MEMORY EXPANSION FOR THE VZ200/VZ300 COMPUTERS

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The unit described extends the memory of the VZ200 by 20 k bytes and the VZ300 by 18 k bytes.

IF YOU OWN a VZ200 or VZ300 computer, you could be interested in extending the memory to run larger programs. To do this, you may choose to visit the nearest Dick Smith store and purchase a memory expansion module. Alternatively, you may take the second option and build one yourself.

The writer decided on the second option and designed the unit described in this article. Making use of the 8 k static RAM packages, now readily available, assembly of the unit was a straightforward task.

DESCRIPTION

Two 8 k static RAM packages, Type 6264, provide 16 k bytes of additional memory. To simplify decoding of memory chip selection, the start locations of the 8 k RAM packages are connected at precise 8 k (or 2000 H) address multiples within the address range. Because the in-built memories of the VZ200/VZ300 do not end just prior to such locations, one additional 2 k RAM Type 6116 is used to fill in the gap at the end of the VZ300 internal memory and two at the end of the VZ200 internal memory. For the VZ300, the memory is therefore extended by 18 k bytes. (This, with the in-built system ROM and in-built RAM, utilises all of the 64 k address range of the VZ300 computer). For the VZ200, the memory is extended by an additional 20 k bytes.

The wiring diagram for the expansion unit is shown in Figure 1. The 8 k RAM packages (28 pin DIL) are shown as N3 and N4 and the 2 k RAM packages (24 pin DIL) as N5 and N6. Chip select decoding is carried out by two 74LS138 decoder packages (16 pin DIL) shown as N1 and N2. A five volt regulator, N7, is included in the unit to supply power to the IC packages. This was thought desirable as total loading on the internal five volt supply might have been marginal with the extra load of the expansion unit.

A three pole, two position, switch (S1) is provided to select decoding for either VZ200 or VZ300. (The switch used was a four pole unit with one redundant section). If only the VZ300 facility had been required without the VZ200, the 2 k RAM (N6), resistor R1 and the switch, could have been omitted. In this case, switch connections S1A and S1B for the VZ300 would be bridged.

The hexadecimal start addresses for the RAM packages are shown in the following table with the decimal addresses, as identified by the BASIC interpreter, shown in brackets.

PACKAGE	VZ200	VZ300
N5 (2 k)	9000 H (-28672)	8800 H (-18432)
N6 (2 k)	9800 H (-26624)	not used
N3 (8 k)	C000 H (-16384)	C000 H (-16384
N4 (8 k)	A000 H (-24574)	E000 H (-8192)

The complete memory map, with expansion unit included, is illustrated in Figure 2.

A further option for the VZ200 (but not used by the writer) could be to parallel up the buses for a third 8 k 6264 RAM to be started at E000H. This would then extend the VZ200 also to the full 64 k capacity. All that would be required for additional chip selection would be to connect the RAM chip select (pin 20) via a switch circuit (similar to S1C) to pin 7 on decoder N1.

ASSEMBLY

The assembled module card is shown in Figure 3. A general purpose circuit board was used to mount the IC sockets and other components. There are various types of board, with printed circuit pads for solder connections, which can be used to do the job. Another method would be to make use of wire-wrap with wire-wrap type IC sockets.

The card was cut to the dimensions 145 by 92 millimetres. It could have been made smaller but allowance was made for components to be added had they been needed. (This is a practice which often pays off on a first attempt at a design).

A 69.5 millimetre length of 0.1 inch (2.54 millimetres) pin spacing edge connector was fitted to the card. The edge connector was carefully cut so that the 22 pairs of pins used are centred to mate with the printed circuit edge pins on the VZ memory expansion connector and so that the edge connector is correctly guided by the recess in the VZ case. The fitting of the edge connector to the circuit board is offset so that it clears the I/O expansion entry. The method of assembly is similar to that previously used by the writer in the RTTY/Morse module described in *Amateur Radio*, September 1985 and January 1986.

A light aluminium box, 96 by 156 by 24 millimetres, was constructed and fitted around the card for protection. The connector protruded through the end of the box so that it could project into the VZ connector recess.

CHECKOUT

Having made sure all the wiring was correctly routed by carrying out a continuity check, the next step was to devise a functional check routine and a program in BASIC was prepared to check out the additional RAM. This is listed in the Appendix.

For each memory address, the program write zeros into all bits and then reads the address to check for concurrence. The process is repeated for ones in each bit and then again for zeros. The memory is accessed sequentially over the whole extended range and, if an address does not read as written, the sequence is stopped and the address identified. The option is then given whether to proceed or escape from the routine. If all memory addresses check out, the memory is flagged as "OK".

At the start of the program there are POKE statements which shift the location of the top of the memory pointer and the stack pointer to within the internal memory. This is necessary as, at power up, the inbuilt VZ monitor automatically searches for the top of memory and references to these pointers to the top part of the expansion memory about to be accessed. If not relocated, the program will "crash" when it gets near the top. Actually there are two separate routines. The first one, which resets the pointers, is started by a RUN command. At its end, this routine requests a RUN 20 command which is used to start the next routine containing the memory scanning process. One might think that it could all be done in the one routine but the writer could not get it to work that way!

The inbuilt BASIC interpreter is comparatively slow and to run this program through the full 20 k bytes of additional memory takes about three-quarters of an hour. (It is a good plan to go away and make a cup of coffee while it is all going on!). Preparation of an object deck would have speeded up the process but this was not considered warranted for the few times the program was to be used.

CONCLUSION

Use of the 8 k static RAMs provides a simpler circuit design than that of the stock dynamic RAM expansion unit published in the VZ200 Technical Reference Manual. The static RAMs are expensive but, providing one does not mind spending a little time on construction, the unit described can be considered to be reasonably cost effective as well as providing a little more memory than the stock unit.

APPENDIX

Expansion RAM Test Program

```
10  REM EXTENSION MEMORY RAM
    CHECK
14  POKE 30880,255:POKE 30881,141
```

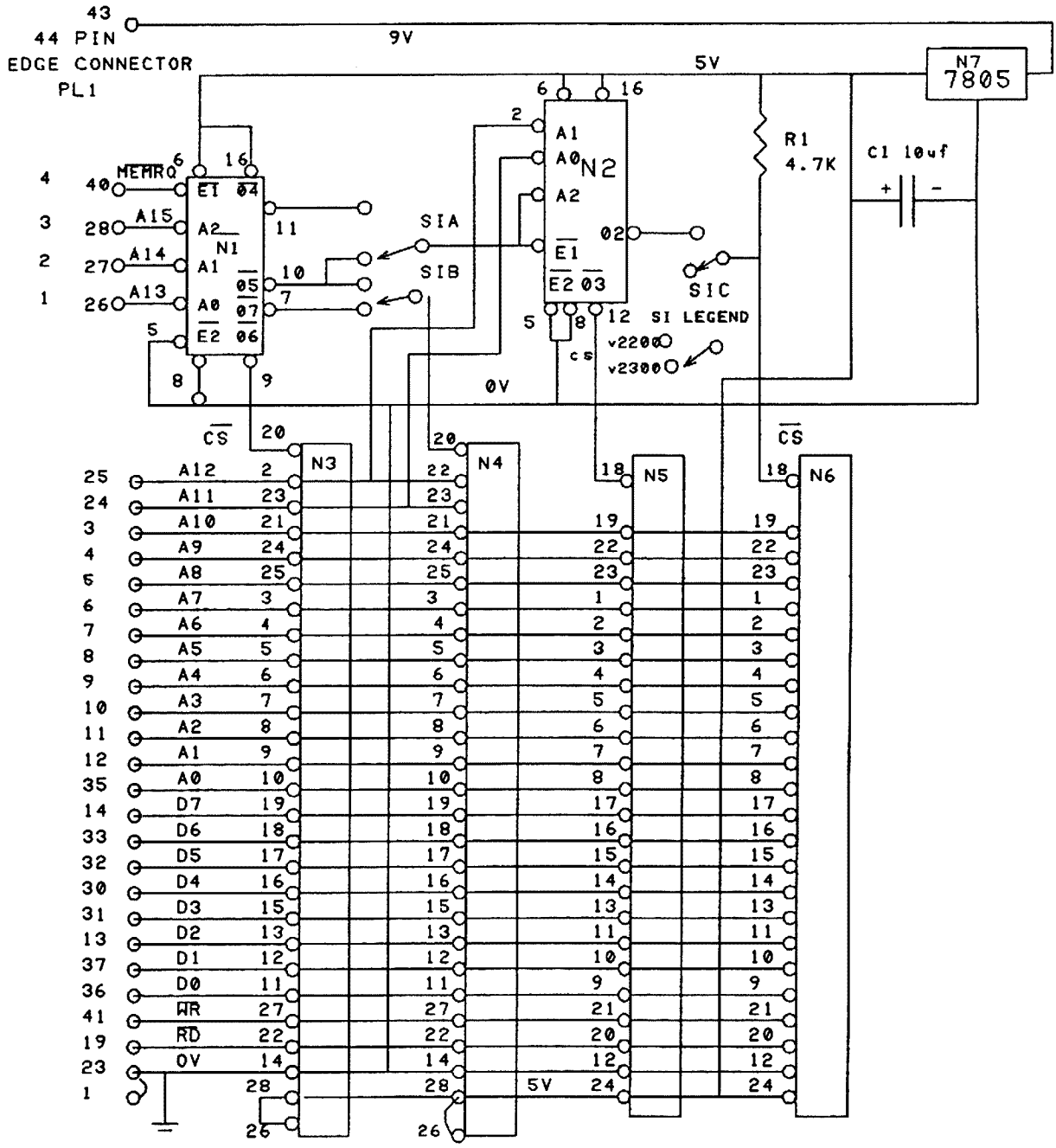
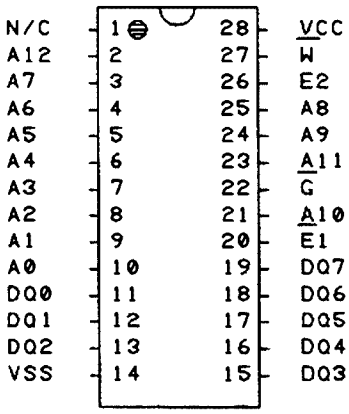
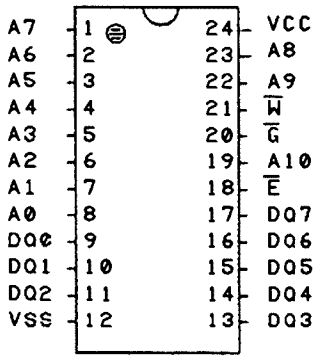


Figure 1: VZ200/VZ300 Expansion Module — Wiring Diagram.





PIN NAMES	
A0-A12	ADDRESS
W	WRITE ENABLE
E1.E2	CHIP ENABLE
DQ0-DQ7	DATA INPUT/OUTPUT
VCC	+ 5V POWER SUPPLY
VSS	GROUND
G	OUTPUT ENABLE

6264

PIN NAMES	
A0-A10	ADDRESS INPUT
DQ0-DQ7	DATA INPUT/OUTPUT
W	WRITE ENABLE
G	OUTPUT ENABLE
E	CHIP ENABLE
VCC	POWER +5V
VSS	GROUND

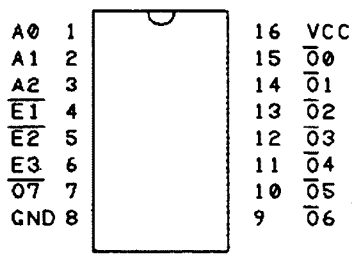
6116

N1-N2 74LSI38
DECODER

N3-N4 6264
8K*8RAM

N5-N6 6116
2K*8RAM

C2-C7 0.1uF
CONNECTED ACROSS
5V RAILS AT EACH
I/C N1-N6



PIN NAMES	DESCRIPTION
A0-A2	ADDRESS INPUTS
E1. E2	ENABLE INPUTS (ACTIVE LOW)
E3	ENABLE INPUTS (ACTIVE HIGH)
O0-O7	OUTPUTS (ACTIVE HIGH)

74LS138

FIGURE 1

V2200/VZ300 EXPANSION
MODULE WIRING DIAGRAM

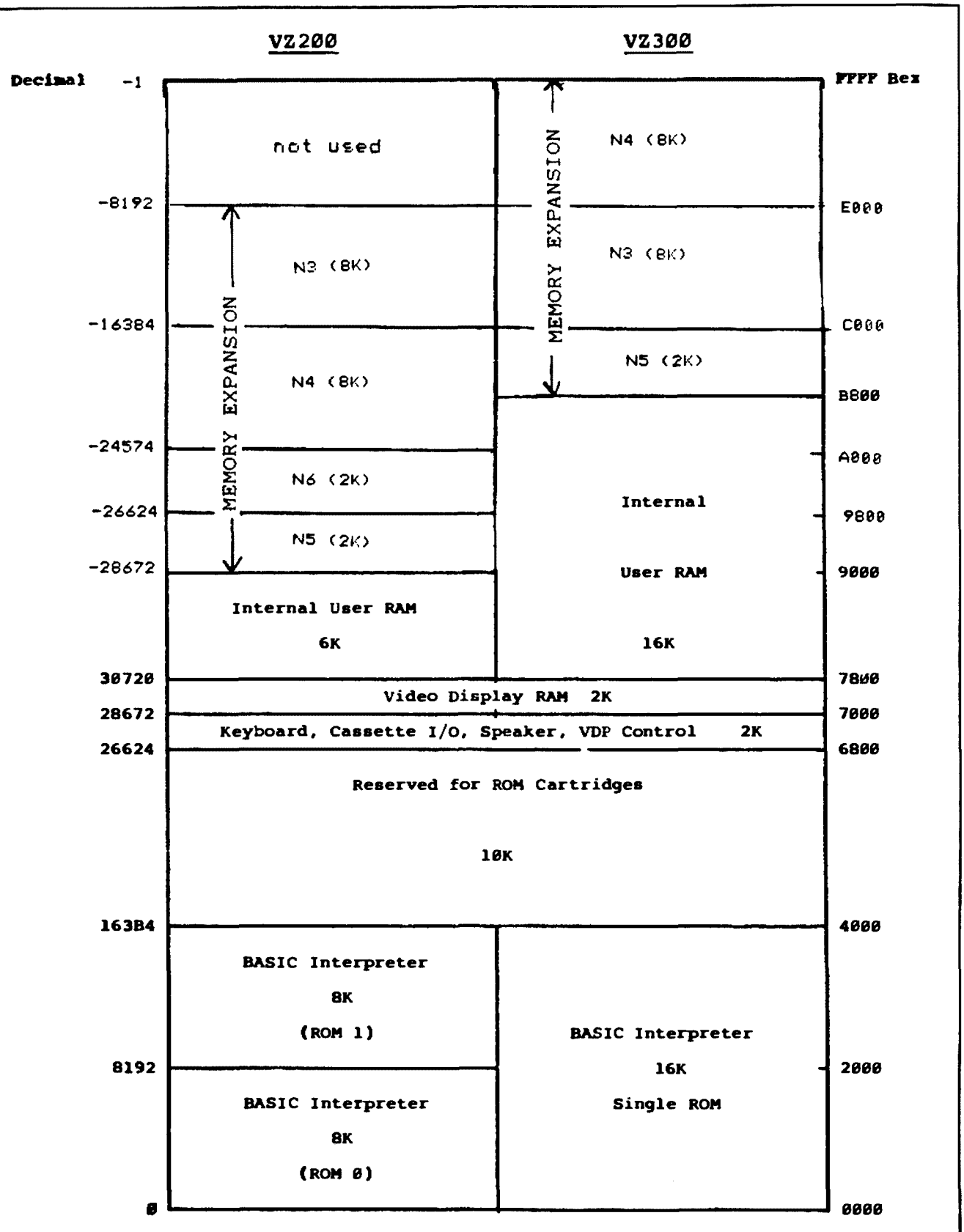


Figure 2: Memory Map showing Expansion RAM.

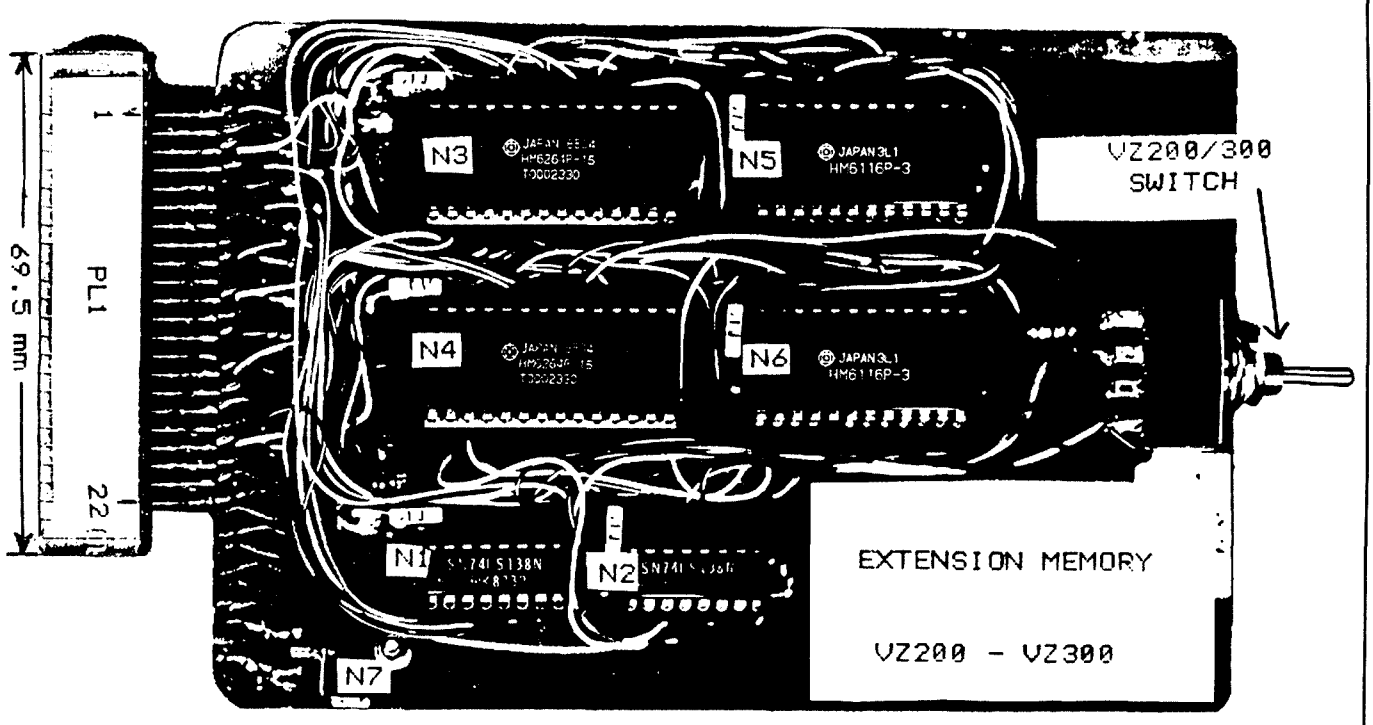


Figure 3: Card Layout.

```
15   POKE 30897,255:POKE 30898,143
16   PRINT "ENTER RUN 20"
17   END
20   PRINT "EXTENSION MEMORY TEST"
30   PRINT "ENTER 200 FOR VZ200 OR 300
     FOR VZ300
40   INPUT A
50   IF A = 200 THEN S = -28672 ELSE S =
     -18432
60   IF A = 200 THEN F = -8193 ELSE F =
     -1
70   L = 0
80   FOR X = S TO F
90   I = 0
100  FOR Y = 1 TO 3
110  IF Y = 2 THEN K = 255 ELSE K = 0
120  POKE X,K
130  B = PEEK(X)
140  IF B < > K THEN I = 1
150  NEXT Y
160  PRINT X
170  IF I = 0 THEN GOTO 230
180  L = 1
190  PRINT "RAM FAULT AT "; X
200  PRINT "ENTER C TO CONTINUE
     CHECKS OR E TO END"
210  INPUT Z$
220  IF Z$ = "E" THEN GOTO 250
230  NEXT X
240  IF L = 0 THEN PRINT "EXTENSION
     RAM OK"
250  END
```

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"CQ DX — New Countries only, please!"

—VK2COP