided by capacitors C1, C2, C3, C4, C5; diodes CR1, CR2; inductor L1; resistors R1 and R3.

TROUBLESHOOTING

5. Troubleshooting of rf driver modules that are defective or are suspected of being defective consists of performing a visual inspection and then conducting a functional test to isolate the defective components.

5.1 TEST EQUIPMENT AND SPECIAL TOOLS: The test equipment required is listed in table 1. There are no special tools required.

5.2 VISUAL INSPECTION: It is recommended that a visual inspection be performed on the rf driver module prior to applying power. Inspect the module for the following:

(a) Inspect all electrical components for evidence of overheating or physical damage.

(b) Verify fuses A1F1 and A1F2 are the correct value and are not defective.

(c) Verify the frequency marked on crystal A2Y1 is between 2.0 MHz and 4.0 MHz, is the desired frequency and the appropriate divide-by-two or divide-by-four link is installed.

(d) Inspect all solder connections for good mechanical bond and adequate solder.

(e) Verify connector P1 does not contain damaged or loose pins and that it is securely fastened to its bracket.

(f) Verify the guide pin is present and that it is securely fastened.

(g) Verify all wiring insulation is not pinched, frayed, broken or otherwise damaged.

(h) Verify wire strands of wiring conductors are not broken or otherwise damaged.

(i) Verify the leads of power MOSFET A1Q1 which protrude thru the metal plate are not shorting to the plate and the protective plastic sleeve over the gate and source leads is present and is not damaged.

(j) Verify the chassis is free from solder slivers and other conductive foreign objects; paying particular attention to areas under the leads of components mounted on insulated standoff terminals on assembly A2's metal plate.

(k) Verify all fastening hardware is securely tightened.

5.3 FUNCTIONAL TEST: Functional testing of the rf driver module is the recommended first step in troubleshooting a defective module and also verifies the module is operating within design limits after corrective action has been taken. Modules that meet the requirements of the functional test may be considered to be operating satisfactorily and returned to service.

NOTE

Final testing and adjustment of the rf driver module is performed with the module installed in the transmitter it will be used in. Instructions are provided in the associated transmitter's instruction manual.

(a) Verify the visual inspection has been completed.

(b) Connect the NAPE12 rf driver module to the test setup depicted in figure 1.

NOTE

If a -24 volt dc power supply is not available, it may be replaced with a dc power supply which provides any voltage from -10 volts dc to -70 volts dc. If any other voltage is used, the amplitude of the 'rf drive' waveform on P1-3 will require correcting to correspond to the voltage of the power supply.

(c) Connect oscilloscope test leads between cathode of diode CR1 (A2Q1 collector) and terminal 2 (ground) of printed circuit board assembly A2. Observe waveform on oscilloscope and adjust oscilloscope time base for approximately six cycles and gain for an amplitude of 2 volts/division.

(d) If waveform in step (c) does not correspond to example in figure 2, the crystal controlled oscillator is defective. Isolate and replace defective component and then repeat step (c).

(e) Connect oscilloscope test leads between end of resistor R7 nearest the handle (A2Q2 collector) and terminal 2 (ground) of printed circuit board assembly A2. Observe waveform on oscilloscope and leave oscilloscope time base and gain at the settings established in step (c).

(f) If waveform in step (e) does not correspond to example in figure 2, buffer amplifier is defective. Isolate and replace defective component and then repeat step (e).

(g) Connect oscilloscope test leads between test point TP1 and terminal 2 (ground) of printed circuit board assembly A2. Observe waveform on oscilloscope leaving oscilloscope time base at the setting established in step (c) and set the gain for an amplitude of 2 volts/division.

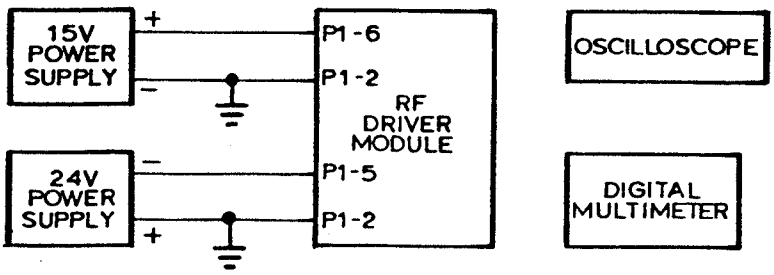


Figure 1 Test Setup for NAPE12 RF Driver Module

(h) If waveform in step (g) does not correspond to example in figure 2, frequency divider A2U1, transistors A2Q3, A2Q4 and/or capacitor C8 is defective. Isolate and replace defective component and then repeat step (g).

(i) Connect oscilloscope test leads between the anode of diode A1CR1 (rf drive on P1-3) ground lug of output coaxial cable shield. Observe waveform on oscilloscope leaving oscilloscope time base at the setting established in step (c) and setting the gain as appropriate for the negative dc voltage applied to P1-5.

(j) If waveform in step (i) does not correspond to example in figure 2, a component in the rf drive stage is defective. Isolate and replace defective component using procedures described in paragraph 5.4 for power MOSFETs A1Q1/A1Q2 and then repeat step (i).

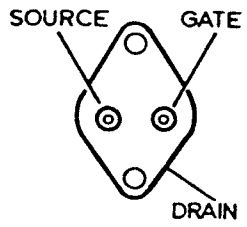
(k) Connect a frequency counter between TP1 and terminal 2 (ground) of printed circuit board assembly A2.

(l) Adjust capacitor A2C4 for the precise desired carrier frquency indication on the frequency counter. If unable to attain desired frequency, check the oscillator crystal and then the value of the components associated with crystal controlled oscillator.

5.4 RESISTANCE MEASUREMENT OF POWER MOSFETS: Isolate defective power MOSFETs by performing a resistance measurement of each device as follows:

NOTE
The power MOSFETS can be checked while still mechanically mounted, provided their source and gate leads have been electrically isolated.

(a) Electrically isolate a power MOSFET by disconnecting the wiring and comonent leads from its source and gate leads.



(b) Measure the resistance between gate and source using an ohmmeter. Resistance reading should be infinity.

(c) Ensure power MOSFET is turned off by momentarily shorting source and gate leads.

(d) Measure forward source/drain resistance ensuring the ohmmeter's negative lead is on the drain. Resistance reading should be the same as the forward resistance of a diode.

(e) Measure reverse source/drain resistance ensuring the ohmmeter's positive lead is on the drain. Resistance reading should be infinity.

(f) Turn power MOSFET on by forward biasing gate/source junction (connect ohmmeter's positive lead to gate and negative lead to source).

(g) Measure source/drain resistance. Resistance reading should be less than one ohm.

(h) Power MOSFETs that meet the requirements of steps (a) thru (g) are acceptable.

(i) Reconnect the wiring to the source and gate leads of each power MOSFET.

REPAIR

6. Replace any component or wiring which does not meet the requirements of the visual inspection, ensuring leads of replacement wiring and passive components, are kept to the shortest length possible without causing mechanical stress to component or lead. Replace power MOSFETs as follows:

NOTE

Refer to table 2 for interconnecting wiring information and to figure 4 for additional wiring information and assembly detail of the rf driver module.

(a) Gain access to the underside of rf drive assembly A1 by removing four screws and four lock washers, one of each from each corner, and then carefully turning the assembly upside down, ensuring interconnecting wiring is not damaged.

(b) Disconnect wiring and component leads from the gate and source leads of the power MOSFET(s) to be removed.

(c) Remove and retain power MOSFET fastening hardware and then extract the power MOSFET.

(d) If power MOSFET A1Q1 is to be replaced, remove insulating tubing from its gate and source leads and install them on the gate and source leads of the replacement power MOSFET.

(e) If power MOSFET A1Q2 is to be replaced, verify the insulator between the power MOSFET and the metal plate is in place, is free from damage and is coated with thermal compound. If necessary, apply a thin coat of thermal compound to both sides of insulator under replacement power MOSFET A1Q2, ensuring the thermal compound is free of foreign objects.

(f) If power MOSFET A1Q2 is to be replaced, verify the insulator on the component side of rf drive assembly A1 is free from damage, paying particular attention to the raised shoulders which extend into the mounting holes in the metal plate.

(g) Position the insulators referred to in steps (e) and (f) on the appropriate side of the metal plate, where power MOSFET A1Q2 will be installed, ensuring lead and mounting holes are properly aligned.

(h) Install the power MOSFET and secure using fastening hardware removed in step (c), ensuring the terminal lugs which were originally secured by the fastening hardware have been reinstalled correctly.

(i) Connect wiring and component leads, which were removed in step (b), to gate and source leads of power MOSFET.

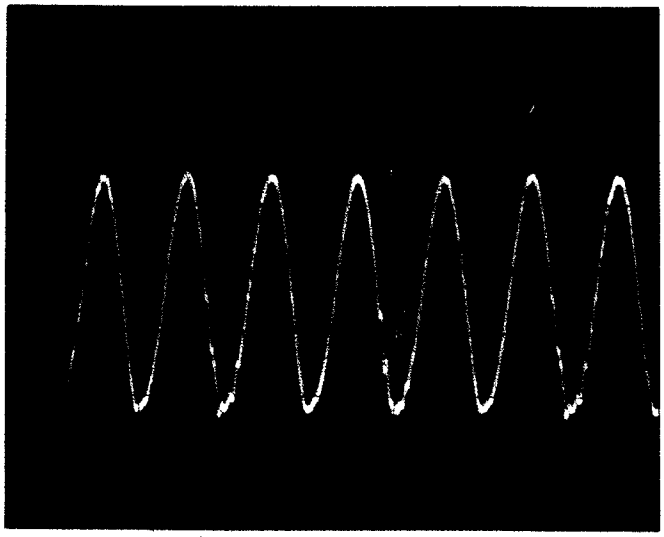
(j) Install rf drive assembly A1 in the module using four screws and lock washers removed in step (a), ensuring rf output coaxial cable shield ground lug and the ground lug on the wire from P1-2 are reinstalled and that interconnecting wiring is not pinched or strained.

Table 1 - Test Equipment

NOMENCLATURE	PART, MODEL, OR TYPE NUMBER (EQUIVALENTS MAY BE USED)
Digital Multimeter	3 1/2 digit, ac and dc volts, ohms and amps, ±0.5% accuracy. Beckman 3010
Oscilloscope	15 MHz. Tektronics Model T922
15 Vdc Power Supply	15 Volts 1 Amp
24 Vdc Power Supply	24 Volts 1 Amp
Frequency Counter	5ppm up to 10 MHz, Fluke 1900A

Table 2 Wiring List - NAPE12 RF Driver Module

SOURCE	DESTINATION	CODE		SIZE	FUNCTION
P1-1	A2-1	1	White	22	
P1-3	A1-Q1 Source	2	Core	RG174/U	(WE37)
P1-4	Ground	-	Shield		
P1-5	F2-1	3	Blue	22	
P1-6	F1-1	4	Red	22	
P1-2	A2-2	5	Black	22	
TP1	A2-6	6	White	22	
TP2	A1-R2	7	Blue	22	
TP3	A2-3	8	White	22	
Junction L1/C2	A2-5	9	Red	22	
T1-1	A2-4	-	-		
T1-2	Gnd lug near A2Q4	-	-		
P1-2	Gnd lug near F1	-	-		

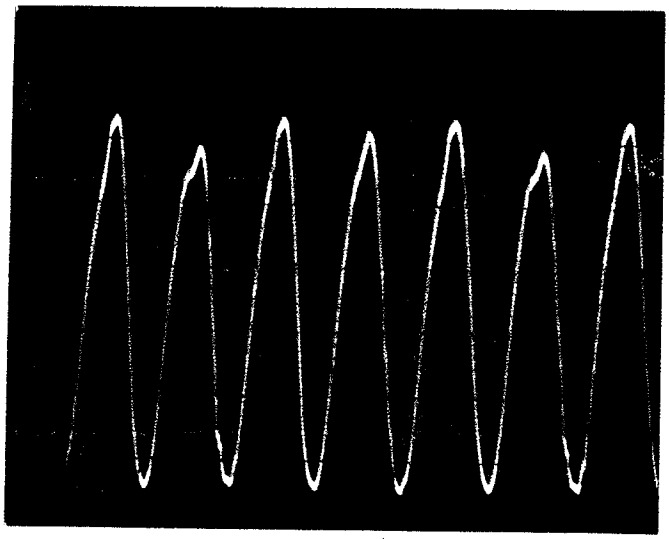


CRYSTAL OSCILLATOR

Frequency 2/4 x Carrier

A2Q1 Collector

2 volts/division
Scale centered at +14 Vdc

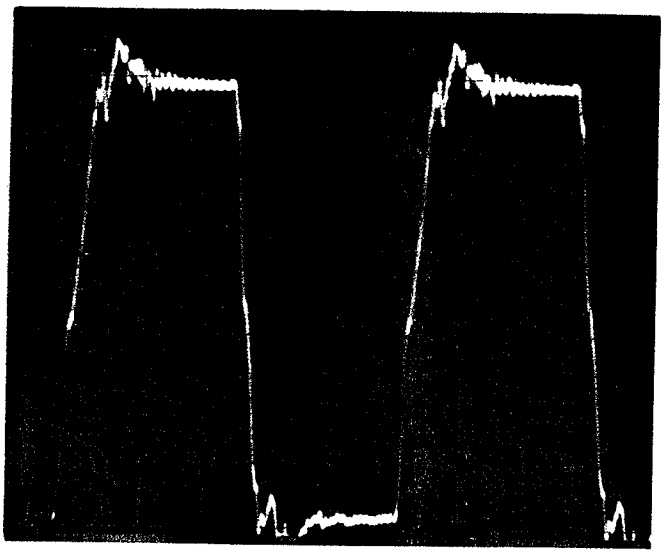


BUFFER AMPLIFIER OUTPUT

Frequency 2/4 x Carrier

A2Q2 Collector

2 volts/division
Scale centered at +8 Vdc



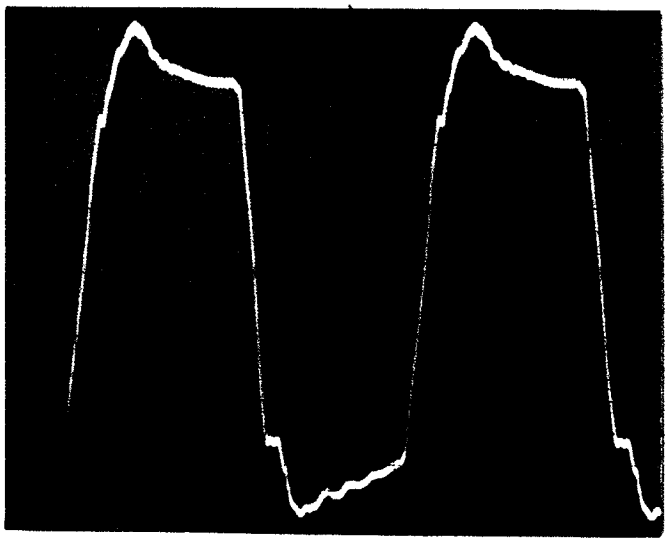
FREQUENCY DIVIDER'S OUTPUT

Carrier Frequency

Divide-by-2/Divide-by-4 Link

2 volts/division
Scale centered at +8 Vdc

Figure 2 Waveforms - NAPE12 RF Driver Module (Sheet 1)

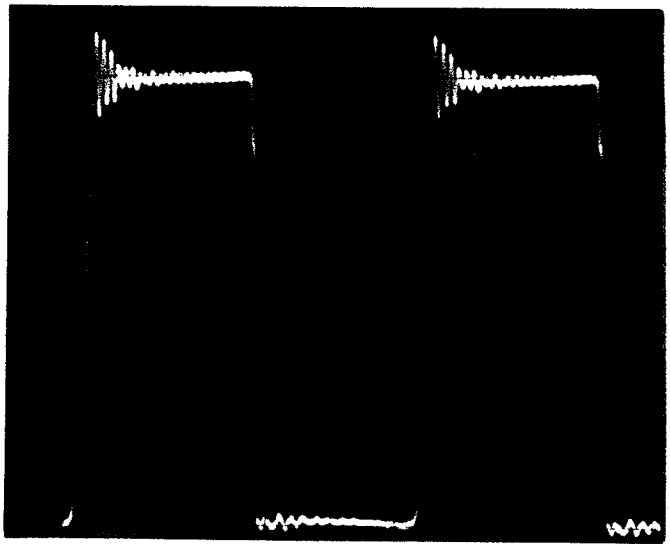


RF DRIVE INPUT

Carrier Frequency

Test Point TP1

2 volts/division
Scale centered at 0 Vdc



RF DRIVE OUTPUT

Carrier frequency
switching between
negative voltage and ground

P1-3

Scale centered at 0 Vdc
Amplitude dependent on
negative voltage level applied
to P1-5.

Figure 2 Waveforms - NAPE12 RF Driver Module (Sheet 2)

Table 3 Reference Designation Index - NAPE12 RF Driver Module

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN, MIL OR MFR PART NO.	(OEM) MFR CODE
-	RF Driver Module	NAPE12	139-3002	37338
A1	RF Drive Assembly	139-3008	139-3008	37338
A1C1	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL	56289
A1C2	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL	56289
A1C3	Capacitor, Plastic, 1.0uF 10%, 100V	CNP11	MFP1W1-10	14655
A1C4	Capacitor, Tantalum, 6.8uF 10%, 35V	CCP19	CSR13F685KM	56289
A1C5	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL	56289
A1CR1	Diode, Schottky Rectifier, 4.5A	QL10	50 SQ 100	81483
A1CR2	Diode, Schottky Rectifier, 4.5A	QL10	50 SQ 100	81483
A1F1	Fuse, 0.25 Amp, Slow Blow	FB11	323.250	75915
A A1F2	Fuse, 2 Amp, Slow Blow	FB25	MDL-250V-2A	71400
B A1F2	Fuse, 1/2 Amp, Slow Blow	FB13	323.500	75915
A1L1	Ferrite Bead	LX16	11-622-B	33062
A1L2	Inductor	139-3036	139-3036	37338
A1Q1	Transistor, Field Effect, N Channel	QA04	IRF130	81483
A1Q2	Transistor, Field Effect, N Channel	QA04	IRF130	81483
▌ A1R1	Resistor, Wirewound, 1.0 ohms, 5% 15W	RS05	HLM15-1.0 Ohms-5%	35005
A1R2	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G	36002
A1R3	Resistor, Film, 0.39 ohms, 5% 1/2W	RP17	A31-0.39 Ohms-5%	36002
A1T1	Transformer	139-3013	139-3013	37338
A1XF1	Fuse Block, 2-pole	FA25	357002	75915
A2	RF Oscillator PCB Assembly	139-3011	139-3011	37338
A2C1	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL	56289
A2C2	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL	56289
A2C3	Capacitor, Mica, 180pF 2%, 500V	CB28	CM05FD181G03	14655
A2C4	Capacitor, Variable, 0.8-16pF	CY18	527-000	72982
A2C5	Capacitor, Mica, 47pF 2%, 500V	CB21	CM05ED470G03	14655
A2C6	Capacitor, Mica, 1000pF 2%, 500V	CB37	CM06FD102G03	14655
A2C7	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL	56289
A2C8	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL	56289
A2CR1	Diode	QK09	1N6263	50434
A2CR2	Diode	QAP29	1N4938	01295
A2CR3	Diode	QAP29	1N4938	01295
A2L1	Ferrite Bead	LX16	11-622-B	33062
A2L2	Inductor, Weeductor, 1000uH	LAP39	SWD1000	00213
A2Q1	Transistor, NPN	QAP06	2N2222	04713
A2Q2	Transistor, NPN	QAP06	2N2222	04713
A2Q3	Transistor, NPN	QAP05	2N2219	04713
A2Q4	Transistor, PNP	QAP08	2N2905	04713
A2R1	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G	36002
A2R2	Resistor, Film, 8200 ohms, 2% 1/2W	RD06	RL20S822G	36002
A2R3	Resistor, Film, 1000 ohms, 2% 1/2W	RAP09	RL20S102G	36002
A2R4	Resistor, Film, 180 ohms, 2% 1/2W	RAP06	RL20S181G	36002
A2R5	Resistor, Film, 27K ohms, 2% 1/2W	RD12	RL20S273G	36002
A2R6	Resistor, Film, 1000 ohms, 2% 1/2W	RAP09	RL20S102G	36002
A2R7	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G	36002
A2R8	Resistor, Film, 100 ohms, 2% 1/2W	RAP05	RL20S101G	36002

Table 3 Reference Designation Index - NAPE12 RF Driver Module (Continued)

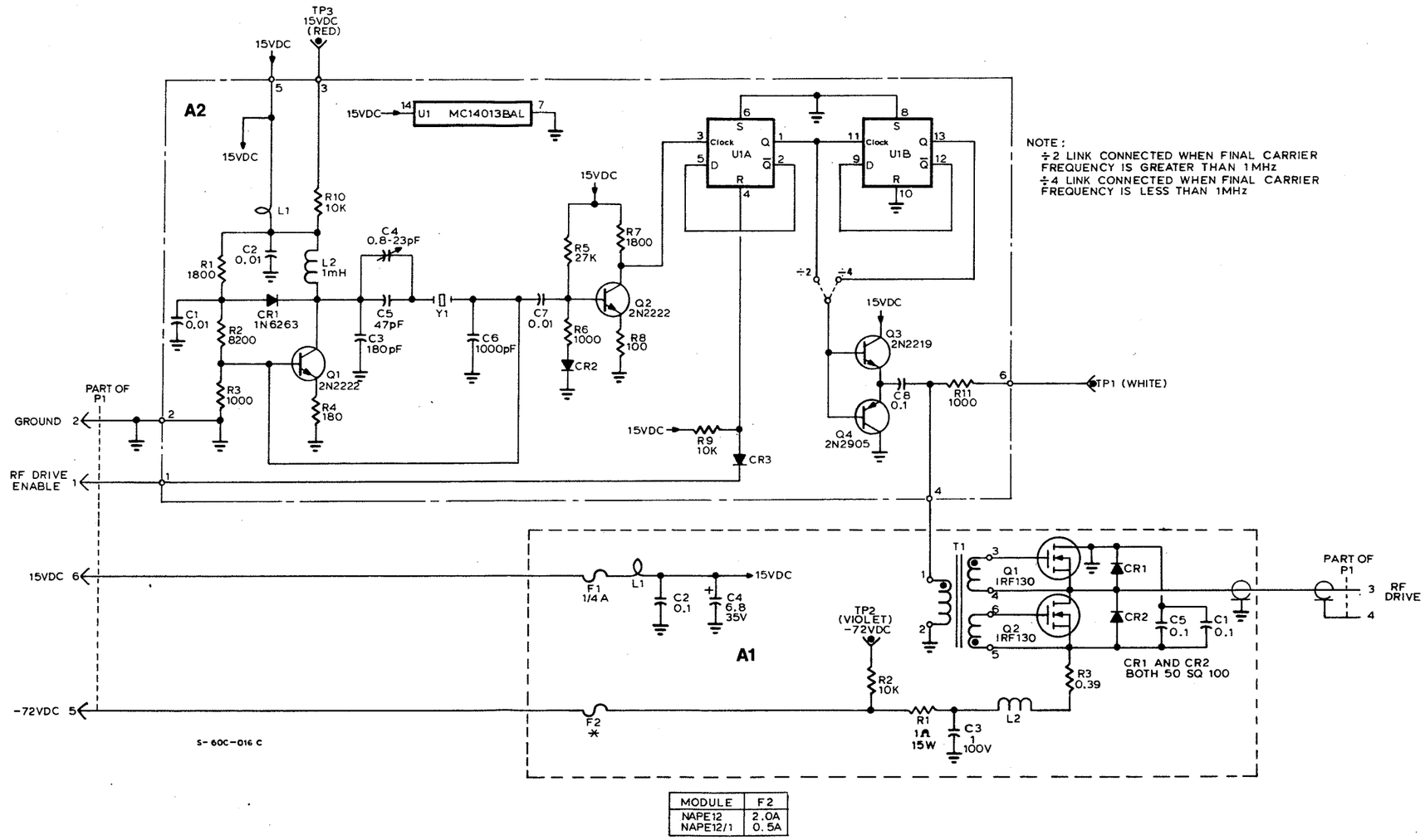
REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN, MIL OR MFR PART NO.	(OEM) MFR CODE
A2R9	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G	36002
A2R10	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G	36002
A2R11	Resistor, Film, 1000 ohms, 2% 1/2W	RAP09	RL20S102G	36002
A2U1	IC, Dual Type D Flip Flop	UB15	MC14013BAL	04713
A2XU1	Socket, IC, 14-pin	UC02	640-357-1	00779
A2Y1	Crystal (Determined by Carrier Freq)	XA19	A061DXA-50	00809
A2XY1	Crystal Socket	BAP39	8000-DG4	91506
P1	Connector, Plug, 6-pin	JD09	P-3306-AB	13150
TP1	Jack, Tip, White	J021	450-4355-1-0319	71279
TP2	Jack, Tip, Violet	J020	450-4355-1-0317	71279
TP3	Jack, Tip, Red	J019	450-4355-1-0312	71279

A in 'Ref Des' column denotes used in NAPE12
B in 'Ref Des' column denotes used in NAPE12/1

Table 4 Quantities Per Unit Index - NAPE12 RF Driver Module

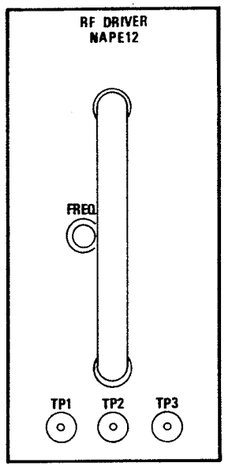
NAUTEL'S PART NO.	NAME OF PART AND DESCRIPTION	JAN, MIL OR MFR PART NO.	(OEM) MFR CODE	TOTAL IDENT PARTS
NAPE12	RF Driver Module	139-3002	37338	REF
139-3008	RF Drive Assembly	139-3008	37338	1
139-3011	RF Oscillator PCB Assembly	139-3011	37338	1
139-3013	Transformer	139-3013	37338	1
139-3036	Inductor	139-3036	37338	1
BAP39	Crystal Socket	8000-DG4	91506	1
CB21	Capacitor, Mica, 47pF 2%, 500V	CM05ED470G03	14655	1
CB28	Capacitor, Mica, 180pF 2%, 500V	CM05FD181G03	14655	1
CB37	Capacitor, Mica, 1000pF 2%, 500V	CM06FD102G03	14655	1
CCG04	Capacitor, Ceramic, 0.01uF 10%, 100V	CKR05BX103KL	56289	3
CCG07	Capacitor, Ceramic, 0.1uF 10%, 100V	CKR06BX104KL	56289	4
CCP19	Capacitor, Tantalum, 6.8uF 10%, 35V	CSR13F685KM	56289	1
CNP11	Capacitor, Plastic, 1.0uF 10%, 100V	MFP1W1-10	14655	1
CY18	Capacitor, Variable, 0.8-16pF	527-000	72982	1
FA25	Fuse Block, 2-pole	357002	75915	1
FB11	Fuse, 0.25 Amp, Slow Blow	323.250	75915	1
FB13	Fuse, 1/2 Amp, Slow Blow	323.500	75915	1 B
FB25	Fuse, 2 Amp, Slow Blow	MDL-250V-2A	71400	1 A
JD09	Connector, Plug, 6-pin	P-3306-AB	13150	1
J019	Jack, Tip, Red	450-4355-1-0312	71279	1
J020	Jack, Tip, Violet	450-4355-1-0317	71279	1
J021	Jack, Tip, White	450-4355-1-0319	71279	1
LAP39	Inductor, Weeductor, 1000uH	SWD1000	00213	1
LX16	Ferrite Bead	11-622-B	33062	2
QA04	Transistor, Field Effect, N Channel	IRF130	81483	2
QAP05	Transistor, NPN	2N2219	04713	1
QAP06	Transistor, NPN	2N2222	04713	2
QAP08	Transistor, PNP	2N2905	04713	1
QAP29	Diode	1N4938	01295	2
QK09	Diode	1N6263	50434	1
QL10	Diode	50 SQ 100	81483	2
RAP05	Resistor, Film, 100 ohms, 2% 1/2W	RL20S101G	36002	1
RAP06	Resistor, Film, 180 ohms, 2% 1/2W	RL20S181G	36002	1
RAP09	Resistor, Film, 1000 ohms, 2% 1/2W	RL20S102G	36002	3
RAP10	Resistor, Film, 1800 ohms, 2% 1/2W	RL20S182G	36002	2
RAP13	Resistor, Film, 10K ohms, 2% 1/2W	RL20S103G	36002	3
RD06	Resistor, Film, 8200 ohms, 2% 1/2W	RL20S822G	36002	1
RD12	Resistor, Film, 27K ohms, 2% 1/2W	RL20S273G	36002	1
RP17	Resistor, Film, 0.39 ohms, 5% 1/2W	A31-0.39 Ohms-5%	36002	1
RS05	Resistor, Wirewound, 1.0 ohms, 5% 15W	HLM15-1.0 Ohms-5%	35005	1
UB15	IC, Dual Type D Flip Flop	MC14013BAL	04713	1
UC02	Socket, IC, 14-pin	640-357-1	00779	1
XA19	Crystal (Determined by Carrier Freq)	A061DXA-50	00809	1

A in 'Total Ident Parts' column denotes used in NAPE12 only
B in 'Total Ident Parts' column denotes used in NAPE12/1 only



MODULE	F2
NAPE12	2.0A
NAPE12/1	0.5A

Figure 3 Electrical Schematic - NAPE12 RF Driver Module



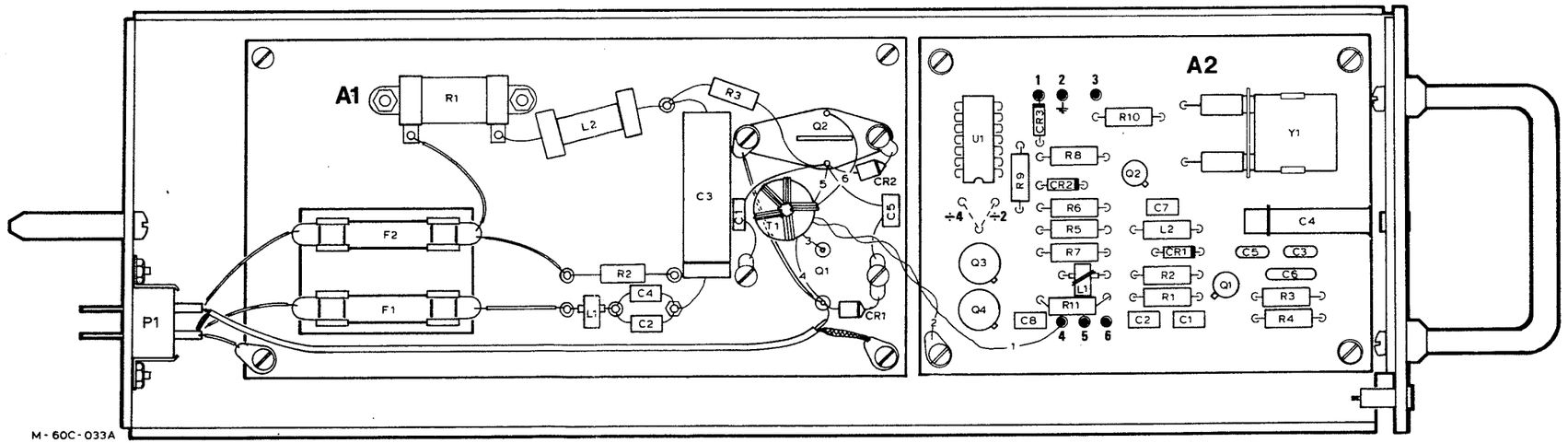
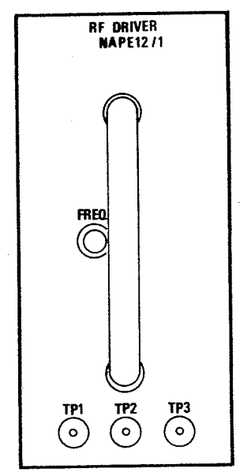


Figure 4 Assembly Detail - NAPE12 RF Driver Module



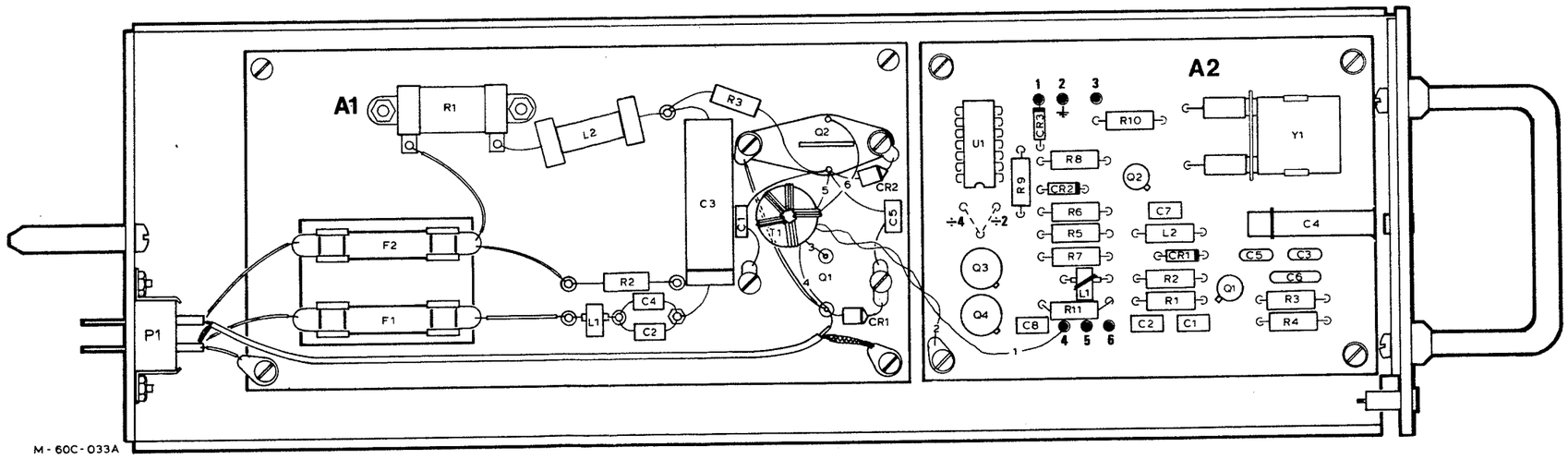


Figure 5 Assembly Detail - NAPE12/1 RF Driver Module