Sailor

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INSTRUCTIONS FOR IDENTITY AND SERVICE PROGRAMMING OF SAILOR VHF RT2048

A/S S. P. RADIO · AALBORG · DENMARK

ONLY FOR AGENTS AND SERVICE PERSONNEL

S. P. RADIO A/S - SAILOR MARINERADIO

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TO OUR AGENTS AND SERVICE WORKSHOPS

From: "SAILOR" After Sale Service Department
S. P. Radio A/S Aalborg Denmark

Subject: Correction pages and supplement for:

Instructions for Identity and Service
Programming of SAILOR VHF RT2048

Enclosed we send you correction pages (marked 6-88) and a supplement which shall be used when the set is equipped with a microcomputer of revision level A (marked 6-88 and an A after the page number).

Correction pages:

Old pages, to be removed	New pages, to be inserted
1- 1A	1- 1A, 6-88
2- 3	2- 3, 6-88
10-11	10-11, 6-88
12-13	12-13, 6-88
14-15	14-15, 6-88
26-27	26-27, 6-88
30-31	30-31, 6-88
32-33	32-33, 6-88
44-45	44-45, 6-88

Supplement pages:

22A-23A, 6-88
31 -31A, 6-88
32A-33, 6-88
34 -35A, 6-88
36A-37A, 6-88
38A-39, 6-88

CONTENT

1. HOW TO SELECT SERVICE MODE

Programming facilities can be selected in one of the following ways:

1.a. Remove the cabinet (see mechanical disassembling).

b. Place a jumper between pin no. 31 on U03 and ground (on interface unit).

c. Switch on the set.

d. Perform the service and identity programming in question.

2.a. Connect the set to be programmed to the special RT2048 programming unit by means of the programming cable.

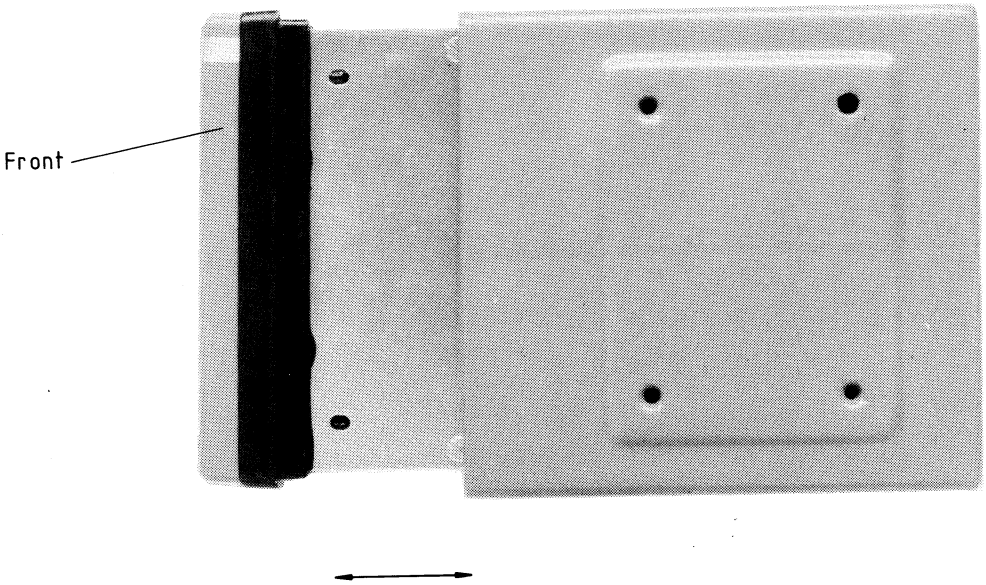
b. Switch on the set.

c. Key-in SHIFT 16 on the programming unit.

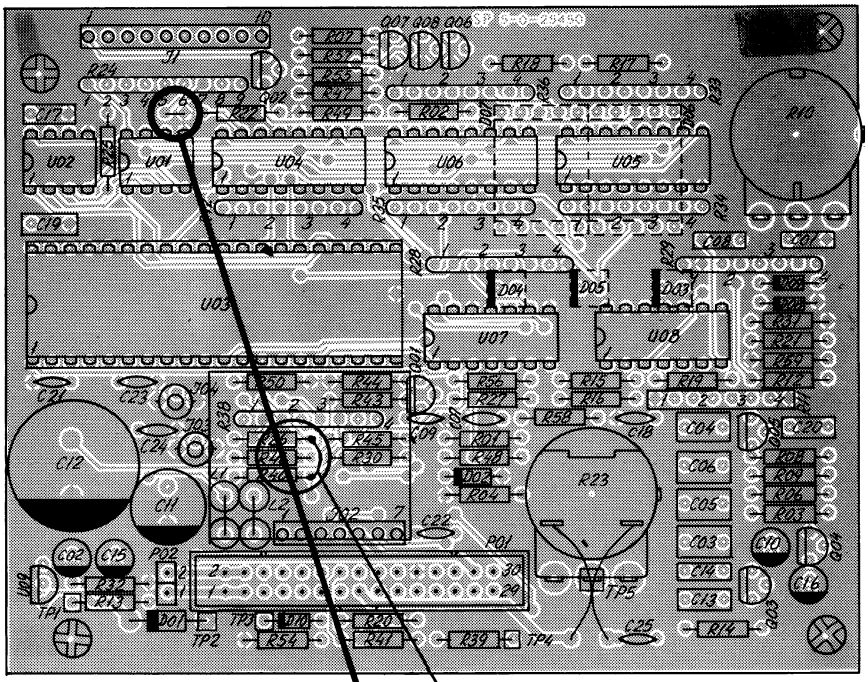
d. Perform the service and identity programming in question by using the keyboard on the programming unit.

MECHANICAL DISASSEMBLING RT2048

To disassemble the RT2048 remove the two allen screws with the black covers at the rear of the set and pull the front plate out of the cabinet.



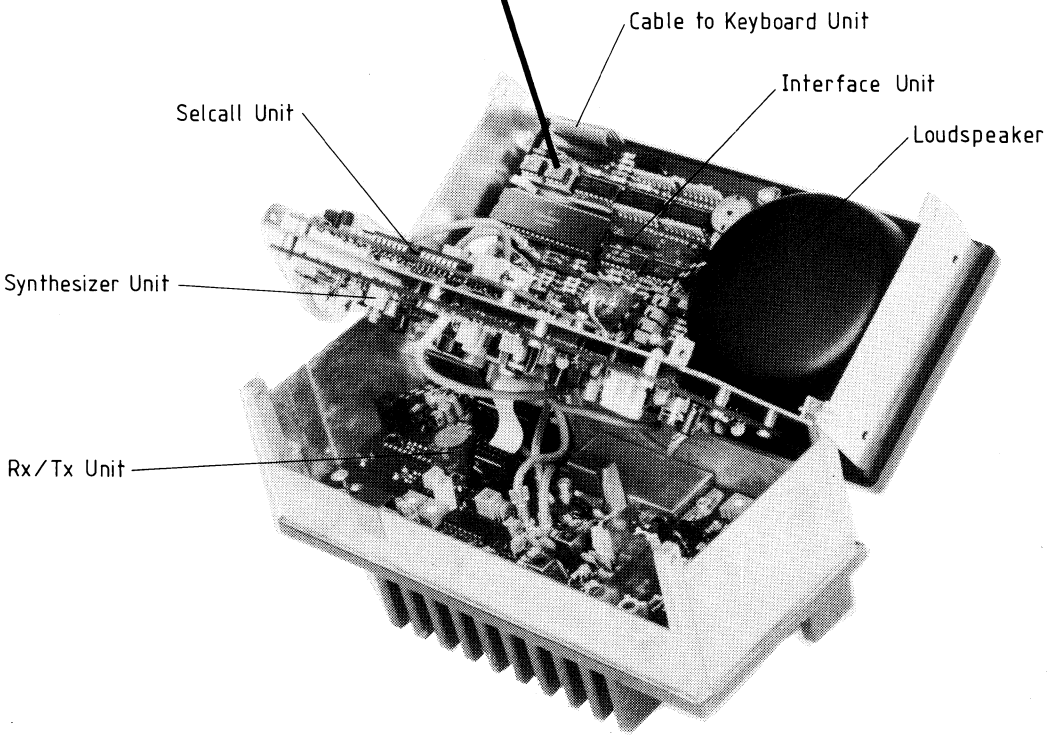
INTERFACE UNIT (MODULE 2)



View from component side with upper side tracks.

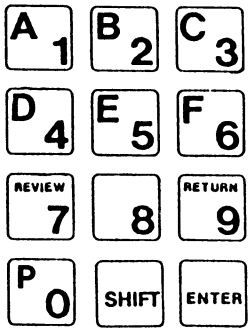
Ref. Section Sd: Selcall adjustment

Ref. Section 1: How to select service mode



2. GENERAL

When the set operating status is changed to service mode, any of the programmable functions or the private channels can be programmed by means of the keyboard.
Besides, a special test mode for adjustment of a selcall filter can be selected.
The internal memory consists of two EEPROM's, each working with 16-bit word length. When the programming is carried out, the microcomputer automatically selects the right PROM for the information being programmed. All information, which can be stored in the memories, are handled as hexadecimal digits. Thus in service mode, the keyboard has the following functions:



When the set is equipped with a microcomputer of revision level A or later, the revision number can be read in service programme No. H. This programme is selected by keying-in SHIFT 8 . Now the microcomputer revision level will be shown in the display when SHIFT REVIEW 7 is keyed-in.

3. CONVERSION TO HEXADECIMAL NOTATION

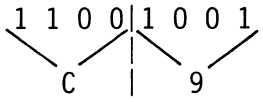
A four bit binary number can be converted by means of the table below:

Binary	Hexadecimal	Decimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

When an 8-bit word has to be converted, just split it up into two 4-bit words consisting of the four most significant bits, respectively the four least significant bits, and convert each of them by means of the above table.

E.g.: bit No.: 7 6 5 4|3 2 1 0

binary code: 1 1 0 0|1 0 0 1



hexadecimal code: C | 9

When a decimal number should be converted to hexadecimal code, follow the procedure mentioned below.

Find the nearest lower value in the table below and the corresponding hexadecimal value.
Then subtract this decimal value from the actual value and convert the result by means of the table below. Finally add the two hexadecimal figures.

3. **CONVERSION TO HEXADECIMAL NOTATION** cont.:

Decimal	Hexadecimal
0	00
16	10
32	20
48	30
64	40
80	50
96	60
112	70
128	80
144	90
160	A0
176	B0
192	C0
208	D0
224	E0
240	F0

Decimal	Hexadecimal
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

E.g.: Convert 171

The nearest lower value is 160 = A0
171 less 160 = 11 = B
Result = AB

Conversion from hexadecimal to decimal.

E.g.: Convert 1A

Find the decimal value corresponding to 10 in the above table.
Find the decimal value corresponding to A in the above table.
Finally add the two numbers 10 = 16
A = 10
Result 26

4. SERVICE PROGRAMMES AVAILABLE

This part summarizes the service programmes which can be selected by the user.

When service mode is selected the display read-out will be 5.- . Now any of the service programmes can be selected just by keying in the programme number followed by an [ENTER]

When the service programme has been selected, an unambiguous identifier is displayed, see the table below.

If you want to return from the selected service programme, just key-in [SHIFT] [RETURN 9], and the display will respond with a read-out of the last selected service programme number, e.g. 5.7 . Now a new service programme can be selected as mentioned above.

Service prog. Number	Service programme description	Service prog. Identification
0	By means of this programme it is possible to read and/or change the content of any of the memory addresses in direct mode, by selecting the addresses one at a time.	0 1W
1	This programme is used to programme the set to the wanted COUNTRY version.	C o.
2	This programme is used to programme the CHANNEL CODE, which describes the status of the channels 15/17, 70 and 75/76.	C.C.
3	This programme is used when the status of the logic output port AUX II should be programmed. This port can be used to indicate that a special channel is selected, e.g. channel 10/13 on river boats or channel 16 distress decoding, when connected to a CRY2001/2.	A.2.
4	This programme is used to define the ENABLE CODE for the set. This code describes the working facilities concerning scanning, US/K mode, additional private channels, special function code for international channels, selcall, and D.W. enable etc.	E.C.
5	This programme is used to programme the QUICK CHANNEL number, normally channel 16.	0.C.
6	This programme is used to programme the DUAL WATCH preference CHANNEL, which will normally be channel 16.	d.C.
7	This programme is used to programme the function/frequency codes for PRIVATE CHANNELS P0-P9.	C h. 1W

4. **SERVICE PROGRAMMES AVAILABLE** cont.:

Service prog. Number	Service programme description	Service prog. Identification
8	This programme is used to programme the function/frequency codes for PRIVATE CHANNELS A0-A9, E0-E9, and F0-F9 if they are selected by means of the enable code. **NOTE!** If the enable code does not open for additional 30 private channels, this programme cannot be entered.	Ch. 1W
9	This programme is used when the set should be used in special frequency bands. In this case a BAND-shift CODE and a synthesizer offset constant should be programmed.	bc. TX
A	This programme is used to specify the maximum NUMBER of CHANNELS which can be stored in a scanning sequence. **NOTE!** If the enable code does not open up the scanning facilities, this programme cannot be entered.	n.C.
b	This programme can COPY any of the function code tables for the international channels into the EEPROM. The function code tables can be any of the country versions available. **NOTE!** If the enable code does not specify the function code for the international channels to be in the EEPROM, this programme cannot be entered.	C.P.
C	This programme is used when you want to programme or EDIT CODES in the function code table for the international channels placed in the EEPROM. **NOTE!** If the enable code does not specify the function code for the international channels to be in the EEPROM, this programme cannot be entered.	E.C. 1W
d	This programme has to be used when a SELCALL ADJUSTMENT procedure has to be carried out. When selected, the microcomputer will generate an appropriate adjustment tone for the selcall filter. **NOTE!** This programme MUST NOT be selected if the enable code does not enable the selcall option. If this happens the set has to be switched off and on before further programming can proceed.	S.A.
E	When a selcall module is installed, the selcall number of the user is entered by means of this programme DIGIT for digit. **NOTE!** If the enable code does not enable the selcall option, this programme cannot be entered.	d.1
F	This IDENTITY programme is only for factory use and has no value for the user.	id.

5. BASIC NECESSARY PROGRAMMING OF RT2048

The basic programming sequence for a new RT2048 will include the following steps.

a. Select and programme the COUNTRY version, service programme No. 1.

b. Determine and programme the CHANNEL CODE for the channels 15/17, 70 and 75/76 by means of service programme No. 2.

c. Determine and programme the ENABLE CODE for the wanted version by means of service programme No. 4.

d. Programme the QUICK CHANNEL number by means of service programme No. 5.

e. Programme the DW preference CHANNEL by means of service programme No. 6.

If the ENABLE CODE opens for the scanning facilities:

f. Programme the maximum number of channels in a scanning sequence by means of service programme No. A.

When a selcall unit should be installed, the programming should include the following step:

g. Programme the user selcall number by means of service programme No. E.

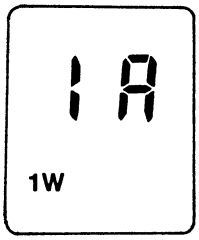
The remaining service programmes should only be used in installations where special programming and/or option interfaces should be used.

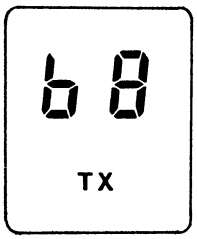
6. SERVICE PROGRAMME DESCRIPTION

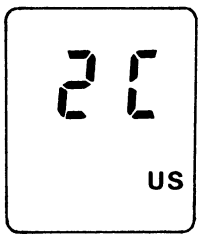
5.0 DIRECT ADDRESS PROGRAMMING

This programme permits you to programme each of the memory addresses directly.
As mentioned in the general part, the memory is working with 16-bit words in all available addresses.
Because of the limits of visual indication, these words are split up into two 8-bit words called High Byte, respectively Low Byte. With High Byte representing the 8 most significant bits in the 16-bit word.
The read-out of both address and content will always be by use of hexadecimal digits.
The meaning of the two digit read-out is distinguished by means of the LED-indicators **1W** , **TX** , **US** .

E.g.







Address number 1A High Byte value B8 Low Byte value 2C

Thus successive activation of the [ENTER] key will result in a read-out sequence as follows: Address number, High Byte value, Low Byte value, next Address number etc.

When pressing [SHIFT] [REVIEW 7] , the last address number which has been selected by use of the keyboard [ENTER] button will be read-out in the display.

The service programme will be left by entering the sequence [SHIFT] [RETURN 9] and the number of the last selected service programme will be displayed 5.0

E.g. Programme the quick channel number to be channel 10 by use of direct address programming.

	Keyboard input	Read-out
1. Select service mode		5.-
2. Select service programme 0	[P 0]	5.0
	[ENTER]	0 1W

Keyboard input	Read-out
3. Select the appropriate address number (see chapter 7) here address No. A.	
SHIFT, A 1	A 1W
4. Select the approriate byte, here High Byte (actual content channel 16)	
ENTER	16 TX
5. Key-in the wanted channel number.	
A 1, P 0	10 TX
6. Store the new quick channel No. (now the Low Byte will be read-out)	
ENTER	16 US
7. Leave the service programme.	
SHIFT, RETURN 9	5.0

5.1 COUNTRY VERSION PROGRAMMING

This programme is used for easy programming of the wanted country version. It is possible to choose between 15 different country versions without making any special function code programming of the international channels. The available versions are listed in the table below and the function code tables belonging to them can be found in chapter 10.
When the service programme has been selected, the actual version can be displayed just by pressing SHIFT REVIEW 7

Country ver. number	Note No.	Version	Private Channels				
			P0	P1	P2	P3	P4
0	-	Standard Int.	-	-	-	-	-
1	-	Standard w.pleasure boat ch's DK	-		-	1L	2L
2	-	Standard w.pleasure boat ch's N	-	L1	L2	L3	-
3	-	Standard w.fishing boat ch's	-	F1	F2	F3	
4	-	Standard w.weather channels	-	WX1	WX2	WX3	WX4
5	-	Standard w.22A	22A	-	-	-	-
6	-	Standard w.22A+weather channels	22A	WX1	WX2	WX3	WX4
7	-	Standard w.channel 37	-	37	-	-	-
8	-	Standard Int.	-	-	-	-	-
9	-	All channels 00->99 as simplex	-	-	-	-	-
A	-	Belgium, inland	-	-	-	-	-
B	-	France, inland	-	-	-	-	-
C	-	Germany, inland	-	-	-	-	-
D	-	Netherlands, inland	-	-	-	-	-
E	1	Standard w. K-mode	-	-	-	-	-
F	2	US-mode w. 1W on ch. 13/67	-	-	-	-	-

Note 1. When K-mode is enabled this version can be selected. In this case the "US-push button will operate as a "K"-button, which shifts the set between a normal standard version and the German inland version.

Note 2. This version will always run in US-mode, independent of the "US"-push button.

PS! If a country version including private channels has been selected, these will have priority compared to private channels with the same number in the EEPROM's which will be ignored.

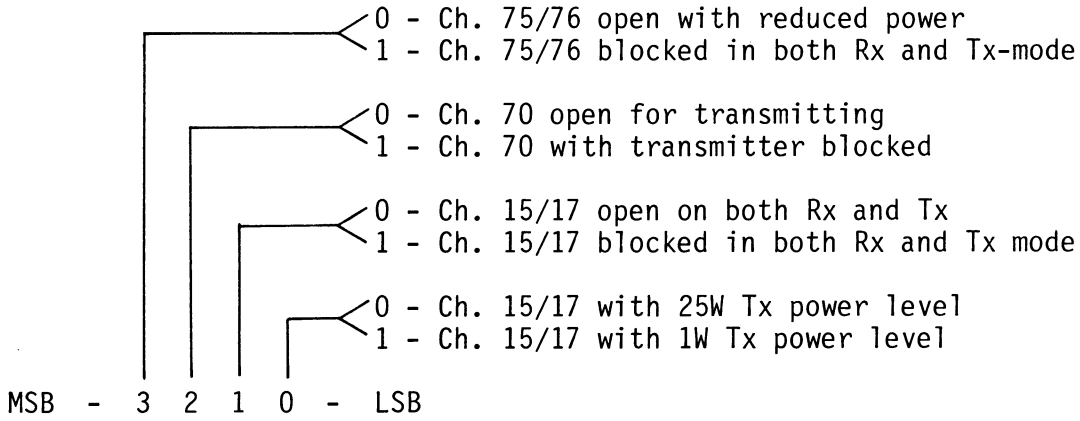
E.g. Programme the set to run as a standard with weather channels and verify that your programming has been carried out correctly.

	Keyboard input	Read-out
1. Select service programme 1	A 1	5. 1
	ENTER	C o.
2. Key-in the appropriate country version No. 4. (according to table above)	D 4	4
3. Store the country version No.	ENTER	5. 1
4. Select service programme No. 1 again to verify programming.	ENTER	C o.
5. Look-up the actual version No.	SHIFT REVIEW 7	4
6. Leave the service programme.	SHIFT RETURN 9	5. 1

Now another service programme can be selected just by keying in the number followed by an enter.

5.2 CHANNEL CODE PROGRAMMING

Due to the different requirements from the PTT's concerning the mode of operation on the channels 15/17, 70 and 75/76, a special programming is necessary.
The correct channel code can be made by means of the table below. This binary code should be converted to hexadecimal before programming e.g. by means of chapter 3.



E.g. Determine and programme the channel code for a set which should be blocked on ch. 75/76 with transmitter blocked on ch. 70 and running with full power on ch. 15/17.

By use of the above table, the following binary channel code is found
1 1 0 0, which converted to hexadecimal notation means a C.

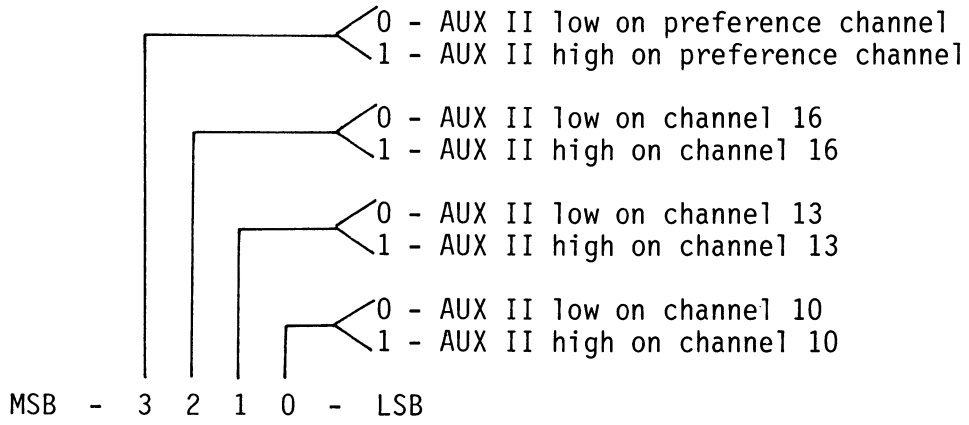
	Keyboard input	Read-out
1. Select service programme No. 2.	B 2	5.2
	ENTER	C.C.
2. Note the actual channel code (e.g. d)	SHIFT REVIEW 7	d
3. Key-in the wanted value, C.	SHIFT C 3	C
4. Store the new channel code. (the last selected service programme will be displayed.	ENTER	5.2

Now another service programme can be selected just by keying-in the number followed by an enter.

PS! It should be noticed that the operation on the channels covered by the channel code, is completely determined by the channel code independent of the selected country version.

5.3 AUX II PORT PROGRAMMING

This programme is used to determine the operation of the logic output port, named AUX II. This port can be used to indicate when some special channels have been selected, when the set is operating.
This port can be used in conjunction with an option board, e.g. for muting of external equipment or for distress decoding when used in conjunction with an encryption unit.
The binary code for the operation of AUX II can be determined by means of the table below. This code has to be converted to hexadecimal before programming.



E.g. Determine the code and programme the AUX II port to be high on ch. 10 and 13.

By use of the table above, the binary code can be determined to be 0 0 1 1, which means 3 in hex-code.

	Keyboard input	Read-out
1. Select service programme No. 3	C 3	5.3
	ENTER	A.2.
2. Key-in the wanted value, 3.	C 3	3
3. Store the AUX II code.	ENTER	5.3

If you want to check the programmed value, just enter the service programme again and press SHIFT REVIEW 7, and the content will be read-out. Now leave the service programme with non-affected memory content by pressing SHIFT RETURN 9

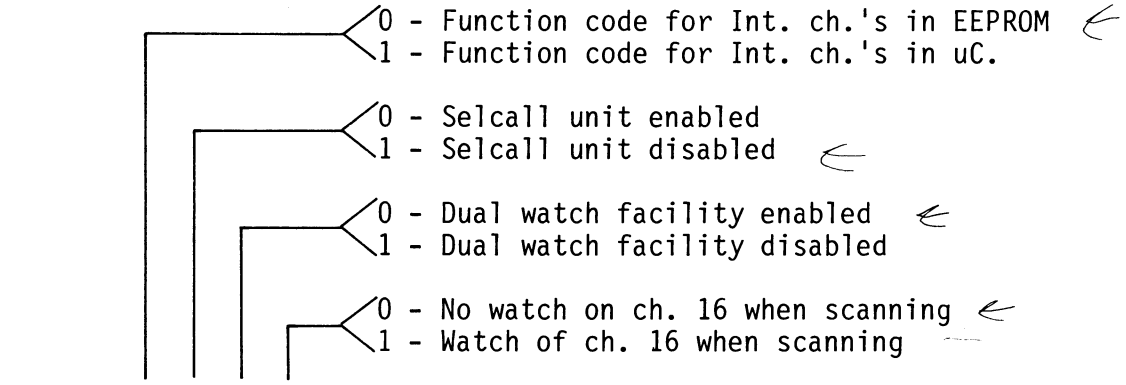
5.4 ENABLE CODE PROGRAMMING

By means of this code the wanted programmable features are defined. This means enabling of US-mode, scanning facilities etc.
The enable code consists of a two digit hexadecimal code, which can be determined by means of the tables below.
The most significant digit is determined by the following:

0 0 X X	US/K-mode disabled
0 1 X X	US-mode enabled ←
1 0 X X	K-mode enabled
1 1 X X	US/K-mode disabled
X X 0 0	Scanning and additional private ch.'s disabled
X X 0 1	30 additional private channels enabled
X X 1 0	Scanning facilities enabled ←
X X 1 1	Scanning and additional private ch.'s disabled

MSB - 3 2 1 0 - LSB

and the least significant digit by this table:



E.g. Programme the set to run with scanning facilities and US-mode enabled. Standard function code for international channels; without selcall unit, with D.W.-facility enabled and watch of ch. 16 when scanning.
From the upper table the binary code for the most significant digit is determined to be 0 1 1 0, which converted to hex-code means a 6.
From the lower table the binary code for the least significant digit is determined to be 1 1 0 1, converted to a D in hex-code.
So the ENABLE CODE should be programmed to be 6D in the following way:

	Keyboard input	Read-out
1. Select service programme No. 4	D 4	5.4
	ENTER	E.C.
2. Key-in the value of the hex-code.	F 6	6
	SHIFT D 4	6d
3. Store the new Enable Code.	ENTER	5.4

The new Enable Code can be checked by entering the service programme again and use the SHIFT REVIEW 7 function. If a wrong digit is keyed-in in an input sequence, just repeat with the wanted input sequence, the memory content will not be affected before an ENTER is executed.

5.5 QUICK CHANNEL NUMBER

This programme is used to programme the channel number connected to the "quick channel" - push button, which normally will be channel 16.
The quick channel number can be any of the valid channels in the set, this means a channel with a function code differing from FF.
The actual quick channel number can be read by entering the service programme and use the [SHIFT] [REVIEW 7] function.

The quick channel number is programmed just by keying-in the wanted channel number, e.g. as follows for channel 69:

	Keyboard input	Read-out
1. Select service programme No. 5	[E 5]	5.5
	[ENTER]	0.0.
2. Key-in the wanted channel number.	[F 6]	6
	[RETURN 9]	69
3. Store the quick channel No.	[ENTER]	5.5

Now the set is ready for selection of a new service programme - if wanted.

5.6 DUAL WATCH PREFERENCE CHANNEL

This programme is used for easy programming of the D.W.-preference channel, which will normally be ch. 16.
The D.W.-preference channel can be any of the valid channels in the set, this means a channel with a function code differing from FF.
The programming of the D.W.-preference channel is made directly as shown below, where ch. 10 should be the preference channel.

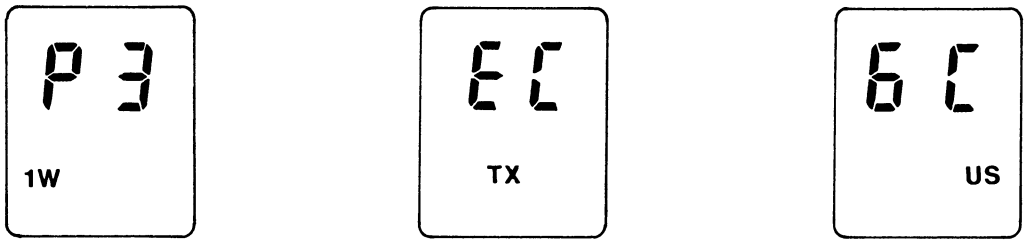
	Keyboard input	Read-out
1. Select service programme No. 6	F 6	5.6
	ENTER	d.C.
2. Key-in the wanted channel number.	A 1	1
	P 0	10
3. Store the new D.W.-preference ch.	ENTER	5.6

If for example a non-valid channel is programmed as the D.W.-preference channel, e.g. a private channel which has not been programmed, the set will not start dual watching when keyed-in, in spite of the dual watch facility being enabled by use of service programme No. 4.

5.7 PRIVATE CHANNELS P0 -> P9

This programme is used to programme the information needed for a normal private channel in the basic frequency band.
A private channel is specified by means of the channel number and the two hexadecimal numbers describing the connected function code and frequency code.
When the wanted operation mode and frequency is determined, the appropriate hex-codes can be determined by means of the tables in chapter 8 and 9.
The meaning of the two digit read-out is distinguished by means of the three LED-indicators 1W, TX, US.

E.g.



Channel number P3 | Function code EC | Frequency code 6C

Successive activation of the ENTER key will result in a sequence where the programme asks for the channel number Ch. , the function code Fu. and the frequency code Fr. . In each step the actual value can be displayed just by pressing SHIFT REVIEW 7. The programme can be left at any time by pressing SHIFT RETURN 9, without changing the memory content.

If a wrong key has been activated in a data input sequence, just restart the input sequence and the digits will roll lefthand out of the display. Only the displayed code will be stored when the enter key is activated.

E.g. Programme a private channel in P3 with the function code EC and the frequency code 6C.

	Keyboard input	Read-out
1. Select service programme No. 7.	REVIEW 7	5.7
	ENTER	Ch. 1W
2. Key-in the channel No. to be programmed.	SHIFT P0	P 1W
	P0	P0 1W

	Keyboard input	Read-out
3. Store the channel No. to be programmed.	ENTER	Fu. TX
4. Key-in the function code, here EC in hexadecimal notation.	SHIFT E 5	E TX
	SHIFT C 3	EC. TX
5. Store the function code.	ENTER	Fr. US
6. Key-in the frequency code, in this case 6C.	F 6	6 US
	SHIFT C 3	6C US
7. Store the frequency code.	ENTER	Ch. 1W

Now another channel can be programmed in the same way, or the service programme can be left by pressing SHIFT RETURN 9

It must be noticed that all non-valid private channels must be programmed with an FF in the function code register.

PS! If a country version with pre-programmed private channels are selected, the set will neglect possible user programmed channels with the same channel number.

5.8 PRIVATE CHANNELS A0-A9, E0-E9, F0-F9.

When additional 30 private channels are selected by means of the ENABLE CODE, this programme can be used to programme the information needed for a normal private channel in the basic frequency band.
The mode of operation of this programme is exactly the same as programme No. 7 used for programming of private channels P0-P9.
E.g. Programme a private channel in F4 with the function code EE and the frequency code 58.

	Keyboard input	Read-out
1. Select service programme No. 8.	8	5.8
	ENTER	Ch. 1W
2. Key-in the channel No. to be programmed.	SHIFT F6	F 1W
	D4	F4 1W
3. Store the channel No. to be programmed.	ENTER	Fu. TX
4. Key-in the function code, in this case EE.	SHIFT E5	E TX
	SHIFT E5	EE TX
5. Store the function code.	ENTER	Fr. US
6. Key-in the appropriate frequency code, here 58.	E5	5 US
	8	58 US
7. Store the frequency code	ENTER	Ch. 1W

The programming just carried out can now be checked using the [SHIFT] [REVIEW 7] function and the [ENTER] push button.

It must be noticed that all non-valid private channels must be programmed with an FF in the function code register.

5.9 BAND-SHIFT CODE PROGRAMMING A0

When the set should be changed to operate below or above the basic frequency band, or a special "duplex distance" is wanted, this programme is used to programme the needed BAND-shift CODE and the synthesizer offset constant.
When the transmit and receive frequencies are given, the appropriate band-shift code and offset constant can be determined by means of the formulas given in chapter 9.
The band-shift values are decimal numbers between -2 and +2. The appropriate binary coding of these codes can be determined by means of the following table:

0 0 X X	Band-shift inhibited
0 1 X X	Sign of band-shift constant is plus
1 0 X X	Sign of band-shift constant is minus
1 1 X X	Band-shift inhibited
X X 0 0	Numerical value of band-shift constant = 0
X X 0 1	Numerical value of band-shift constant = 1
X X 1 0	Numerical value of band-shift constant = 2
X X 1 1	Numerical value of band-shift constant = 0

MSB - 3 2 1 0 - LSB

When the binary codes are determined they must be converted to hexadecimal digits before programming.
The most significant digit represents the band-shift number for the transmitter and the least significant digit represents the band-shift number for the receiver.
The receiver offset constant is a decimal number between 0 and 254, which just have to be converted to a two digit hexadecimal number before programming, e.g. by means of the tables in chapter 3.

E.g. Find and programme the band-shift code and the receiver offset number when the decimal numbers are determined to be B_{TX} = +1, B_{RX} = -1 and nP = 40.
By means of the table above, the binary code for B_{TX} = +1 will be 0 1 0 1, which equals 5 in hex-code. For B_{RX} = -1 the binary code will be 1 0 0 1, which means 9 in hex-code.
So the band-shift code (bc.) should be 59.
The receiver offset constant equals 28 when converted to hex-code.

6. **SERVICE PROGRAMME DESCRIPTION** cont.:

	Keyboard input	Read-out
1. Select service programme No. 9.	RETURN 9	5.9
	ENTER	bc. TX
2. Key-in the band-shift code.	E 5	5 TX
	RETURN 9	59 TX
3. Store the band-shift code.	ENTER	nP. US
4. Key-in the receiver offset constant, in this case 28.	B 2	2 US
	8	28 US
5. Store the receiver offset constant.	ENTER	5.9

It should be noticed that the band-shift coding will only be used on channels where the function code specifies "special frequency coding".

5.9 BAND-SHIFT CODE PROGRAMMING (C1078A)

This programme should be used when special frequency coding is specified in a channel function code.
Therefore, when operating above or below the basic frequency band, when moving the "fixed frequency" channels 00 -> 99, or a special "duplex distance" is wanted, this programme is used to programme the band-shift code, the base constant for the "fixed frequency" channels, and the receiver frequency offset constant.
When the transmit and receive frequencies are given, the appropriate band-shift code, transmitter base constant, and receiver offset constant can be determined by means of the formulas given in chapter 9.
The band-shift values are decimal numbers between -2 and +2. The appropriate binary coding of these codes can be determined by means of the following table:

0 0 X X	Band-shift inhibited
0 1 X X	Sign of band-shift constant is plus
1 0 X X	Sign of band-shift constant is minus ←
1 1 X X	Band-shift inhibited
X X 0 0	Numerical value of band-shift constant = 0
X X 0 1	Numerical value of band-shift constant = 1 ←
X X 1 0	Numerical value of band-shift constant = 2
X X 1 1	Numerical value of band-shift constant = 0

MSB - 3 2 1 0 - LSB 99

When the binary codes are determined they must be converted to hexadecimal digits before programming.
The two digit hex codes has the most significant digit representing the bandshift number for the transmitter (B_{TX}) and the least significant digit representing the band-shift number for the receiver (B_{RX}).
The transmitter base constant is a decimal number between 0 and 254, which just has to be converted to a two digit hexadecimal number before programming, e.g. by means of the tables in chapter 3.
The receiver offset constant is also a decimal number between 0 and 254, which have to be converted to a two digit hexadecimal number before programming, e.g. by means of the tables in chapter 3.

E.g. Find and programme the band-shift code, the transmitter base constant and the receiver offset constant, when the decimal numbers are determined to be B_{TX} = +1, B_{RX} = -1 and bP = 0 and nP = 40.
By means of the table above, the binary code for B_{TX} = +1 will be 0 1 0 1, which equals 5 in hex-code. For B_{RX} = -1 the binary code will be 1 0 0 1, which means 9 in hex-code.
So the band-shift code (bc.) should be 59.
The transmitter base constant equals 0.
The receiver offset constant equals 28 when converted to hex-code.

	Keyboard input	Read-out
1. Select service programme No. 9.	RETURN 9	5.9
	ENTER	bc. 1W
2. Key-in the band-shift code.	E 5	05 1W
	RETURN 9	5.9 1W
3. Store the band-shift code.	ENTER	bP. TX
4. Key-in the transmitter base constant, in this case 0.	P 0	00 TX
5. Store the transmitter base constant.	ENTER	nP. US
6. Key-in the receiver offset constant in this case 28.	B 2	02 US
	8	28 US
7. Store the receiver offset constant.	ENTER	5.9

It should be noticed that the band-shift coding will only be used on channels where the function code specifies "special frequency coding".

5.A MAXIMUM NUMBER OF CHANNELS IN SCANNER

When the equipment ENABLE CODE permits the set to scan, this programme is used to specify the maximum number of channels which can be stored in the scanning sequence.
The number must be stored as a hexadecimal number.

E.g. Specify the maximum number of channels to be 10.
Converted to hex-code this means an A.

	Keyboard input	Read-out
1. Select service programme No. A	SHIFT, A 1	5.A
	ENTER	n.C.
2. Key-in the maximum number in hex-code.	SHIFT, A 1	A
3. Store the maximum number.	ENTER	5.A

5.b COPY OF INT. CH.'s FUNCTION CODE TO EEPROM

This programme is used to copy a function code table from the microcomputer into the EEPROM.
It should be noticed that the ENABLE CODE must specify the function code table for the international channels to be in the EEPROM. If not you cannot select this service programme.
The function code table can be selected among all the 16 country versions mentioned in this chapter section 5.1 . The content of these function code tables can be found in chapter 10.
E.g. Copy the function code table for the German inland version (No. C) into the EEPROM.

	Keyboard input	Read-out
1. Select service programme No. B.	SHIFT + B 2	5.b
	ENTER	C.P.
2. Key-in the country version number, in this case C.	SHIFT + C 3	C
3. Execute the copy procedure.	ENTER	5.b

The display will be blank while the copy process is executed.
Now the function code table can be edited by means of service programme No. C.

5.C EDIT FUNCTION CODE TABLE IN EEPROM

When the ENABLE CODE specifies the function code table for the international channels to be read from the EEPROM, this programme can be used to programme and/or edit the function code table found in the EEPROM.
Chapter 8 describes how to determine the function code.
The meaning of the two digit read-out is distinguished by means of the two LED-indicators **1W** and **TX**.
When selected, the programme asks for the EDIT CHANNEL number and when entered it asks for the FUNCTION code for this channel. By using [SHIFT] [REVIEW 7] the actual function code will be displayed.

E.g. The function code table for the German inland version has been copied into the EEPROM by means of service programme no. B.
Now change ch. 67 to run with reduced output power, which means to change the function code from EC to EE.

	Keyboard input	Read-out
1. Select service programme No. C.	[SHIFT] [C 3]	5.C
	[ENTER]	E.C. 1W
2. Key-in the channel number for which the function code must be changed,	[F 6]	6 1W
	[REVIEW 7]	67 1W
3. Store the channel number to be edited.	[ENTER]	Fu. TX
4. Key-in the new function code for channel 67.	[SHIFT] [E 5]	E TX
	[SHIFT] [E 5]	EE TX (E8)
5. Store the new function code.	[ENTER]	E.C. 1W

Now a new channel can be selected; the change just made can be checked or the service programme can be left. If the service programme is left by [SHIFT] [RETURN 9], the number of the last selected service programme will be displayed

5.C.

5.d SELCALL ADJUSTMENT PROGRAMME

ATTENTION! This programme MUST NOT be selected if the enable code do not enable the selcall option.
If it should happen, the set must be switched off and on again, before further programming can proceed.
When a selcall unit has been repaired or adjusted, this programme should be used.
When seleced, the microcomputer will generate an adjustment tone for the selcall AF-input.
At the same time the filter will be set up to the correct tone, ready for adjustment. Note that with microprocessor version SP C1078A, selcall number 44444 must be programmed before executing this adjustment.
So the procedure will be as follows:

1. Make sure that the selcall unit is enabled by means of the enable code service programme No. 4.

2. Make sure that the selcall unit has been correctly installed.

3. Connect a DC-voltmeter to the detector output point on the selcall unit. Pin 2 on U04. Establish a short-circuit between the two non-common ends of resistors R26 (51 Kohm) and R40 (10 Kohm) (see page 1A).

4. Turn the volume potentiometer into its maximum position, fully clockwise.

	Keyboard input	Read-out
5. Select service programme No. D.	SHIFT, D 4	5.d
	ENTER	5.A.
6. Adjust potmeter R01 until maximum deflection is reached on the DC-meter.		5.A.
7. Leave the service programme.	SHIFT, RETURN 9	5.d

Remove the DC-probe and the short-circuit between the two resistors, and now the selcall unit should be ready for use, if the selcall number is already programmed. If not select service programme No. E for programming of selcall number.

5.E SELCALL NUMBER PROGRAMMING

When the selcall option has been enabled by means of the ENABLE CODE, this programme can be entered and the users selcall number programmed into the EEPROM.
The selcall number is a 5 digit number which has to be entered digit by digit.
If the number includes a sequence with two or more identical digits, it should be programmed with the repetition tone representing every second of these digits. I.e. the number 3 3 4 7 1 should be programmed 3 R 4 7 1.

The repetition tone is programmed as SHIFT B 2.

E.g. Programme the above selcall number.

	Keyboard input	Read-out
1. Select service programme No. E.	SHIFT E 5	5.E
	ENTER	d.1
2. Key-in the first digit in the number.	C 3	3
3. Store the first digit.	ENTER	d.2
4. Key-in the second digit in the number. In this case the repetition tone should be programmed.	SHIFT B 2	b
5. Store the second digit.	ENTER	d.3
6. Key-in the third digit in the selcall number.	D 4	4
7. Store the third digit.	ENTER	d.4
8. Key-in the fourth digit in the selcall number.	REVIEW 7	7
9. Store the fourth digit.	ENTER	d.5
10. Key-in the last digit in the number.	A 1	1

Keyboard input	Read-out
11. Store the last digit. ENTER	5.E

Now the number can be checked by entering the service programme again and use the SHIFT REVIEW 7 function.

5.F IDENTITY CODE PROGRAMMING

This programme just stores a number in a register which does not influence the function of the set. The information in this register is only used by the factory and has no value for the user.

7. MEMORY ALLOCATION TABLE

The programmable internal memory consisting of two EEPROM's, contains all the programmable information.
As mentioned in the general part, the memories are working with 16-bit word length. Because of the two digit read-out, the 16-bit word is divided into two 8-bit words, the High byte representing the 8 most significant bits and Low bite representing the 8 least significant bits.
When service programme No. 0 is used, the addresses can be programmed directly from the keyboard.
The content of the memory is organized as follows:

Address code in Hex-notation	High byte 7 6 5 4 3 2 1 0	Low byte 7 6 5 4 3 2 1 0
	Function code for P-channels	Frequency code for P-channels
0	P0	P0
1	P1	P1
2	P2	P2
3	P3	P3
4	P4	P4
5	P5	P5
6	P6	P6
7	P7	P7
8	P8	P8
9	P9	P9
A	Quick channel number	D.W. preference ch. number
B	Spare; AUX II code	Spare; Selcall No. digit 1
C	Selcall No. digit 2 and 3	Selcall No. digit 4 and 5
D	Band-shift code B_{RX}, B_{TX}	Synthesizer offset constant nP
E	Last selected channel No.	Identity code
F	Enable code	Channel code; Country version

The content of the remaining part of the memory space depends on the ENABLE CODE.
If the Scan-facility is enabled, the content will be as follows:

Address code in Hex-notation	High byte 7 6 5 4 3 2 1 0	Low byte 7 6 5 4 3 2 1 0
10	Binary table containing the user programmed scan-sequence.	
16	"	"
17	Spare	Maximum number of channels in scan-sequence.
18	Scan-Time in seconds in decimal notation. First digit.	Second digit.
19	Not in use	Not in use
|	"	"
33	"	"

7. **MEMORY ALLOCATION TABLE** cont.:

Address code in Hex-notation	High byte 7 6 5 4 3 2 1 0	Low byte 7 6 5 4 3 2 1 0
	Function codes for inter-	national channels.
34	Channel number 2	Channel number 1
|		
41	Channel number 28	Channel number 27
42	Channel number 61	Channel number 60
|		
4F	Channel number 87	Channel number 86
50	Spare	Channel number 88

If the additional 30 PRIVATE CHANNELS is enabled, the content will be as follows:

Address code in Hex-notation	High byte 7 6 5 4 3 2 1 0	Low byte 7 6 5 4 3 2 1 0
10	Not in use	Not in use
|		
14	"	"
	Function code for A-ch.'s	Frequency code for A-ch.'s
15	A0	A0
|		
1F	A9	A9
	Function code for E-ch.'s	Frequency code for E-ch.'s
20	E0	E0
|		
29	E9	E9
	Function code for F-ch.'s	Frequency code for F.ch.'s
2A	F0	F0
|		
33	F9	F9
	Function codes for inter-	national channels
34	Channel number 2	Channel number 1
|		
41	Channel number 28	Channel number 27
42	Channel number 61	Channel number 60
|		
4F	Channel number 87	Channel number 86
50	Spare	Channel number 88

7. MEMORY ALLOCATION TABLE (C1078A)

The programmable internal memory consisting of two EEPROM's, contains all the programmable information.
As mentioned in the general part, the memories are working with 16-bit word length. Because of the two digit read-out, the 16-bit word is divided into two 8-bit words, the High byte representing the 8 most significant bits and Low byte representing the 8 least significant bits.
When service programme No. 0 is used, the addresses can be programmed directly from the keyboard.
The content of the memory is organized as follows:

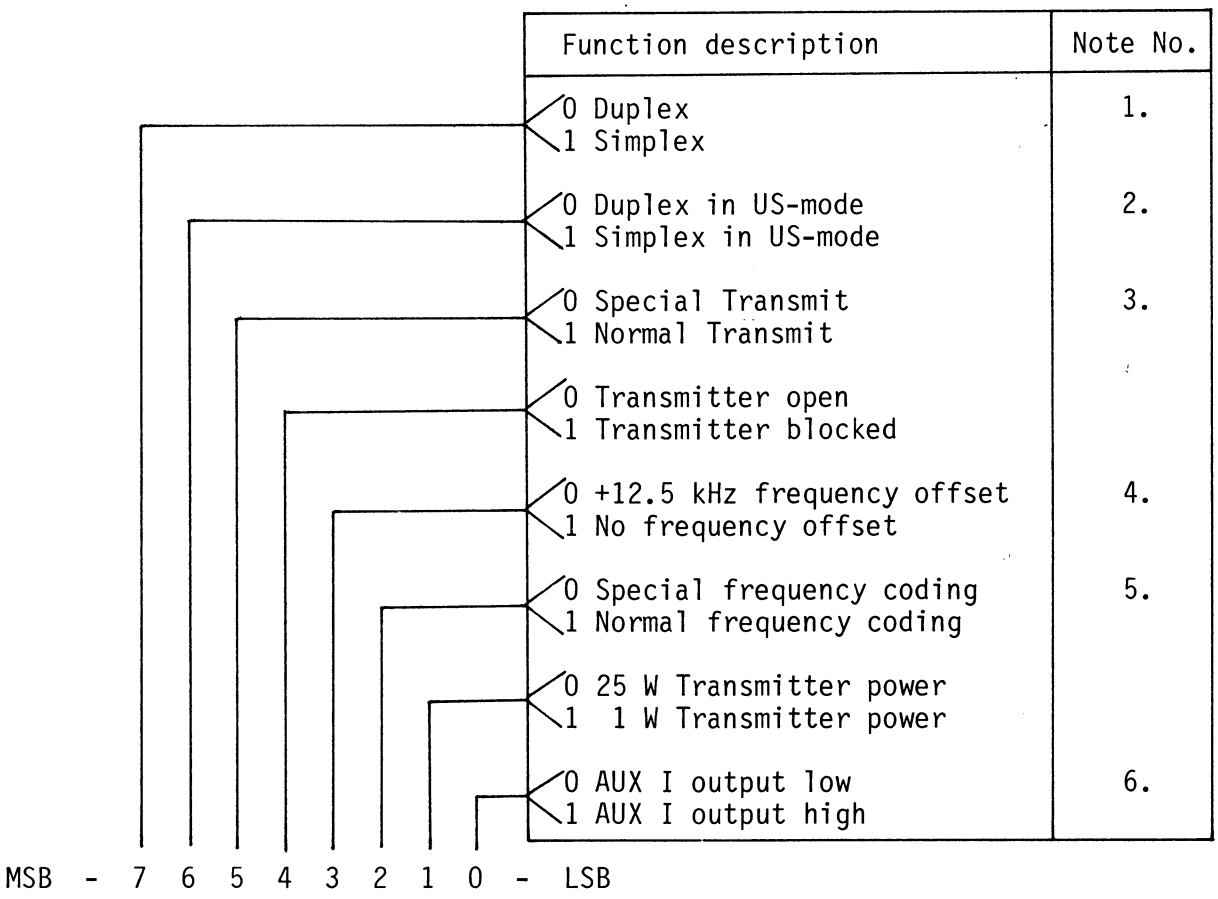
Address code in Hex-notation	High byte 7 6 5 4 3 2 1 0	Low byte 7 6 5 4 3 2 1 0
	Function code for P-channels	Frequency code for P-channels
0	P0	P0
1	P1	P1
2	P2	P2
3	P3	P3
4	P4	P4
5	P5	P5
6	P6	P6
7	P7	P7
8	P8	P8
9	P9	P9
A	Quick channel number	D.W. preference ch. number
B	Spare; AUX II code	Spare; Selcall No. digit 1
C	Selcall No. digit 2 and 3	Selcall No. digit 4 and 5
D	Band-shift code B_{Tx}, B_{Rx}	Synthesizer offset constant nP
E	Last selected channel No.	Identity code
F	Enable code	Channel code; Country version
	Function code for A-channels	Frequency code for A-channels
10 | 19	A0 | A9	A0 | A9
	Function code for E-channels	Frequency code for E-channels
1A | 23	E0 | E9	E0 | E9
	Function code for F-channels	Frequency code for F-channels
24 | 2D	F0 | F9	F0 | F9
2E	Transmitter base constant	Spare

7. **MEMORY ALLOCATION TABLE** (C1078A) cont.:

Address code in Hex-notation	High byte 7 6 5 4 3 2 1 0	Low byte 7 6 5 4 3 2 1 0
2F | 3F	Not in use " "	Not in use " "
40 | 46	Binary table containing the "	user programmed scan-sequence "
47	Spare	Maximum No. of ch's in scan sequence
48	Scan time in seconds in First digit	decimal notation Second digit
	Function code for all	channels 00 -> 99
49 | 56	channel No. 2 Channel No. 28	Channel No. 1 Channel No. 27
57 | 65	Channel No. 61 Spare	Channel No. 60 Channel No. 88
66	Channel No. 29	Spare
67 | 75	Channel No. 31 Channel No. 59	Channel No. 30 Channel No. 58
76 | 7B	Channel No. 90 Channel No. 00	Channel No. 89 Channel No. 99
7C | 7F	Not in use " "	Not in use " "

8. CHANNEL FUNCTION CODE GENERATION

All channels in the set are characterized by means of an 8-bit function code and an 8-bit frequency code.
This chapter describes how the function code is generated on the basis of the wishes to the channel performance.
When the 8-bit function code has been determined, it is split-up into two 4-bit words, which are translated into hexadecimal notation before programming.



Notes:

1. When duplex is selected, the receiving frequency is increased with 4.6 MHz, compared to the normal simplex receiving frequency.

2. When duplex in US-mode is selected, the channel will run as a duplex channel when the set is in US-mode.

3. When Special Transmit is selected, the transmitter frequency is increased with 4.6 MHz compared to the normal transmitter frequency.

4. When using this bit, the normal transmit and receive frequency can be increased by 12.5 kHz.

5. This bit specifies whether special frequency coding is used. This means that the band-shift constants and receiver offset constants are used in the channel frequency coding. See chapter 9 for further details.

6. This bit specifies the logic output level of the AUX I port on the microcomputer. In conjunction with an option board it can be used e.g. to mute external equipment when a certain channel has been selected.

Finally it should be noted, that a channel will be blocked on both transmitter and receiver when the function code equals 1 1 1 1 1 1 1 1, converted to hexadecimal notation FF.

Examples:

A. A channel operating as a normal duplex channel both in normal mode and in US-mode, with no special frequency coding, 25W transmit power and a logic low at AUX I, would have the following binary function code (according to the table above) 0 0 1 0 1 1 0 0. Converted to the hex-code it equals 2C.

B. Same as above, except that the channel will function as a simplex channel in US-mode. The binary code will be 0 1 1 0 1 1 0 0, equal to 6C in hex-code.

C. A channel operating as a normal simplex channel both in normal mode and in US-mode with no special frequency coding, 1W transmit power and a logic low at AUX I, would have the function code 1 1 1 0 1 1 1 0, which converted to hex-code will be EE.

D. Same as above, except that the receive and transmit frequency is increased by 12.5 kHz.
The binary code will be 1 1 1 0 0 1 1 0, equal to E6 in hex-code.

9. CHANNEL FREQUENCY CODE GENERATION

The frequency coding of a channel will normally consist of an 8-bit code, which should be programmed as a two digit hexadecimal number.
In special cases, where the set should operate with special duplex distances or operate below or above the basic frequency band, the frequency programming will include the programming of the two band-shift constants and a receiver offset constant.
The basic frequency band for the transmitter operating in normal mode will be:

$$152{,}800 \text{ MHz} \leq f_{Tx\ Normal} \leq 159{,}150 \text{ MHz}.$$

By means of the channel function code, special transmit can be selected, resulting in the following frequency range:

$$157{,}400 \text{ MHz} \leq f_{Tx\ Special} \leq 163{,}750 \text{ MHz}$$

The normal transmit frequency can be determined by means of the following formula:

1. $$f_{Tx\ Normal}\ (MHz) = 152{,}800 + M_{Tx} \cdot 0{,}025 + B_{Tx} \cdot 6{,}35$$

   where the transmitter bandshift constant $-2 \leq B_{Tx} \leq +2$
   and the transmitter frequency code (decimal) $0 \leq M_{Tx} \leq 254$

   In the basic frequency band $B_{Tx} = 0$.

   When the normal transmit frequency is specified, the transmitter frequency code M_{Tx} and the bandshift code B_{Tx} can be determined by means of this formula:

2. $$M_{Tx}\ (\text{in decimal}) = \frac{\frac{f_{Tx\ Normal}\ (MHz)}{0{,}0125} - 12224}{2} - B_{Tx} \cdot 254$$

   B_{Tx} should be selected to give a frequency code M_{Tx} between 0 and 254.

   Before programming, M_{Tx} should be converted to a two digit hexadecimal number.

   In the table below, $f_{Tx\ Normal}$ and M_{Tx} is listed for the basic frequency band.

   The basic frequency band for the receiver operating in simplex mode will be:

$$152{,}800 \text{ MHz} \leq f_{Rx\ Simplex} \leq 159{,}150 \text{ MHz}.$$

   When operated in duplex mode, the frequency range for the receiver will be:

$$157{,}400 \text{ MHz} \leq f_{Rx\ Duplex} \leq 163{,}750 \text{ MHz}.$$

   The receiving frequency in simplex mode can be determined by means of the following formula:

3. $f_{Rx\ Simplex}$ (MHz) = $f_{Tx\ Normal}$ (MHz) + nP · 0,025 + B_{Rx} · 6,35

where the receiver bandshift constant $-2 \leq B_{RX} \leq 2$
and the receiver offset constant $0 \leq nP \leq 254$

For a normal simplex channel in the basic frequency band, both B_{RX} and nP will equal 0.

When the normal transmit frequency and the simplex receiving frequency is specified, the receiver offset constant and the bandshift constant B_{RX} can be determined by means of the following formula:

4. **nP (in decimal)** = $\dfrac{\dfrac{\text{fRx Simplex - fTx Normal (MHz)}}{0,0125}}{2} - B_{Rx} \cdot 254$

B_{RX} should be selected to give a receiver offset constant between 0 and 254.

Note! When either the bandshift constants B_{TX}, B_{RX} or the receiver offset constant nP differs from 0, the channel function code MUST specify special frequency coding.

Note! In spite of the possibility of programming channels in a large frequency range (140,1 MHz to 171,85 MHz) and with large duplex distance, it MUST be remembered that there can be some physical constraints. The VCO tuning and adjustment range are limited by the components in the standard set. In the same way the fixed tuned buffer amplifiers will only operate properly in a limited frequency range, when no changes have been made.

Examples

A. Determine the necessary frequency coding to make a channel with $f_{Tx\ Normal}$ = 153,800 MHz and $f_{Rx\ Simplex}$ = 154,800 MHz.

The transmitter frequency lies in the basic frequency band, so B_{TX} = 0. By use of formula 2 (or the table below) the transmitter frequency code M_{TX} can be determined to be 40 in decimal, which converted to hex-code means 28.

Now B_{RX} and nP can be determined by means of formula 4. When $f_{Rx\ Simplex} > f_{Tx\ Normal}$ and $f_{Rx\ Simplex} - f_{Tx\ Normal} < 6,35$ (MHz) the bandshift code B_{RX} = 0, and nP can be determined to be 40 in decimal, converted to 28 in hex-code.

B. Programme the channel in A. to be a simplex channel both in normal mode and in U.S.-mode, with normal transmit running at 25 W power level and AUX I being logic high. The channel should lie in PO.

When using chapter 8, the channel function code can be determined to be E9 in hex-code.

9. **CHANNEL FREQUENCY CODE GENERATION** cont.:

	Keyboard input	Read-out
1. Select service mode		5.-
2. Select service programme No. 7 for programming of private ch.'s P0 -> P9.	REVIEW 7	5.7
	ENTER	Ch. 1W
3. Enter the channel number to be programmed, P0.	SHIFT P0	P 1W
	P0	P0 1W
4. Store the channel number.	ENTER	Fu. TX
5. Key-in the function code.	SHIFT E5	E TX
	RETURN 9	E9 TX
6. Store the function code.	ENTER	Fr. US
7. Key-in the transmitter frequency code, M_{TX}, in this case 28.	B2	2 US
	8	28 US
8. Store the value of M_{TX}.	ENTER	Ch. 1W
9. Leave this service programme.	SHIFT RETURN 9	5.7
10. Select service programme No. 9 for programming of bandshift code and receiver offset constant.	RETURN 9	5.9
	ENTER	bc. TX

9. CHANNEL FREQUENCY CODE GENERATION (C1078A)

The frequency coding of a channel will normally consist of an 8-bit code, which should be programmed as a two digit hexadecimal number.
In special cases, where the set should operate with special duplex distances or operate below or above the basic frequency band, the frequency programming will include the programming of the two band-shift constants B_{Tx}, B_{Rx} and the transmitter base constant bP, and the receiver offset constant nP.
The basic frequency band for the transmitter operating in normal mode will be:

$$152{,}800 \text{ MHz} \leq f_{Tx\ Normal} \leq 159{,}150 \text{ MHz}.$$

By means of the channel function code, special transmit can be selected, resulting in the following frequency range:

$$157{,}400 \text{ MHz} \leq f_{Tx\ Special} \leq 163{,}750 \text{ MHz}$$

The normal transmit frequency can be determined by means of the following formula:

1. $$\mathbf{f_{Tx\ Normal}\ (MHz) = 152{,}800 + M_{Tx} \cdot 0{,}025 + B_{Tx} \cdot 6{,}35 + bP \cdot 0.025\ (MHz)}$$

   where the transmitter bandshift constant $-2 \leq B_{Tx} \leq +2$
   and the transmitter frequency code (decimal) $0 \leq M_{Tx} \leq 254$
   and the transmitter base constant (decimal) $0 \leq bP \leq 254$.

   In the basic frequency band $B_{Tx} = 0$.

   For the "fixed frequency" channels, ch's 00 -> 99 is the M_{Tx} constants fixed and thus not programmable.

   When the normal transmit frequency is specified for a private channel P0 - P9, A0 - A9, E0 - E9 or F0 - F9, the transmitter frequency code M_{Tx} and the bandshift code B_{Tx} can be determined by means of this formula (transmitter base constant bP = 0):

2. $$\mathbf{M_{Tx}\ (in\ decimal)} = \frac{\frac{fTx\ Normal\ (MHz)}{0{,}0125} - 12224}{2} - B_{Tx} \cdot 254$$

   B_{Tx} should be selected to give a frequency code M_{Tx} between 0 and 254.

   Before programming, M_{Tx} should be converted to a two digit hexadecimal number.

   In the table below, $f_{Tx\ Normal}$ and M_{Tx} is listed for the basic frequency band.

   When the normal transmit frequency for the "fixed frequency" channels should be changed, it must be done by means of the transmitter base constant bP and B_{Tx}. By the use of these two constants, the frequency band covered by the channels 00 -> 99 can be placed anywhere in the frequency range.

   $$143{,}3 \text{ MHz} \leq f_{Tx\ Normal}\ \text{ch. 00} \leq 168{,}7 \text{ MHz}.$$

   The relative frequency distance between the individual channels will still be the same.

9. **CHANNEL FREQUENCY CODE GENERATION** (C1078A) cont.:

This feature can only be used when the function code for the ch's 00→99 are placed in the EEPROM, and the function code specifies special frequency coding.

The basic frequency band for the receiver operating in simplex mode will be:

$$152{,}800 \text{ MHz} \leq f_{Rx\ Simplex} \leq 159{,}150 \text{ MHz}.$$

When operated in duplex mode, the frequency range for the receiver will be:

$$157{,}400 \text{ MHz} \leq f_{Rx\ Duplex} \leq 163{,}750 \text{ MHz}.$$

The receiving frequency in simplex mode can be determined by means of the following formula:

3. $$\mathbf{f_{Rx\ Simplex}\ (MHz) = f_{Tx\ Normal} + nP \cdot 0{,}025 + B_{Rx} \cdot 6{,}35\ (MHz)}$$

where the receiver bandshift constant $-2 \leq B_{Rx} \leq 2$
and the receiver offset constant $0 \leq nP \leq 254$

For a normal simplex channel in the basic frequency band, both B_{Rx} and nP will equal 0.

When the normal transmit frequency and the simplex receiving frequency is specified, the receiver offset constant and the bandshift constant B_{Rx} can be determined by means of the following formula:

4. $$\mathbf{nP\ (in\ decimal) = \frac{\frac{fRx\ Simplex - fTx\ Normal\ (MHz)}{0{,}0125}}{2} - B_{Rx} \cdot 254}$$

B_{Rx} should be selected to give a receiver offset constant between 0 and 254.

Note! When either the bandshift constants B_{Tx}, B_{Rx} or the transmitter base constant bP or the receiver offset constant nP differs from 0, the channel function code MUST specify special frequency coding.

Note! In spite of the possibility of programming channels in a large frequency range (140,1 MHz to 171,85 MHz) and with large duplex distance, it MUST be remembered that there can be some physical constraints. The VCO tuning and adjustment range are limited by the components in the standard set. In the same way the fixed tuned buffer amplifiers will only operate properly in a limited frequency range, when no changes have been made.

Examples

A. Determine the necessary frequency coding to make a channel with $f_{Tx\ Normal} = 153{,}800$ MHz and $f_{Rx\ Simplex} = 154{,}800$ MHz.

The transmitter frequency lies in the basic frequency band, so $B_{Tx} = 0$. The transmitter base constant is set to zero, bP = 0.

By use of formula 2 (or the table below) the transmitter frequency code M_{Tx} can be determined to be 40 in decimal, which converted to hex-code means 28.

Now B_{Rx} and nP can be determined by means of formula 4. When $f_{Rx\ Simplex} > f_{Tx\ Normal}$ and $f_{Rx\ Simplex} - f_{Tx\ Normal} < 6{,}35$ (MHz) the bandshift code $B_{Rx} = 0$, and nP can be determined to be 40 in decimal, converted to 28 in hex-code.

9. **CHANNEL FREQUENCY CODE GENERATION** (C1078A) cont.:

B. Programme the channel in A. to be a simplex channel both in normal mode and in U.S.-mode, with normal transmit running at 25 W power level and AUX I being logic high. The channel should lie in P0.

When using chapter 8, the channel function code can be determined to be E9 in hex-code.

	Keyboard input	Read-out
1. Select service mode		5.-
2. Select service programme No. 7 for programming of private ch.'s P0 -> P9.	REVIEW 7	5.7
	ENTER	Ch. 1W
3. Enter the channel number to be programmed, P0.	SHIFT P 0	P 1W
	P 0	P0 1W
4. Store the channel number.	ENTER	Fu. TX
5. Key-in the function code.	SHIFT E 5	E TX
E8 wed 12,5 KHz E0 wed 10 KHz	RETURN 9	E9 E8 TX
6. Store the function code.	ENTER	Fr. US
7. Key-in the transmitter frequency code, M_{TX}, in this case 28.	B 2	2 US
145.975 = A28d	8	28 US
8. Store the value of M_{TX}.	ENTER	Ch. 1W
9. Leave this service programme.	SHIFT RETURN 9	5.7
10. Select service programme No. 9 for programming of bandshift code and receiver offset constant.	RETURN 9	5.9
	ENTER	bc. TX

	Keyboard input	Read-out
11. Key-in the bandshift code, in this case both B_{RX} and B_{TX} equal 0.	P 0	00 1W
12. Store the bandshift code.	ENTER	bP. TX
13. Key-in the transmitter base constant. In this case 0.	P 0	00 TX
14. Store the transmitter base constant.	ENTER	nP. US
15. Key-in the receiver offset constant, in this case 28.	B 2	02 US
	8	28 US
16. Store the receiver offset constant.	ENTER	5.9

Leave service mode and check the channel by means of an RF-counter and a signal generator.

C. Determine the needed frequency coding to generate a channel operating with $f_{Tx\ Normal}$ = 152,000 MHz and $f_{Rx\ Simplex}$ = 152,000 MHz.

The transmitter frequency lies below the basic frequency band and 152,8 - $f_{Tx\ Normal}$ < 6,35 MHz, so the transmitter bandshift constant should be -1.

When using formula 2, the transmitter frequency code can be determined by B_{Tx} = -1.

The calculation ends with M_{Tx} = 222 in decimal, which converted to hex-code equals DE.

The receiver frequency in simplex mode equals the normal transmitter frequency, so both B_{Rx} and nP must be 0.

The table below lists the frequency code for normal transmitting frequencies in the basic frequency range.

f_{Tx} Normal MHz	M_{Tx} in Hex-code	f_{Tx} Normal MHz	M_{Tx} in Hex-code
152,800	00	156,025	81
152,825	01	156,050	82
152,850	02	156,075	83
152,875	03	156,100	84
152,900	04	156,125	85
152,925	05	156,150	86
152,950	06	156,175	87
152,975	07	156,200	88
153,000	08	156,225	89
153,025	09	156,250	8A
153,050	0A	156,275	8B
153,075	0B	156,300	8C
153,100	0C	156,325	8D
153,125	0D	156,350	8E
153,150	0E	156,375	8F
153,175	0F	156,400	90
153,200	10	156,425	91
153,225	11	156,450	92
153,250	12	156,475	93
153,275	13	156,500	94
153,300	14	156,525	95
153,325	15	156,550	96
153,350	16	156,575	97
153,375	17	156,600	98
153,400	18	156,625	99
153,425	19	156,650	9A
153,450	1A	156,675	9B
153,475	1B	156,700	9C
153,500	1C	156,725	9D
153,525	1D	156,750	9E
153,550	1E	156,775	9F
153,575	1F	156,800	A0
153,600	20	156,825	A1
153,625	21	156,850	A2
153,650	22	156,875	A3
153,675	23	156,900	A4
153,700	24	156,925	A5
153,725	25	156,950	A6
153,750	26	156,975	A7
153,775	27	157,000	A8
153,800	28	157,025	A9
153,825	29	157,050	AA
153,850	2A	157,075	AB
153,875	2B	157,100	AC
153,900	2C	157,125	AD
153,925	2D	157,150	AE
153,950	2E	157,175	AF
153,975	2F	157,200	B0
154.000	30	157,225	B1
154,025	31	157,250	B2
154,050	32	157,275	B3
154,075	33	157,300	B4
154,100	34	157,325	B5
154,125	35	157,350	B6

f_{Tx} Normal MHz	M_{Tx} in Hex-code	f_{Tx} Normal MHz	M_{Tx} in Hex-code
154,150	36	157,375	B7
154,175	37	157,400	B8
154,200	38	157,425	B9
154,225	39	157,450	BA
154,250	3A	157,475	BB
154,275	3B	157,500	BC
154,300	3C	157,525	BD
154,325	3D	157,550	BE
154,350	3E	157,575	BF
154,375	3F	157,600	C0
154,400	40	157,625	C1
154,425	41	157,650	C2
154,450	42	157,675	C3
154,475	43	157,700	C4
154,500	44	157,725	C5
154,525	45	157,750	C6
154,550	46	157,775	C7
154,575	47	157,800	C8
154,600	48	157,825	C9
154,625	49	157,850	CA
154,650	4A	157,875	CB
154,675	4B	157,900	CC
154,700	4C	157,925	CD
154,725	4D	157,950	CE
154,750	4E	157,975	CF
154,775	4F	158,000	D0
154,800	50	158,025	D1
154,825	51	158,050	D2
154,850	52	158.075	D3
154,875	53	158,100	D4
154,900	54	158,125	D5
154,925	55	158,150	D6
154,950	56	158,175	D7
154,975	57	158,200	D8
155,000	58	158,225	D9
155,025	59	158,250	DA
155,050	5A	158,275	DB
155,075	5B	158,300	DC
155,100	5C	158,325	DD
155,125	5D	158,350	DE
155,150	5E	158,375	DF
155,175	5F	158,400	E0
155,200	60	158,425	E1
155,225	61	158,450	E2
155,250	62	158,475	E3
155,275	63	158,500	E4
155,300	64	158,525	E5
155,325	65	158,550	E6
155,350	66	158,575	E7
155,375	67	158,600	E8
155,400	68	158,625	E9
155,425	69	158,650	EA

9. **CHANNEL FREQUENCY CODE GENERATION** cont.:

f_{Tx} Normal MHz	M_{Tx} in Hex-code	f_{Tx} Normal MHz	M_{Tx} in Hex-code
155,450	6A	158,675	EB
155,475	6B	158,700	EC
155,500	6C	158,725	ED
155,525	6D	158,750	EE
155,550	6E	158,775	EF
155,575	6F	158,800	F0
155,600	70	158,825	F1
155,625	71	158,850	F2
155,650	72	158,875	F3
155,675	73	158,900	F4
155,700	74	158,925	F5
155,725	75	158,950	F6
155,750	76	158,975	F7
155,775	77	159,000	F8
155,800	78	159,025	F9
155,825	79	159,050	FA
155,850	7A	159,075	FB
155,875	7B	159,100	FC
155,900	7C	159,125	FD
155,925	7D	159,150	FE
155,950	7E		
155,975	7F		
156,000	80		

10. COUNTRY VERSION FUNCTION CODE TABLES

Country Vers. Code 0	Country Vers.: Standard international			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Frequency Code Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code 1	Country Vers.: Standard w. pleasure boat ch's DK			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Frequency Code Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				
P3 - 1L	155.500	108	6C	EC
P4 - 2L	155.525	109	6D	EC

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code 2	Country Vers.: Standard w. pleasure boat ch's N			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Frequency Code Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				
P1 - L1	155.500	108	6C	EC
P2 - L2	155.525	109	6D	EC
P3 - L3	155.650	114	72	EC

Country Vers. Code 3	Country Vers.: Standard w. fishing channels			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				
P1 - F1	155.625	113	71	EC
P2 - F2	155.775	119	77	EC
P3 - F3	155.825	121	79	EC

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code 4	Country Vers.: Standard w. weather channels			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				
P1 - WX1	157.950	206	CE	3C
P2 - WX2	157.800	200	C8	3C
P3 - WX3	157.875	203	CB	3C
P4 - WX4	157.050	170	AA	3C

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code 5	Country Vers.: Standard w. 22A			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				
P0 - 22A	157.100	172	AC	EC

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code 6	Country Vers.: Standard w. weather channels and 22A			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Frequency Code Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch. P0 - 22A	157.100	172	AC	EC
P1 - WX1	157.950	206	CE	3C
P2 - WX2	157.800	200	C8	3C
P3 - WX3	157.875	203	CB	3C
P4 - WX4	157.050	170	AA	3C

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code 7	Country Vers.: Standard w. ch. 37			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Frequency Code Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch. P1 - 37	157.850	202	CA	EC

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code 8	Country Vers.: Standard			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Frequency Code Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				

Country Vers. Code 9	Country Vers.: Ch. 00 -> 99 all simplex

Channel No.	Normal Transmitting Frequency MHz	Frequency Code $N_{dec.}$	Hex	Channel No.	Normal Transmitting Frequency MHz	Frequency Code $N_{dec.}$	Hex
00	156.000	128	80	50	158.500	228	E4
01	156.050	130	82	51	158.550	230	E6
02	156.100	132	84	52	158.600	232	E8
03	156.150	134	86	53	158.650	234	EA
04	156.200	136	88	54	158.700	236	EC
05	156.250	138	8A	55	158.750	238	EE
06	156.300	140	8C	56	158.800	240	F0
07	156.350	142	8E	57	158.850	242	F2
08	156.400	144	90	58	158.900	244	F4
09	156.450	146	92	59	158.950	246	F6
10	156.500	148	94	60	156.025	129	81
11	156.550	150	96	61	156.075	131	83
12	156.600	152	98	62	156.125	133	85
13	156.650	154	9A	63	156.175	135	87
14	156.700	156	9C	64	156.225	137	89
15	156.750	158	9E	65	156.275	139	8B
16	156.800	160	A0	66	156.325	141	8D
17	156.850	162	A2	67	156.375	143	8F
18	156.900	164	A4	68	156.425	145	91
19	156.950	166	A6	69	156.475	147	93
20	157.000	168	A8	70	156.525	149	95
21	157.050	170	AA	71	156.575	151	97
22	157.100	172	AC	72	156.625	153	99
23	157.150	174	AE	73	156.675	155	9B
24	157.200	176	B0	74	156.725	157	9D
25	157.250	178	B2	75	156.775	159	9F
26	157.300	180	B4	76	156.825	161	A1
27	157.350	182	B6	77	156.875	163	A3
28	157.400	184	B8	78	156.925	165	A5
29	157.450	186	BA	79	156.975	167	A7
30	157.500	188	BC	80	157.025	169	A9
31	157.550	190	BE	81	157.075	171	AB
32	157.600	192	C0	82	157.125	173	AD
33	157.650	194	C2	83	157.175	175	AF
34	157.700	196	C4	84	157.225	177	B1
35	157.750	198	C6	85	157.275	179	B3
36	157.800	200	C8	86	157.325	181	B5
37	157.850	202	CA	87	157.375	183	B7
38	157.900	204	CC	88	157.425	185	B9
39	157.950	206	CE	89	157.475	187	BB
40	158.000	208	D0	90	157.525	189	BD
41	158.050	210	D2	91	157.575	191	BF
42	158.100	212	D4	92	157.625	193	C1
43	158.150	214	D6	93	157.675	195	C3
44	158.200	216	D8	94	157.725	197	C5
45	158.250	218	DA	95	157.775	199	C7
46	158.300	220	DC	96	157.825	201	C9
47	158.350	222	DE	97	157.875	203	CB
48	158.400	224	E0	98	157.925	205	CD
49	158.450	226	E2	99	157.975	207	CF

Country Vers. Code A	Country Vers.: Belgium, inland

Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6E
02	156.100	132	84	2E
03	156.150	134	86	2E
04	156.200	136	88	2E
05	156.250	138	8A	6E
06	156.300	140	8C	EE
07	156.350	142	8E	6C
08	156.400	144	90	EE
09	156.450	146	92	EE
10	156.500	148	94	EE
11	156.550	150	96	EE
12	156.600	152	98	EE
13	156.650	154	9A	EE
14	156.700	156	9C	EE
15	156.750	158	9E	EE
16	156.800	160	A0	EC
17	156.850	162	A2	EE
18	156.900	164	A4	6E
19	156.950	166	A6	6E
20	157.000	168	A8	2E
21	157.050	170	AA	6E
22	157.100	172	AC	6E
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2E
61	156.075	131	83	2E
62	156.125	133	85	2E
63	156.175	135	87	2E
64	156.225	137	89	2E
65	156.275	139	8B	6E
66	156.325	141	8D	6E
67	156.375	143	8F	EE
68	156.425	145	91	EE
69	156.475	147	93	EE
70	156.525	149	95	EE
71	156.575	151	97	EE
72	156.625	153	99	EE
73	156.675	155	9B	EE
74	156.725	157	9D	EE
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EE
78	156.925	165	A5	6C
79	156.975	167	A7	6E
80	157.025	169	A9	6E
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code B	Country Vers.: France, inland			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EE
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EE
11	156.550	150	96	EE
12	156.600	152	98	EE
13	156.650	154	9A	EE
14	156.700	156	9C	EE
15	156.750	158	9E	EE
16	156.800	160	A0	EC
17	156.850	162	A2	EE
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EE
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EE
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EE
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code C	Country Vers.: Germany, inland			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6C
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	6C
06	156.300	140	8C	EC
07	156.350	142	8E	6C
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EE
11	156.550	150	96	EE
12	156.600	152	98	EE
13	156.650	154	9A	EE
14	156.700	156	9C	EE
15	156.750	158	9E	EE
16	156.800	160	A0	EC
17	156.850	162	A2	EE
18	156.900	164	A4	6C
19	156.950	166	A6	6C
20	157.000	168	A8	2C
21	157.050	170	AA	6C
22	157.100	172	AC	6C
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	6C
64	156.225	137	89	2C
65	156.275	139	8B	6C
66	156.325	141	8D	6C
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EE
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EE
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EE
78	156.925	165	A5	6C
79	156.975	167	A7	6C
80	157.025	169	A9	6C
81	157.075	171	AB	6C
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code D	Country Vers.: Holland, inland			
Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	6E
02	156.100	132	84	2E
03	156.150	134	86	2E
04	156.200	136	88	2E
05	156.250	138	8A	6E
06	156.300	140	8C	EE
07	156.350	142	8E	6C
08	156.400	144	90	EE
09	156.450	146	92	EE
10	156.500	148	94	EE
11	156.550	150	96	EE
12	156.600	152	98	EE
13	156.650	154	9A	EE
14	156.700	156	9C	EE
15	156.750	158	9E	EE
16	156.800	160	A0	EC
17	156.850	162	A2	EE
18	156.900	164	A4	6E
19	156.950	166	A6	6E
20	157.000	168	A8	2E
21	157.050	170	AA	6E
22	157.100	172	AC	6E
23	157.150	174	AE	6C
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2E
61	156.075	131	83	2E
62	156.125	133	85	2E
63	156.175	135	87	6E
64	156.225	137	89	2E
65	156.275	139	8B	6E
66	156.325	141	8D	6E
67	156.375	143	8F	EE
68	156.425	145	91	EE
69	156.475	147	93	EE
70	156.525	149	95	EE
71	156.575	151	97	EE
72	156.625	153	99	EE
73	156.675	155	9B	EE
74	156.725	157	9D	EE
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EE
78	156.925	165	A5	6C
79	156.975	167	A7	6E
80	157.025	169	A9	6E
81	157.075	171	AB	6E
82	157.125	173	AD	6C
83	157.175	175	AF	6C
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	6C
89		255	FF	FF
Private ch.				

10. **COUNTRY VERSION FUNCTION CODE TABLES** cont.:

Country Vers. Code F	Country Vers.: USA-version w. 1W on ch. 13/67

Channel No.	Normal Transmitter Frequency MHz	Frequency Code $N_{dec.}$	Hex	Function Code in Hex. Number
00		255	FF	FF
01	156.050	130	82	EC
02	156.100	132	84	2C
03	156.150	134	86	2C
04	156.200	136	88	2C
05	156.250	138	8A	EC
06	156.300	140	8C	EC
07	156.350	142	8E	EC
08	156.400	144	90	EC
09	156.450	146	92	EC
10	156.500	148	94	EC
11	156.550	150	96	EC
12	156.600	152	98	EC
13	156.650	154	9A	EC
14	156.700	156	9C	EC
15	156.750	158	9E	EC
16	156.800	160	A0	EC
17	156.850	162	A2	EC
18	156.900	164	A4	EC
19	156.950	166	A6	EC
20	157.000	168	A8	2C
21	157.050	170	AA	EC
22	157.100	172	AC	EC
23	157.150	174	AE	EC
24	157.200	176	B0	2C
25	157.250	178	B2	2C
26	157.300	180	B4	2C
27	157.350	182	B6	2C
28	157.400	184	B8	2C
29		255	FF	FF
60	156.025	129	81	2C
61	156.075	131	83	2C
62	156.125	133	85	2C
63	156.175	135	87	EC
64	156.225	137	89	2C
65	156.275	139	8B	EC
66	156.325	141	8D	EC
67	156.375	143	8F	EC
68	156.425	145	91	EC
69	156.475	147	93	EC
70	156.525	149	95	EC
71	156.575	151	97	EC
72	156.625	153	99	EC
73	156.675	155	9B	EC
74	156.725	157	9D	EC
75	156.775	159	9F	EE
76	156.825	161	A1	EE
77	156.875	163	A3	EC
78	156.925	165	A5	EC
79	156.975	167	A7	EC
80	157.025	169	A9	EC
81	157.075	171	AB	EC
82	157.125	173	AD	EC
83	157.175	175	AF	EC
84	157.225	177	B1	2C
85	157.275	179	B3	2C
86	157.325	181	B5	2C
87	157.375	183	B7	2C
88	157.425	185	B9	EC
89		255	FF	FF
Private ch.				
P1 - WX1	157.950	206	CE	3C
P2 - WX2	157.800	200	C8	3C
P3 - WX3	157.875	203	CB	3C
P4 - WX4	157.050	170	AA	3C