COMMON SYSTEMS MULTIFREQUENCY SIGNAL GENERATOR CIRCUIT

CHANGES

B. Changes In Apparatus

B.01 Superseded (App Fig. 1)	Superseded By (App Fig. 1)
C0 Capacitor 0.01 µF KS-13368 L26	C0 Capacitor 0.01 µF KS-16742 L31
C1 Capacitor 5900 µF KS-13368 L32	C1 Capacitor 5900 PF KS-16742 L32
C2 Capacitor 7430 µµF KS-13368 L27	C2 Capacitor 7410 PF KS-16742 L32
C4 Capacitor 5200 µµF KS-13368 L32	C4 Capacitor 5170 PF KS-16742 L32
C7 Capacitor 5870 µµF KS-13368 L32	C7 Capacitor 5830 PF KS-16742 L32
C10 Capacitor 4500 µµF KS-13368 L32	C10 Capacitor 4480 PF KS-16742 L32
CA0 Capacitor KS-14056 L34	Any below trimmer values per Note 105 are typical: KS-16958 L34
CA1 Capacitor 51 µµF KS-14056 L34	CA1 Capacitor 51.1 PF KS-16958 L34
CA2 Capacitor 100 µµF KS-14056 L34	CA2 Capacitor 100 PF KS-16958 L34

Superseded (Cont) (App Fig. 1)	Superseded By (App Fig. 1)
CA4 Capacitor 150 µµF KS-14056 L34	CA4 Capacitor 147 PF KS-16958 L34
CA7 Capacitor 200 µµF KS-14056 L34	CA7 Capacitor 196 PF KS-16958 L34
CA10 Capacitor 240 µµF KS-14056 L34	CA10 Capacitor 237 PF KS-16958 L34
CB0, CB1, CB2, CB4, CB7, and CB10 - 0.01 µF all 594G	CB0, CB1, CB2, CB4, CB7, and CB10 - 0.01 µF all KS-20977 L4
D5 Resistor 0.75 Ohm 227C	D5 Resistor 0.75 Ohm KS-14603 L3AD

D. Description of Changes

D.01 Circuit Notes 104 and 105 are revised and clarified so that they are in closer agreement with BSP 179-603-501.

D.02 Capacitor codes are changed to reduce manufacturing costs. Because certain values were not exactly available in the new codes, Circuit Note 110 is added to record the insignificant difference, if any,

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between the old and new replacement codes. Because this circuit uses trimmer capacitors in frequency alignment anyway, the slight change in values is of no consequence to the frequency precision of this circuit.

D.03 Information Note 301 is added to explain resistor, capacitor, and voltage terminologies.

D.04 Table A is corrected to include the SXS-OGT INCPT circuit which is connected to this circuit.

F. Changes in CD SECTION III

F.01 In 4. CONNECTING CIRCUITS, under 4.01 (b), add the following connecting circuits:

SD-32375-01 (ANI-C), or

SD-35017-01 (ANI-D)

F.02 Under 4.01 add the following:

(p) Outgoing Intercept Trunk - SD-35057-01.

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DEPT 5242-DAJ

WE DEPT 45830-WCR-WEA-GLW

COMMON SYSTEMS
MULTIFREQUENCY SIGNAL
GENERATOR CIRCUIT

CHANGES

D. Description of Changes

D.1 Table A is changed to delete reference to "SXS Intertoll Dialing with CAMA, Manual Test Circuit," since that circuit was never changed to connect to this circuit.

D.2 The rating of this circuit is changed to rate it as A&M Only for the SXS Automatic Outgoing Trunk Test (AOTT) Circuit, SD-32504-01.

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DEPT 5245

WE DEPT 25830-WCR-GWC-VK

F. Changes in CD Section III

F.1 In 4. CONNECTING CIRCUITS, add the following under Common Systems:

(b.1) Automatic Trunk Test Circuit - ANI-B SD-95889-01.

F.2 In 4. CONNECTING CIRCUITS, add also under SXS Systems:

(p) ANI Outpulser Circuits, Type C - SD-32375-01, Type D - SD-35017-01.

(q) Automatic Trunk Test Circuit - SD-32315-01.

(r) Automatic Outgoing Trunk Test System - SD-32504-01 (A&M Only).

COMMON SYSTEMS
MULTIFREQUENCY SIGNAL
GENERATOR CIRCUIT

TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit provides connecting circuits with as many as six individual or multipled signal frequencies ranging from 700 to 1700 Hz, upon application of a direct current voltage closure by a controlling circuit.

2. GENERAL DESCRIPTION OF OPERATION

2.01 The multifrequency signal generator circuit is a set of six transistor oscillators providing the signal frequencies for the transmission of MF signaling through a single signaling circuit such as an auxiliary sender, ANI outpulser, OGT test frame or OGT testboard in a building not equipped with a MF current supply and distribution circuit.

2.02 Since the multifrequency signal generator is provided on a circuit per signal output basis it is not equipped with a frequency failure alarm, reserve osciallator, or automatic oscillator transfer on failure. If 20 or more multifrequency signal generator circuits are required in one building the provision of an MF current supply and distribution circuit should be considered.

2.03 Six frequencies from 700 to 1700 Hz are generated at a level of approximately 2.4 volts into an 1100-ohm load at terminal 5 of the oscillator transformer. The F- output resistors prevent overloading of the oscillators and limit the output level applied to a trunk (through an approved network) to -3 dBm, -6 dBm or -8 dBm per tone, ± 1 dBm (45 to 50 volts) or ± 1-1/2 dBm (42.75 to 52.5 volts).

SECTION II - DETAILED DESCRIPTION

1. START OF GENERATOR

1.01 The power for operating the six transistor oscillators of the MF signal generator circuit is derived from a single potentiometer circuit from 48-volt battery to ground. With the associated circuit normal the potentiometer is open between leads GS and GS-1. As the associated circuit moves from normal it closes a contact connecting lead GS to lead GS-1 and the six oscillators start. No warmup time is required and the output voltage and wave shape from each osciallator is normal in less than 0.3 millisecond.

2. GENERATION OF FREQUENCIES

2.01 The transistor operates as a current amplifier. A change is current in the emitter will cause a larger change in current in the collector when operating with the normal voltage between the collector and the base. Voltage amplification is also obtained since the emitter circuit is much lower in impedance than the

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collector. The emitter current and the collector current are in phase with each other.

2.02 Sufficient amplification is obtained from a transistor for it to be used to drive a tuned circuit and therefore to act as an oscillator. In the arrangement used in this circuit, energy is fed from a winding inductively coupled to the tuned circuit, consisting of the transformer winding and the capacitor C- to the emitter. The transformer is designed so that the collector is connected to the point of proper impedance on the tuned circuit. Bias current for the emitter is obtained by connecting the base to a low negative voltage. The direct current voltage for the emitter is supplied through part of the tuned circuit.

2.03 The possibility of high-frequency ringing is damped by added capacitance across the secondary winding of the transformer of each oscillator stage. Option Q provides capacitor CB- to each oscillator for this feature.

2.04 When the GS1 and GS-1 leads are closed through, direct current voltage is applied to the transistor. The voltage across the tuned circuit will build up to the point where the power losses in the tuned circuit at the various loads connected to it will equal the power supplied by the transistor. Since the power obtainable for a transistor decreases sharply as the peak of the alternating current voltage applied to the collector closely approaches that of the direct current voltage between the collector and the base, the output stabilizes at this point and is approximately the same for all transistors. The output level is also fairly independent of the load applied so long as the ability of the transistor to supply power is not exceeded.

2.05 The F- resistors in the output leads are provided to improve the impedance match with the trunk and reduce the tone levels to the required transmission level. The power supplied by an oscillator to a 600-ohm or 900-ohm load connected to the output of the repeating coil in a sender is -3 dBm per tone for oscillators equipped with X option, -6 dBm per tone for oscillators equipped with V option, -8 dBm per tone for oscillators equipped with W option and -8 dBm per tone for oscillators equipped with S option when the sender is equipped with hybrid coils.

2.06 The cross-connection to V- points on the voltage divider are made so that the proper output voltage will be available. The potentiometers P- vary feedback in the oscillators, therefore controlling the oscillator output impedance. The output voltage of an oscillator into an 1100-ohm load is approximately 2.4 volts and is within 0.15 volts of any other oscillator. The minimum output voltage is 2.15 volts.

3. MULTIFREQUENCY PULSING

3.01 Six frequencies in steps of 200 cycles from 700 to 1700 cycles are used. The first five are assigned on a 2-out-of-5 basis to the digits 0 to 9 and the sixth is used in combination with others of the first five for a gate opener or keypulse signal and for a "start" or "end" of pulse signal. These frequencies are assigned designations 0, 1, 2, 4, 7, and 10 so as to fit in with standard additive 2-out-of-5 code. The frequencies and their assignments are as follows:

	FREQUENCY					
	700	900	1100	1300	1500	1700
	DESIGNATION					
Digit	0	1	2	4	7	10
0				X	X	
1	X	X				
2	X		X			
3		X	X			
4	X			X		
5		X		X		
6			X	X		
7	X				X	
8		X			X	
9			X		X	
Key Pulse			X			X
Start Pulse					X	X

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Pulse Lead Length - The multifrequency signal generator circuit shall be mounted as closely as possible to the circuit with which it is associated; the maximum length of the 0, 1, 2, 4, 7, and 10 signal leads is specified in Equipment Note 201.

1.02 Voltage Limits -

Voltage	Min	Max	Output Level Tolerance
-48	-45	-50	± 1 dB
-48	-42.75	-52.5	± 1-1/2 dB

2. FUNCTIONAL DESIGNATIONS

2.01 None.

3. FUNCTIONS

3.01 To provide 700, 900, 1100, 1300, 1500, and 1700 cycle ±1 percent frequencies for a single signaling circuit for MF signal pulsing.

3.02 To provide through a suitable sending circuit, -3 dBm, -6 dBm, or -8 dBm per frequency to a 600-ohm or 900-ohm termination.

3.03 To provide full output voltage and optimum wave shape after the first half cycle of oscillation, when direct current voltage is applied to the oscillators.

3.04 To cease oscillation when the direct current voltage is removed from the oscillators.

3.05 To have the cross modulation products of any two frequencies fed into a linear load be at a level not highter than -36 dBm.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a keysheet, the information thereon is to be followed.

Common Systems

(a) Auxiliary Sender Circuit - SD-96479-01

(b) ANI Outpulser Circuit - SD-95811-01.

(c) Pulse Converter Circuit DP to MF - SD-96453-01.

(d) Line Concentrator No. 1A - Control End - SD-95971-01.

(e) Line Concentrator No. 1A - Remote End - SD-95972-01.

(f) Test Control Circuit - SD-96587-01.

Toll Systems

(g) 2-Way Trunk Circuit - SD-56475-01*.

(h) Recording and Completing Trunk - SD-56478-01*.

(i) Toll Switching Trunk - SD-56509-01*.

Panel Systems

(j) Outgoing Trunk Testboard - SD-21610-01.

Crossbar System No. 1 or Crossbar Tandem

(k) Outgoing Trunk Test Frame - SD-25177-01.

(l) Remote Office Test Line for use with CAROT - SD-28067-01.

SXS Systems

(m) Manual - Outgoing Trunk Test Frame Test Circuit - SD-32349-01.

(n) Automatic Outgoing Trunk Test Frame - SD-32504-01.

(o) Remote Office Test Line Circuit - SD-32521-01.

*Typical

5. MANUFACTURING TEST REQUIREMENTS

5.01 The sender shall be capable of performing all the functions listed in this circuit description and shall meet the requirements listed in the Circuit Requirements Table and Circuit Note.

6. TAKING EQUIPMENT OUT OF SERVICE

6.01 When the MF signal generator circuit is to be removed from service for calibration or repair, make busy the associated auxiliary sender, ANI outpulser, etc. in accordance with the TEOS information in the associated circuit CD.

7. ALARM INFORMATION

7.01 If the fuse alarm functions, make busy the associated auxiliary sender,

ANI outpulser, etc, until the trouble is cleared and the fuse replaced.

SECTION IV - REASONS FOR REISSUE

B. Changes in Apparatus

B.01

Superseded		Superseded By
C0 Capacitor KS-13368,L-14	0.01 UF	L-26
C1 Capacitor KS-13368,L-13	5900 UUF	L-32
C2 Capacitor KS-13368,L-13	7430 UUF	L-27
C4 Capacitor KS-13368,L-13	5200 UUF	L-32
C7 Capacitor KS-13368,L-13	5870 UUF	L-32
C10 Capacitor KS-13368,L-13	4500 UUF	L-32
CA0 Capacitor KS-14056,L1	(Various Trimmer Values:	L-34
CA1 Capacitor KS-14056,L1	51,	L-34
CA2 Capacitor KS-14056,L1	100,	L-34
CA4 Capacitor KS-14056,L1	150,	L-34
	200,	
CA7 Capacitor KS-14056,L1	240 UUF	L-34
CA10 Capacitor KS-14056,L1	Per Circuit Note 105)	L-34

Superseded		Superseded By
D2 Resistor 145C, 215Ω		KS-20810, L-1A
D3 Resistor 145C, 215Ω		KS-20810, L-1A
F0 Resistor 145A	(Value in Ohms:	KS-20810, L-1A
F1 Resistor 145A	536, S Option	KS-20810, L-1A
F2 Resistor 145A	634, V Option	KS-20810, L-1A
F4 Resistor 145A	845, W Option	KS-20810, L-1A
F7 Resistor 145A	412, X Option)	KS-20810, L-1A

D. Description of Changes

D.01 Reference to Table A is made on FS1, sheet 2.

D.02 Table A is revised to add references to No. 1 crossbar ROTL for options W or V.

D.03 Table A is referenced in CADs 3, 4, and 5, sheet 4.

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