NEW ZEALAND POST OFFICE,
ENGINEER-IN-CHIEF'S OFFICE,
WELLINGTON,
NEW ZEALAND.

ER/TP: 2033
ISSUE: 1
DATE: DECEMBER 1975

ENGINEERING REPORT

ESTABLISHMENT OF TONE LEVEL STANDARDS FOR THE NZPO TELEPHONE NETWORK

FILE REFERENCE: EIC 393/33

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This Report establishes standards for the levels of supervisory tones in the New Zealand Telephone Network and provides data on measuring and adjusting tone levels for various types of exchange.

CONTENTS

1. SCOPE.

1.1 The object of this Report is to specify suitable power levels of supervisory tones for the New Zealand exchange switching network in accordance with international standards and to indicate appropriate techniques whereby levels at exchanges throughout New Zealand can be adjusted to comply with these standards.

2. GENERAL.

2.1 At present the instructions issued for the standards of tone levels in exchanges require the technician to listen to the tones on the AER or RER, and adjust if the volume, pitch and quality are not satisfactory. (Ref. TELES Auto B 5651).

2.2 In contrast, the British Post Office, have prepared a detailed specification of tone levels for various types of exchanges, ref. BPO E.I. POWER Machines and Switchboards C 3903.

2.3 The CCITT have recommended acceptable levels for tone on international circuits, ref. CCITT - Green Book Vol. VI Q 35, which indicates that "Supervisory tone levels should not be more than -5 dBm or less than -15 dBm, nominally -10 dBm, at the zero level relative point at the incoming end of the international circuit". As a basic premise of this report it is intended to comply with the CCITT recommendation for tone levels and establish practical limits for the adjustment of all tones based on the CCITT recommendation.

2.4 In accordance with the 1975 Transmission Plan (TRANS Teles B2000), the zero level relative point in the NZPO switching network will be at the local exchange. To simplify the requirements for tone level adjustment this will be taken as the level at the exchange MDF.

3. EXISTING TONE LEVELS.

3.1 Present Practice. As the supervisory tone levels in NZPO exchanges have not been specified, the installing technician adjusts the tones to a level that sounds satisfactory. It is unlikely that they would be changed in the life of the exchange.

3.2 A series of samples of tone levels were taken in the Wellington area during investigations for a previous report on tone levels ("Report on the Investigations of Tone Levels in the NZPO network" Draft). These tones (measured at the MDF reference point) ranged from -11.25 (Busy Tone) to +4.75 dBm (Ringing Tone) at one exchange, and -13.25 dBm (Dial Tone) to +0.25 dBm (Ringing Tone) at another, i.e., a maximum variation of approximately 16 dBm.

3.3 A number of tone level samples have been taken at crossbar exchanges in the Wellington District. These exchanges were the Ashhurst (NC230), and the Wellington GCX (NC400). The tone level values measured both "as supplied" and following on site adjustment are detailed in Appendix II.

4. RINGING AND TONE MACHINES FOR STEP EXCHANGES.

4.1 Specification. The ringing and tone machines are rated at 46 volts input and are capable of working at normal exchange voltages (i.e., up to 52 volts). The normal machine speed at the rated voltage, (46 volts), is 1000 rpm for 16⅔ Hz machines and 1500 rpm for 25 Hz machines.

4.2 Results of Tests. Because NZTO ringing machines are not governed, their speed when working at 52 volts was found to be higher than normal with a corresponding increase in frequency. However, the power output of the supervisory tones was found to be relatively constant.

4.3 Maximum Output Level. The ringing and tone machines tested were capable of producing supervisory tones in the order of +17 dBm to +20 dBm, measured at the machine. This level would adequately satisfy all foreseeable exchange requirements.

5. RINGING AND TONE GENERATORS FOR NEC CROSSBAR EXCHANGES.

5.1 The NC 100, NC 230, NC 400, NC 460 and NC 820 exchanges are equipped with solid state tone generators.

5.1.1 These tone generators are 48 volt powered and generate frequencies of 2 400, 400 + 450, and 900 Hz. The generator interrupts these frequencies w[illegible] required, to form the necessary cadences and tones for all the above exchanges.

5.1.2 This equipment comes complete with a standby system and will switch over to the standby when a fault is encounted on one of the supplies.

5.2 This ring and tone equipment although it is incorporated within the same cabinet consists of several sub circuits of equipment.

These are as follows:

Unit	Qty	Remarks
CTL(R) Unit	1	
RY(R) Unit	1	
INT Unit	2	No. 1 and No. 2
RG Unit	2	No. 1 and No. 2
FIL Unit	1	
TRF Unit	1	
TB Unit	1	

(i) CTL(R) Unit

This unit consists of push-button switches, circuit transfer switch, voltmeter, pilot lamp, and fuses.

(ii) RY(R) Unit

This unit consists of relays required for controlling the equipment, a circuit for supervising output voltage from 25-Hz power supply section and a circuit for supervising interrupting operation.

(iii) INT Unit

This unit consists of a timing circuit including integrated circuits (the main circuit for interrupting the signals), a signal monitor section for supervising the signalling condition and giving a visual indication by means of luminous diodes, an automatic voltage regulator (AVR) for ICs, etc.

(iv) RG Unit

This unit consists of an AVR section and power supply section for various signals of 25 Hz, 400 Hz, 400 + 450 Hz, and 900 Hz.

(v) FIL Unit

This unit consists of an input filter, (NFB) and a DC electromagnetic contactor for switching the operating unit.

(vi) TRF Unit

This unit consists of interrupted output transfer relays and a signal transformer which converts the interrupted output signals into the required voltage levels.

(vii) TB Unit

This unit consists of input/output terminals, signal transfer terminals and a service outlet for the buzzer.

5.3 The composition and nominal capacity of signal power supply section of the RG Unit are shown in the table below:

Designation	Type of Exchange	Capacity in Watts	Nominal Capacity of Each Signal Power Supply Section (W)			
			25Hz	400Hz	400+450Hz	900Hz
10-S-S RINGER	NC100, 820	10 Watts	10	3	1	0.5
30-S-S RINGER	NC230	30 Watts	30	9	3	1.5
50-S-S RINGER	NC460	50 Watts	50	15	5	2.5
100-S-S RINGER	NC400	100 Watts	100	30	10	5
150-S-S RINGER	Large NC400	150 Watts	150	15	15	7.5

6. PROPOSED TONE LEVELS FOR THE NZPO NETWORK. (See appendix 4 for timing and cadence chart).

6.1 Dial Tone (400 Hz)

6.1.1 As these tones are always sent to the calling subscriber from his local exchange, it is only necessary to consider the circuit between the exchange and the calling subscriber.

6.1.2 CCITT assume a mean speech level at the zero relative level point of ~~-11 dBm~~ -15 dBm. A nominal level of dial tone of -10 dBm is therefore specified.

6.1.3 This level of -10 dBm would not overload carrier systems. The only carrier systems between an exchange and calling subscribers at present (apart from OBS systems on a few foreign exchange lines) are rural carrier systems. No problems are anticipated with future subscribers carrier systems (e.g., PCM) with the -10 dBm tone.

6.2 Busy Tone, Number unobtainable Tone and Ring Tone (400 Hz, 400 Hz, and 400 + 450 Hz) respectively.

6.2.1 (a) All crossbar connection (non-toll).

(i) Busy tone and NU tone are fed from the originating crossbar exchange (TKT) to the calling subscriber.

(ii) Ring tone is fed from the terminating crossbar exchange (ICT) to the calling subscriber.

(b) All crossbar connection (toll).

Refer to para. 8.4

6.2.2 Mixed step and crossbar connection or all step connection.

All three tones are transmitted back from the terminating exchange to the calling subscriber as follows:

Terminating exchange	BT	NUT	RT
Step	FS	GS/FS	FS
Crossbar	TKT	TKT	ICT

6.2.3 This places two restraints on the acceptable range of levels:

(a) The level must be sufficiently high so that it is still reasonably audible after passing through the chain of junction and/or trunk circuits, remembering that suitable attenuators are in the speech circuit until the "called subscriber answer" condition is received.

(b) It must not be so high that it overloads trunk or junction FDM carrier systems.

6.2.4 In the New Zealand telephone network the local exchange is considered to be the zero level relative point (Refer 1975 Transmission Plan, Transmission Telephone B 2000).

6.2.5 The specified level of these three tones at this LX is to be -10 dBm for the following reasons:

(a) CCITT (ref Q35) recommends that for international calls the nominal signalling level of -10 dBm at the zero level relative point is to be achieved at the incoming country. For transmission purposes the terminal exchange is originating these tones.

(b) This proposed level of -10 dBm may appear low from an audibility point of view, however, it is undesirable to raise this level because of carrier overloading problems.

(c) People with hearing impediments may have difficulty hearing these tones from a 20 dB connection. However, as a 20 dB LX-LX loss and a 10 dB loop would be a rare occurrence under STD conditions and, as the supervisory tones are interrupted, this is not thought to be a problem.

6.3 Disconnect Tone (DCT) (previously known as "Overflow Busy Tone"); Answer Tone.

6.3.1 These are 900 Hz tones, continuous or interrupted. (See Appendix III)

6.3.2 Disconnect tone was previously referred to as Overflow Busy Tone (OFBT). However, with the widespread use of this tone in conjunction with time-out facilities (line lock-out) in crossbar exchanges it was decided to change its title (Ref. EIC 392/3, 17 July 1975).

6.3.3 The level of these 900 Hz tones is specified at -15 dBm at the zero level relative point (i.e., the local exchange) for the following reasons:

(a) Measurements made in the laboratory B Ref. ER/TP 1198, "Supervisory Tone Levels Proposed for the Telephone Network" indicate that a 900 Hz tone has a sound pressure level approximately 5 dB greater than a 400 Hz tone and so the proposed level of -15 dBm would give a level of loudness comparable with that for all other supervisory tones.

(b) The frequency of these tones is outside the range of those frequencies recommended by the CCITT for supervisory purposes.

6.3.4 Problems have been experienced during and after commissioning of crossbar exchanges with level setting of disconnect tone. The feed arrangements on the line circuit are unbalanced whereas all other feed arrangements (e.g., ICT) are balanced and it is difficult with the existing adjustments to supply an acceptably low level tone to the local subscriber without it being unacceptably low to the junction connection.

6.3.5 Until a satisfactory solution is found, the DCT level and crossbar exchanges is to be set to -20 dBm at the MDF from an ICT. Consideration is being given to changing the frequency of DCT, and crossbar exchanges to 400 Hz, with a cadence of 250 ms off, 250 ms on. Retrospective changes to step exchanges may also apply.

6.4 Call Waiting Tones (CWT).

6.4.1 Call waiting service is being provided at NC 400 and NC 460 type exchanges.

6.4.2 There are three tones provided for this service (ref. appendix III):

(i) Call waiting tone A, (400 + 450 Hz modulated, i.e., a pulse of RT) is sent to the called subscriber only. A -10 dBm level will apply.

(ii) Call waiting tone B, (400 Hz pulsed) is superimposed on the speech circuit to both the A and B parties of the original

connection and is to be sent to line at approximately -20 dBm.

(iii) Holding tone (400 Hz and 400 + 450 Hz) is sent back to either the B or C party. A -10 dBm level is to apply.

6.5 Switching Completed Tone. (400 + 450 Hz)

6.5.1 This tone is used by subscribers with Call Diversion service and is used to indicate a successful call transfer when 16X is dialled.

6.5.2 Inverted ring tone is used and is to be set at the MDF at a level of -10 dBm.

6.5.3 This tone will not normally be sent over the junction or trunk network as all lines involved must be connected to the one exchange.

7. SUMMARY OF TONE LEVELS.

7.1 All 400 Hz tones (dial tone, busy tone, number unobtainable tone) and all modulated tones (Ring tone, switching completed-tone, call waiting tone) are to be set at or as near as possible to -10 dBm.

7.2 Generally all 900 Hz tones (Answer tone, number verification tone) are to be set at, or as near as possible to -15 dBm.

7.2. Disconnect Tone (900 Hz) at NEC crossbar exchanges, is to be set to -20

8. MEASURING TECHNIQUE.

8.1 TEST UNIT

8.1.1 All tones are to be measured with the switch unit shown in Appendix 1.

8.1.2 The termination will be either 900 or 600 ohms depending on the nominal impedance of the exchange at which the tones are being measured.

8.1.3 The latest issue of Transmission Telephones, B 2000 will give the necessary information regarding which nominal impedance applies at each particular exchange.

8.2 STEP EXCHANGES.

8.2.1 The level of all tones will be as specified in para. 7 and are to be measured at the MDF terminals of an incoming junction except for dial tone which will be measured at the subs line circuit termination on the MDF.

8.2.2 The measurements must be done with a Transmission measuring set terminated in its high impedance mode. In this way the impedance of the measuring set will not affect the impedance of the termination.

8.2.3 It is recommended that a 0.2-4KHz Siemens Halske level tracer or equivalent measuring set be used as the TMS to avoid sleeving the interrupters on the ringer so that only continuous tone is measured. Also this particular TMS is able to respond to the level of the tones during the ON period of the cadenced signal.

8.2.4 The Siemens Halske set should be used terminated on the 25X position

on the appropriate 900 or 600 ohm range, enabling dBm tone levels to be read directly from the display.

8.2.5 The test telephone is used from the point on connection to dial appropriate digits to gain access to the required tone. Following verification that the correct tone has been received, the key is then thrown connecting the TMS in circuit and the tone level is recorded.

8.2.6 Tones may be obtained in step exchanges as follows.

8.2.7 Dial tone is fed from a first selector A relay tone feed bridge. It may be accessed from the MDF by looping a subscriber's line circuit with the appropriate termination and key unit as shown in Appendix 1.

8.2.8 Number unobtainable tone is generally fed from an A relay bridge. It may be obtained by dialling a spare level (e.g., '9') from an incoming junction.

8.2.9 Disconnect tone is fed from the A relay bridge of all selectors. It may be obtained by busying out all of the free selectors in a particular grading. However it is recommended that on a working exchange a call be set up from an incoming junction, the call traced and then a relay condition set up in the particular selector so that disconnect tone is fed back to the MDF.

8.2.10 Ring tone is fed from the Final selector A relay bridge. This is obtained by dialling to a test telephone across a particular ring tone feed. All exchanges are equipped with three ring tone feeds so it will be necessary to ensure that each supply is measured. Common service circuit will give the allocation of ring tone feeds in individual exchanges.

8.2.11 Busy tone is fed from the Final selector A relay bridge. This is obtained by dialling a busied telephone.

8.2.12 When using the TMS to measure ring tone or Switching Completed tone, (400 + 450 Hz), the wave trace will be a single vertical line. The reading to be taken is the uppermost point of the trace.

8.3 CROSSBAR EXCHANGES (NC 100, NC 230, NC 400, NC 460).

8.3.1 The measurements for crossbar exchanges are essentially the same as enumerated above.

8.3.2 Tones may be obtained in NNC Crossbar exchanges as follows:

8.3.3 Dial tone is fed from the DFOR. It is possible to obtain this tone by looping a subscriber line circuit at the MDF. It must be noted that dial tone drops back to an unbalanced DCT feed after 30 seconds.

8.3.4 Number unobtainable tone is fed from the talkie trunk relay bridge. It may be obtained by dialling a spare level (e.g., '9') from an incoming trunk.

8.3.5 Disconnect tone is fed from the ICTs, IOTs and also the subscribers line circuit. It must not be measured from a subscribers line circuit as this feed is unbalanced and unreliable results would be obtained. A convenient method of obtaining DCT is to dial about 2 digits less than required for a working number. DCT is obtained after about 30 seconds.

8.3.6 Ring tone is fed from the ICT and the ICT relay bridge. This is obtained by dialling a test telephone. All exchanges are equipped with three ring tone feeds so it will be necessary to ensure that each supply is measured. NEC common service circuits will give the allocation of ring tone feeds in individual exchanges.

8.3.7 Busy tone is fed from the talkie trunk. This is obtained by dialling a busied telephone.

8.3.8 Switching completed tone (SCT), is used on the Transfer Number Group Frame (TRNGF). It may be obtained by dialling 16X from a subscriber's line circuit allocated for this facility.

8.3.9 Call Waiting Tones (ref. para. 6.4).

Three telephones are required to be set up at the MDF on subscriber's lines circuits, one of which must be allocated with the Call Waiting facility.

The service operation is outlined in NEP C018 and use should be made of this document in setting up calls to enable all three tones used with the [illegible] to be measured.

8.4 <u>TRUNK EXCHANGES NC 820 and ASCs</u>.

8.4.1 NC 820 exchanges are provided with a 10-S-S solid state ringer as the load requirements are relatively low.

8.4.2 Tones are provided for:

(a) 2-wire terminating equipment (e.g., TELOGT's),

(b) ASCs etc., via the interposition equipment and

(c) time-out and congestion indications for the trunk switching network.

8.4.3 All tone levels must be measured with the Siemens Halske TMS or equivalent terminated in the high impedance mode appropriate to the nominal impedance for the exchange.

8.4.4 The measurements must be done at a two-wire point. The terminal blocks on the MDF of the associated local exchange would be the most convenient point.

8.4.5 For this case it will be necessary to set a terminal repeater for the correct insertion loss and gain given to TRANS Telnes B2000 for this trunking arrangement. This can be achieved by sending a test tone from the MDF into the terminal repeater and measuring at the 4-wire receive point of the terminal repeater with the associated send terminals terminated in 600 ohms. The other direction is measured by sending a test tone into the send direction of the terminal repeater and measuring the terminal block of the MDF with the receive point terminated in 600 ohms.

8.4.6 Trunk exchanges send only 4 tones back onto the trunk network. They are: ring tone, busy tone, number unobtainable tone and disconnect tone. The remaining tones, dial tone and verification tone are used on the TMX (e.g., ASCs) for interposition calling.

8.4.7 To obtain these 4 tones it will be necessary to set up a normal train

call (ref. CO 30295-001) on the Master Test Frame (MTF) to the following equipment:

(1) TELOGT - Ring tone

(2) Reorder trunk (ROT) - Busy tone

(3) Reorder trunk (ROT) - Number unobtainable

(4) Incoming trunk (ICT) - Disconnect tone

8.4.8 It will then be necessary to patch the connection set up from the MTF to the terminal repeater selected.

8.4.9 The 2-wire point is terminated correctly and the tone level measured. The same levels as specified in para. 7 will apply.

8.4.10 Dial tone should be adjusted for operator comfort.

8.4.11 The level of verification tone is adjusted using similar techniques but using an OGT and terminal repeater.

9. ADJUSTMENT FOR STEP EXCHANGE RINGERS.

9.1 Main Exchanges.

9.1.1 At main exchanges, adjustments in the form of choke tappings or resistor capacitor strappings are available for obtaining the required tone levels. The circuits involved are listed below, together with the type of adjustments and reference notes quoted on the GBW circuit diagrams.

CIRCUIT	ADJUSTMENT	GBW REFERENCE NOTE
GBW 14370 (20 + 20 watts)	Choke tappings	Note 6
GBW 14830 (15 watts)	Resistor/capacitor strappings	Note 1
GBW 10901 and MODA (37.5, 75, 150 watts)	Resistor/capacitor strappings	Note 1
GBW 12320 (15 watts)	Resistor/capacitor strappings	Note 1
GBW 13101 and MODA (37.5, 75, 150 watts)	Resistor/capacitor strappings	Note 1
GBW 10900 and MODA (37.5, 75, watts)	Resistor/capacitor strappings	Note 1
GBW 13100 (37.5, 75 150 watts)	Resistor/capacitor strappings	Note 1
GBW 15240/1	Choke tappings	Note 2
GBW 19420 (Geothermal Areas) (15, 37.5, 75 watts)	Choke tappings	Note 2

9.1.2 The adjustments provided give a wide range of levels. However, additional resistors may have to be substituted in some instances to give a specific level of tone.

9.2 UAXs.

9.2.1 The circuits providing the required supervisory tones at UAXs do not incorporate tone level adjustments. The circuits involved are GBW 13690/1, GBW 14520, GBW 16970 and GBW 13720/1/2/3. Required tone levels are as specified in para. 7.

9.2.2 Tests taken at three different UAXs in the Hamilton area in 1972 indicated an overall range in tone levels of -8.6 dBm to -12.4 dBm (average -9.6 dBm) for transistor tone generator types. Within limits of measurement it is considered that this range complies satisfactorily with CCITT limits and, since tone levels at other UAXs (when tone generators are converted to transisterised type) can be expected to be similar, it is not considered necessary to take any special action to adjust tone levels at UAXs throughout New Zealand.

9.3 STEP PABXs.

9.3.1 PABX supervisory tones are to be measured at the terminals of the MDF of the PABX as for other exchanges and adjusted to the limits indicated in para. 7.

9.3.2 PABX supervisory tones fed into the local network are to be measured at the MDF of the local exchange.

9.3.3 All 900 Hz PABX tones are to be adjusted to -15 dBm.

10. ADJUSTMENT FOR NEC CROSSBAR EXCHANGE RINGERS.

10.1 NC 100 Exchanges.

10.1.1 The NC 100 exchange is equipped with a ringer which has adjustable transformer tappings, on a terminal strip in the back of the ringer.

10.2 NC 230 Exchanges.

10.2.1 The NC 230 exchange is equipped with a ringer which has adjustable transformer tappings on a terminal strip in the back of the ringer. There is also an additional adjustable transformer on the MISCF for dial tone, disconnect tone, and ring tone.

10.3 NC 400, NC 460, NC 820 Exchanges.

10.3.1 These exchanges have adjustable transformers on the S.F. These ringers also have adjustable screw tappings on the output transformers of the ringer itself. The method of adjustment is not yet known and has been refused with NEC.

10.4 No information is available at present for crossbar PABXs. However, as soon as this becomes available, it is intended to similarly arrange adjustments (detailed in a subsequent issue of this report) to comply with the standard levels outlined in para. 7.1, 7.2.

11. REFERENCES.

11.1 NZPO Specification G.S. 5.

EIC 719/11, 15.11.74.- Tone levels with reference to a zero level reference point.

BPO E.I. POWER Machines and Switchboards C 3903.

CCITT green book Vol. VI Q 35.

NZPO ER/TP 1198. "Supervisory Tone Levels Proposed for the Telephone Network."

NZPO E.I. TRANSMISSION Telephones B 2000.

Maintenance Manual Part 2 (NC 820) ND-30215-804.

NC 820 CIRCUIT DESCRIPTION CO 30295-001

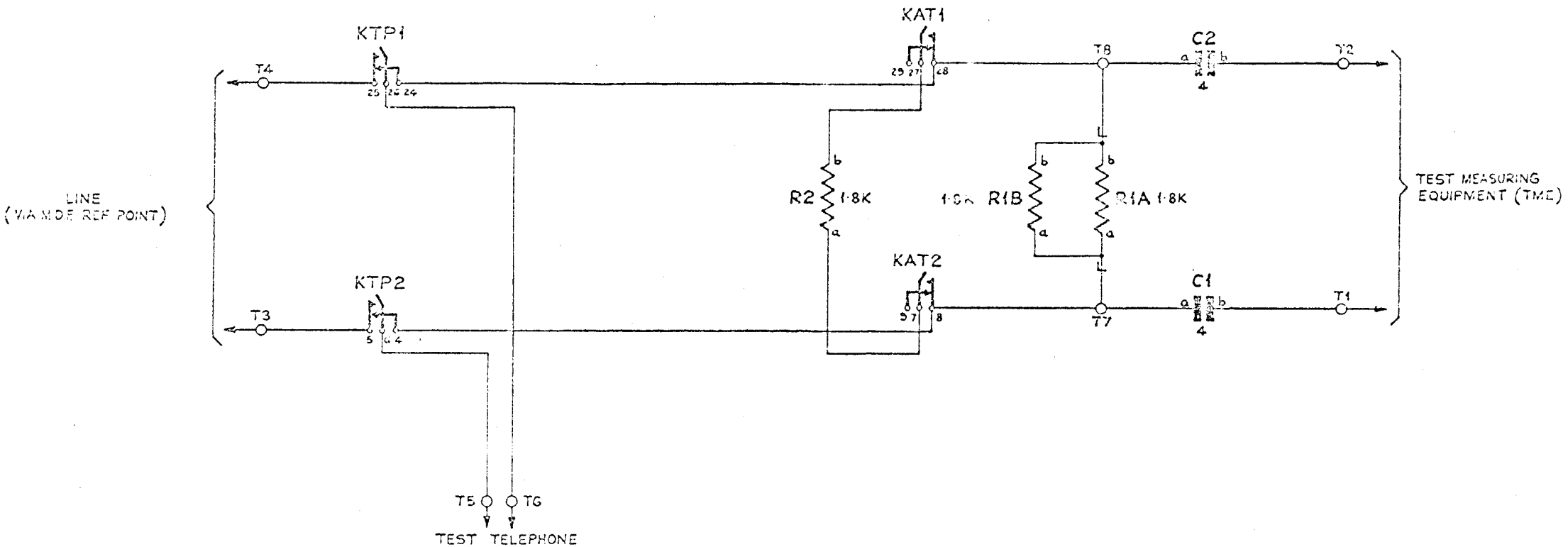
NEP 0018

12. ATTACHMENTS.

12.1 Appendix I - Drawing 40009: Line Switching Unit for use in tone level measurements.

Appendix II - Tone levels at crossbar exchanges tested and adjusted in the Wellington area.

Appendix III - Tones and earth pulses provided at crossbar and step exchanges.



MEASURING (KM) / 2

TEST PHONE (KTP) / 2 + ALTERNATIVE TERMINATION (KAT) / 2

LINE SWITCHING UNIT FOR USE IN TONE LEVEL MEASUREMENTS.

DEL	CKD	APD	ORDER	DATE	ISS	CHANGE
AJB	JE	CJW	68009	19 5 75	A	

NZPO
ENGINEER-IN-CHIEF WELLINGTON
COY No2
1 OF 2
DRAWING No 1000

RELAY CODES AND COMPONENTS LIST

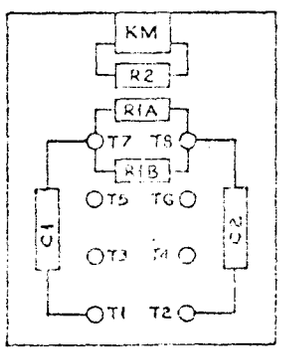
RELAY NAME	BCC CODE	NZPO CODE	BPO CODE	COY CODE	NOTES	STOCK LIST NO

NOTES
A - SPECIAL FACTORS OF SAFETY B - SPECIAL ADJUST. C - CCT POINTS OR MODS

COMPONENT DESIGNATION	BPO CODE	COY CODE	NOTES	STOCK LIST NO
KEY (KM)				521H
KEY CAP			YELLOW	K525D
KEY BOX				K520
CAPACITORS (2 OFF)			4 μf RADIO TYPE	CC615
R1A, R1B, R2			1800 Ω RADIO TYPE (N1)	ER328
SECURING SCREWS			8 BA 2" BRASS COUNTER SUNK	S201

M SC COMPONENTS	NOTES	STOCK LIST NO

LAYOUT



KEY BOX

LINE SWITCHING UNIT FOR USE IN TONE LEVEL MEASUREMENTS.

N.Z.P.O.

APPENDIX II

1. MEASUREMENTS TAKEN AT ASHHURST EXCHANGE (NC 230, 4.6.75).

1.1

Tone	Supplied (dBm)	Adjusted Levels (dBm)
RBTA	-3.5	-5
RBTB	-3.5	-5
RBTC	-3.5	-5
BT	-5.5	-7
NUT	-6	-7.5
DCT	-4.2	-8.5
DT	-8	-12 (line cct)
DCT	-	-16 (line cct)

* Correct values in accordance with para. 8.2.4.

1.1.1 It was found that at Ashhurst it was difficult to obtain the required tone level as the adjustment provided was at the lowest equipped transformer strapping (ref. para. 10.2.1).

1.1.2 All levels were measured at an incoming junction except dial tone. The disconnect tone can also be accessed from the line circuit but it should always be adjusted at an incoming trunk as disconnect tone at the line circuit is an unbalanced tone feed. Dial tone was measured at the line circuit.

2. MEASUREMENTS TAKEN AT WELLINGTON GCX (NC 200, 3.6.75).

2.1 A Unit

Tone	Supplied (dBm)	Adjusted Levels (dBm)
RBTA	-2.5 (approx)	-5 (approx)
RBTB	-2.5 (approx)	-5 (approx)
RBTC	-2.5 (approx)	-5 (approx)
BT	-6	-8
NUT	-6	-8
DCT	-15	-15
SCT	-4 (approx)	-6 (approx)
DT	-17	-8 (line cct)

2.2 B Unit

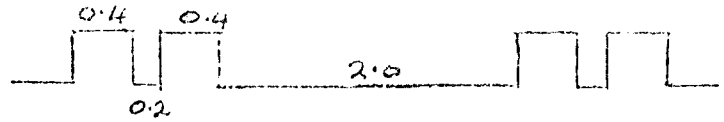
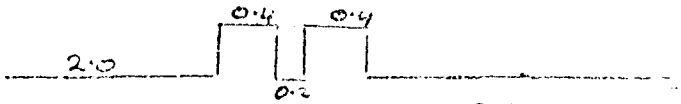
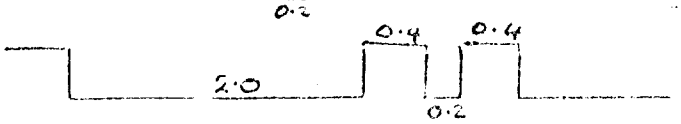
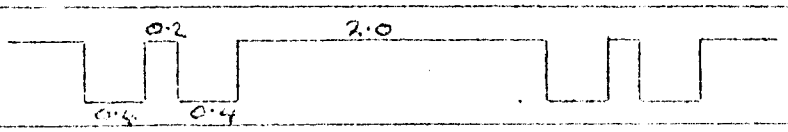
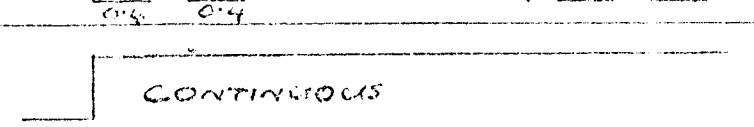
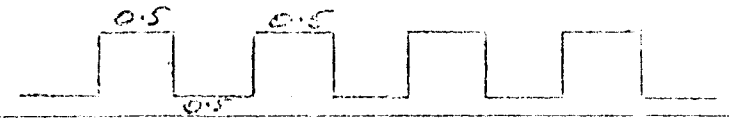
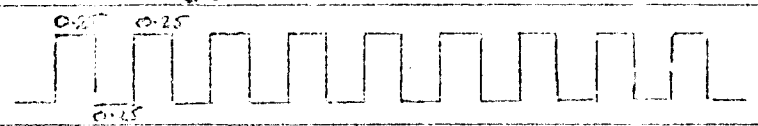
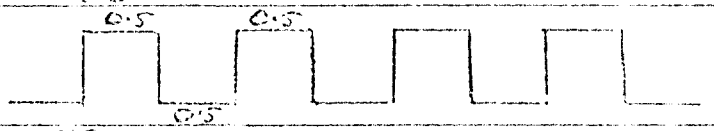
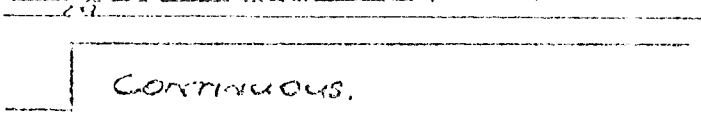
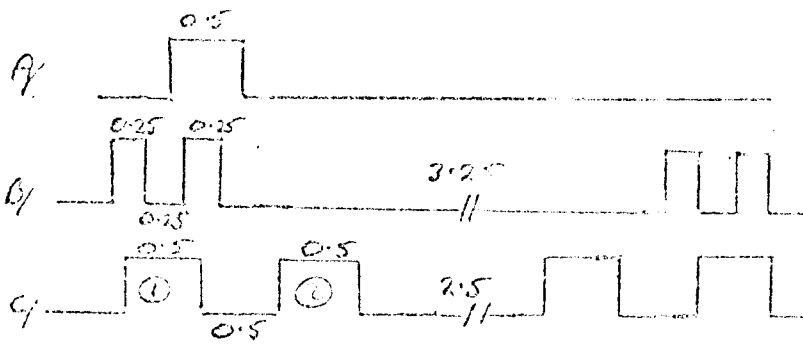
Tone	Supplied (dBm)	Adjusted Level (dBm)
RBTA	-3.5 (approx)	-5 (approx)
RBTB	-3.5 (approx)	-5 (approx)
RBTC	-3.5 (approx)	-5 (approx)
NUT	-6.5	-8.5
DCT	-14	-14
BT	-5	-7
DT	-8	-8

2.3 These levels have been adjusted since to the new standard levels.

END

APPENDIX III

TONES USED IN N2PO NETWORKS

Frequency (Hz)	Timing Chart (Cadence) in Seconds.	NC100/230 ADD STEP	NC400/460	NC820/ASC
300+450		Ring Tone	Ring Tone	Ring Tone
"		"	"	"
"		"	"	"
400+450		Switching Completed Tone (Not Step)	Switching Command Tone	—
400		—	—	Number Verification Tone
400		Present Disconnect Tone	Present Disconnect Tone	Present Disconnect Tone
400		Proposed Disconnect Tone	Proposed Disconnect Tone	Proposed Disconnect Tone
400		Busy Tone	Busy Tone	Busy Tone
400		Number Unobtainable Tone	Number Unobtainable Tone	Number Unobtainable Tone
400		Dial Tone	Dial Tone	Dial Tone
300+450		Tones above go with call waiting frame usually provided in NC400 or NC820		
400		A/ : Call waiting tone A		
400+450		B/ : Call waiting tone B		
400		C/ : Holding tone.		

Abbreviations used in text for above tones.

Ring Tone : RT

Switching Completed Tone : SCT

Number Verification Tone : NVT

Dial Tone : DT

Disconnect Tone : DCT

Number Unobtainable Tone : NUT

Busy Tone : BT