REPORT 1159

# CHARACTERISTICS OF AN AUTOMATIC IDENTIFICATION SYSTEM FOR VHF AND UHF TRANSMITTING STATIONS IN THE MARITIME MOBILE SERVICE

(Question 97/8)

(1990)

## Introduction

Administrations participating in the Regional Agreement concerning the VHF radiotelephone service on the river Rhine have developed a system for the automatic identification of maritime VHF radiotelephone equipment (ATIS).

This ATIS system will eventually be employed in all maritime VHF radiotelephones, for hand-held and fixed installations, on-board inland waterway vessels sailing the river Rhine, and the Netherlands inland waterways. Implementation of ATIS on a mandatory basis for maritime VHF radiotelephones on such vessels is expected to be completed in 1994.

The ATIS signal format is based on Recommendation 493 *- Digital Selective Calling - for use in the maritime mobile service and on Recommendation 7 of the Regional Rhine Agreement.

## Signal characteristics

ATIS signals will be emitted at the end of every transmission cycle (release of PTT switch). For extended or continuous transmission the ATIS signal will be repeated at least once in every five minutes.

ATIS signal emission at the end of a transmission cycle avoids the effects of settling time of the VHF transmitter and receiver. It also enables the communication link to be directly available for speech when the PTT switch is activated.

The aural perception of the FSK modulated ATIS signal is like a short noise burst with a duration of approximately 285 msec.

By transmitting the ATIS signal at the end of a transmission cycle, the end of the ATIS "noise burst" will almost coincide with the noise generated in VHF receivers due to lifting of the squelch and no additional audible interference is heard.

The ATIS signal will be transmitted by the mobile unit on the communication channel selected, irrespective of the choice except for VHF channel 70 on Appendix 18 to the Radio Regulations which is allocated for regular DSC calls. In Rhine VHF radiotelephone equipment channel 70 will normally be blocked since no DSC infrastructure is foreseen along the river Rhine.

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* NOTE BY THE CCIR SECRETARIAT:

In the revision of Recommendation 493 certain terms have been changed (for example "signal" and "symbol" have been replaced with the term "character" in a number of places in Annex I.

By selecting a specific format specifier for ATIS purposes, symbol 121, DSC decoders which might be used on public correspondence channels can be programmed not to read ATIS signal sequences.

Annexed to this Report is the performance standard developed for use in the framework of the Regional Agreement concerning the VHF radiotelephone service on the river Rhine, Munich 1976.

## ANNEX

### Automatic transmitter identification (ATIS) for maritime VHF radiotelephones

1. GENERAL

1.1 The ATIS equipment which is intended to be permanently connected to an existing VHF Rhine radiotelephone installation shall be type-approved by the administration.

1.2 VHF Rhine radiotelephone installations in which an ATIS facility is integrated shall be subject to additional type-testing by the administration.

1.3 The ATIS facility shall generate the identification signal automatically.

1.4 The ATIS signal shall be transmitted at the end of every transmission. In case a continuous transmission takes place the ATIS signal shall be transmitted at least once in a five minutes period. The end of a transmission is considered to be every release of the "push-to-transmit" switch of the equipment.

1.5 The ATIS signal shall be transmitted on all channels available in the VHF Rhine radiotelephone installation.

1.6 In the case the VHF Rhine radiotelephone installation is equipped with a Digital Selective Calling facility in conformity with CCIR Rec.493, the ATIS signal may be inhibited when a DSC call is made.

1.7 In the case the VHF Rhine radiotelephone installation is equipped with a facility to transmit data, the transmission of an ATIS signal may be inhibited if the dataprotocol contains the identification of the transmitting station. During the subsequent correspondence the ATIS signal shall be transmitted periodically in conformity with § 1.4.

2. TECHNICAL REQUIREMENTS

2.1 The ATIS shall comply with the CCIR recommendation 493* digital selective calling system for use in the maritime mobile service with exception of the dot-pattern, which may be omitted.

2.2 The ATIS facility shall in no way influence the functioning of other communication or navigational equipment.

2.3 If separate ATIS equipment is used the equipment shall be connected to an existing VHF Rhine radiotelephone installation by means of a electrical connection which can not be removed easily. Use of an acoustical or similar interconnection is not allowed.

2.4 The ATIS facility shall be considered to be a part of the VHF Rhine radiotelephone installation. The requirements for VHF Rhine radiotelephone installations apply, if relevant, to the ATIS equipment.

2.5 During the transmission of the ATIS-signal the RF output power of the transmitter shall be retained at nominal value.

2.6 It shall not be possible for the operator to easily disconnect or to change the programming of the ATIS facility.

2.7 The format of the ATIS signal sequence shall comply with the requirements of this specification.

2.8 The system is a synchronous system using a ten-unit error-detecting code as listed in Table 1 of this specification. The first seven bits of the ten-unit code of Table 1 of this specification are information bits. Bits 8, 9 and 10 indicate, in the form of a binary number, the number of B elements that occur in the seven information bits, a Y element being binary number 1 and a B element a binary number zero. For example, a BYY sequence for bits 8, 9 and 10 indicates 3 (0 x 4 + 1 x 2 + 1 x 1) B elements in the associated seven information bit sequence; and a YYB sequence indicates 6 (1 x 4 + 1 x 2 + 0 x 1) B elements in the associated seven information bit sequence. The order of transmission for the information bits is the least significant bit first, but for the check bits it is the most significant bit first.

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In the revision of Recommendation 493 certain terms have been changed (for example "signal" and "symbol" have been replaced with the term "character" in a number of places in Annex I.

3. SIGNAL REQUIREMENTS

3.1 If separate ATIS equipment is used in combination with an existing VHF Rhine radiotelephone installation the ATIS signal shall be an audio frequency signal with a:
- frequency-shift between 1300 Hz and 2100 Hz; the sub-carrier being at 1700 Hz
- frequency tolerance of the 1300 Hz and 2100 Hz tones of ±10 Hz.
- modulation rate of 1200 bauds
- the audio frequency output shall have an impedance of 600 ohm and shall be balanced to earth
- the audio frequency output voltage shall be internally adjustable from 0.1 to 150 millivolt (rms).

3.2 If the ATIS facility is integrated in a VHF Rhine radiotelephone installation the transmitted ATIS signal sequence shall be a phase modulated radio frequency signal (frequency modulation with a pre-emphasis of 6 dB/octave).
The modulating sub-carrier shall have a:
- frequency-shift between 1300 Hz and 2100 Hz; the sub-carrier being at 1700 Hz
- frequency tolerance of the 1300 Hz and 2100 Hz tones of ± 10 Hz
- modulation rate of 1200 bauds
- modulation index of 2.0 ± 10%.

3.3 The information in the ATIS signal is presented as a sequence of seven-unit binary combinations constituting a primary code.
The seven information bits of the primary code express a symbol number from 00 to 127, as shown in Table 1. The symbols from 00 to 99 are used to code two decimal figures according to Table II.

3.4 The higher frequency corresponds to the B-state and the lower frequency corresponds to the Y-state of the signal elements.

3.5 The receiver decoder should provide maximal utilization of the received signals including use of the error check character.

4. TECHNICAL FORMAT OF AN ATIS SIGNAL SEQUENCE

4.1 The technical format of the ATIS signal sequence is:

| Dot * pattern | Phasing sequence | Format specifier | Self-identification | End of sequence | Error check character |
|---|---|---|---|---|---|

* may be omitted

4.2 The composition of the ATIS transmission format and signal sequence are given in fig.1 and 2.

4.3 Time diversity is provided in the ATIS signal sequence as follows.
Besides the phasing signals, each signal is transmitted twice in a time-spread mode; the first transmission (DX) of a specific signal is followed by the transmission of four other signals before the re-transmission (RX) of that specific signal takes place, allowing for a time-diversity reception interval of 33 1/3 ms.

5. DOT PATTERN

To provide appropriate conditions for earlier bit synchronization the phasing sequence may be preceded by a dot pattern (i.e. an alternating B-Y bit sequence) with a duration of 20 bits.

6. PHASING

6.1 The phasing sequence provides information to the receiver to permit correct bit phasing and unambiguous determination of the positions of the signals within a ATIS signal sequence.

6.1.1 Acquisition of symbol synchronization should be achieved by means of symbol recognition rather than, for example, by recognizing a change in the dot pattern, in order to reduce false synchronization caused by a bit error in the dot pattern.

6.2 The phasing sequence consists of specific signals in the DX and RX positions transmitted alternatively. Six DX signals are transmitted.

6.2.1 The phasing signal in the DX position is symbol 125 of Table I.

6.2.2 The phasing signals in the RX position specify the start of the information sequence (i.e. the format specifier) and consist of the signals for the symbols 111, 110, 109, 108, 107, 106, 105 and 104 of Table I, consecutively.

6.3 Phasing is considered to be achieved when two DX's and one RX, or two RX's and one DX, or, if practical three RX's in the appropriate DX or RX positions, respectively, are successfully received.

7. FORMAT SPECIFIER

The format specifier signal is transmitted twice in both the DX and RX positions (see figure 2) and will consist of symbol 121.

8. SELF-IDENTIFICATION

**The Maritime Mobile Service Identity assigned to the calling station, coded according to Table II and conform RR appendix 43, is used for self-identification.**

9. END OF SEQUENCE

9.1 The "end of sequence" signal is transmitted 3 times in the DX position and once in the RX position (see fig.2).

9.2 The "end of sequence" signal is symbol 127.

10. ERROR CHECK CHARACTER

10.1 The error check character is the final character transmitted and it serves to check the entire sequence for the presence of errors which are undetected by the ten-unit error-detecting code and the time diversity employed.

10.2 The seven information bits of the error-check signal shall be equal to the least significant bit of the modulo-2 sums of the corresponding bits of all information characters (i.e., even vertical parity). The Format Specifier and the End of Sequence characters are considered to be information characters. The phasing signals shall not be considered to be information characters. Only one format specifier signal and one end of sequence signal should be used in constructing the error check character. The error check character shall also be sent in the DX and RX positions.

11. CONVERSION OF CALL SIGNS TO MARITIME MOBILE SERVICE IDENTITIES

The following procedure shall be used for the conversion of callsigns to Maritime Mobile Service Identities.

The 10-digit code constituing a ship station identity shall be formed as follows :

$$Z\ M\ I\ D\ X_1\ X_2\ X_3\ X_4\ X_5\ X_6$$

Wherein

| | |
|---|---|
| Z | represents the figure 9 and shall be used for inland waterways only. |
| M I D | represent the Maritime Identification Digits for each country, conform RR appendix 43. |
| $X_1$ to $X_6$ | represent the converted callsign figures. |

The value of the digits $X_1$ to $X_6$ shall be derived as follows :

| | |
|---|---|
| $X_3$ to $X_6$ | shall contain the number of the callsign, where $X_6$ is the least significant digit. |
| $X_1$ to $X_2$ | shall contain a figure representing the second letter of the callsign, wherein 01 represents A, 02 represents B, etc. $X_2$ is the least significant digit. |

The first letter of the callsign is not used in the conversion.

12. EXPLANATORY NOTE - TIME REQUIREMENTS

12.1 Bits and time required by various parts of the ATIS sequence

| | | Bits | Time (msec.) | |
|---|---|---|---|---|
| 1) | Dot pattern | 20 | 16.67 | 00 |
| 2) | Phasing sequence | 140 | 116.67 | 116.67 |
| 3) | Format | 40 | 33.33 | 33.33 |
| 4) | Identification code | 100 | 83.33 | 83.33 |
| 5) | End of sequence | 40 | 33.33 | 33.33 |
| 6) | Error check | 20 | 16.67 + | 16.67 + |
| | | 300 | | 283.33 |

| | | A) | B) | C) | D) |
|---|---|---|---|---|---|
| Dot * pattern | Phasing | Format specifier | Identifi-cation | End of sequence | Error check |
| | 6x DX (125)<br>8x RX | 2 ident. symbols | 5 symbols | 3x DX(127)<br>1x RX(127) | 1 symbol |
| 20 bits | (111 to 104) | (2 times) | (2 times) | | (2 times) |

* see par. 2.1

Figure 1 - Technical format of the ATIS signal

| Dot * pattern | |
|---|---|
| DX | |
| | RX 7 |
| DX | |
| | RX 6 |
| DX | |
| | RX 5 |
| DX | |
| | RX 4 |
| DX | |
| | RX 3 |
| DX | |
| | RX 2 |
| A | |
| | RX 1 |
| A | |
| | RX 0 |
| B | |
| | A |
| B | |
| | A |
| B | |
| | B |
| B | |
| | B |
| B | |
| | B |
| C | |
| | B |
| D | |
| | B |
| C | |
| | C |
| C | |
| | D |

RX/DX = phasing sequence
A = Format specifier
B = Identification
C = End of sequence
D = Error check symbol

FIGURE 2 - Transmission sequence

TABLE I – *Ten-unit error-detecting code*

| Symbol No. | Emitted signal and bit position 1 2 3 4 5 6 7 8 9 10 |
|---|---|
| 00 | BBBBBBBYYY |
| 01 | YBBBBBBYYB |
| 02 | BYBBBBBYYB |
| 03 | YYBBBBBYBY |
| 04 | BBYBBBBYYB |
| 05 | YBYBBBBYBY |
| 06 | BYYBBBBYBY |
| 07 | YYYBBBBYBB |
| 08 | BBBYBBBYYB |
| 09 | YBBYBBBYBY |
| 10 | BYBYBBBYBY |
| 11 | YYBYBBBYBB |
| 12 | BBYYBBBYBY |
| 13 | YBYYBBBYBB |
| 14 | BYYYBBBYBB |
| 15 | YYYYBBBBYY |
| 16 | BBBBYBBYYB |
| 17 | YBBBYBBYBY |
| 18 | BYBBYBBYBY |
| 19 | YYBBYBBYBB |
| 20 | BBYBYBBYBY |
| 21 | YBYBYBBYBB |
| 22 | BYYBYBBYBB |
| 23 | YYYBYBBBYY |
| 24 | BBBYYBBYBY |
| 25 | YBBYYBBYBB |
| 26 | BYBYYBBYBB |
| 27 | YYBYYBBBYY |
| 28 | BBYYYBBYBB |
| 29 | YBYYYBBBYY |
| 30 | BYYYYBBBYY |
| 31 | YYYYYBBBYB |
| 32 | BBBBBYBYYB |
| 33 | YBBBBYBYBY |
| 34 | BYBBBYBYBY |
| 35 | YYBBBYBYBB |
| 36 | BBYBBYBYBY |
| 37 | YBYBBYBYBB |
| 38 | BYYBBYBYBB |
| 39 | YYYBBYBBYY |
| 40 | BBBYBYBYBY |
| 41 | YBBYBYBYBB |
| 42 | BYBYBYBYBB |
| 43 | YYBYBYBBYY |
| 44 | BBYYBYBYBB |
| 45 | YBYYBYBBYY |
| 46 | BYYYBYBBYY |
| 47 | YYYYBYBBYB |
| 48 | BBBBYYBYBY |
| 49 | YBBBYYBYBB |
| 50 | BYBBYYBYBB |
| 51 | YYBBYYBBYY |
| 52 | BBYBYYBYBB |
| 53 | YBYBYYBBYY |
| 54 | BYYBYYBBYY |
| 55 | YYYBYYBBYB |
| 56 | BBBYYYBYBB |
| 57 | YBBYYYBBYY |
| 58 | BYBYYYBBYY |
| 59 | YYBYYYBBYB |
| 60 | BBYYYYBBYY |
| 61 | YBYYYYBBYB |
| 62 | BYYYYYBBYB |
| 63 | YYYYYYBBBY |
| 64 | BBBBBBYYYB |
| 65 | YBBBBBYYBY |
| 66 | BYBBBBYYBY |
| 67 | YYBBBBYYBB |
| 68 | BBYBBBYYBY |
| 69 | YBYBBBYYBB |
| 70 | BYYBBBYYBB |
| 71 | YYYBBBYBYY |
| 72 | BBBYBBYYBY |
| 73 | YBBYBBYYBB |
| 74 | BYBYBBYYBB |
| 75 | YYBYBBYBYY |
| 76 | BBYYBBYYBB |
| 77 | YBYYBBYBYY |
| 78 | BYYYBBYBYY |
| 79 | YYYYBBYBYB |
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| 99 | YYBBBYYBYY |
| 100 | BBYBBYYYBB |
| 101 | YBYBBYYBYY |
| 102 | BYYBBYYBYY |
| 103 | YYYBBYYBYB |
| 104 | BBBYBYYYBB |
| 105 | YBBYBYYBYY |
| 106 | BYBYBYYBYY |
| 107 | YYBYBYYBYB |
| 108 | BBYYBYYBYY |
| 109 | YBYYBYYBYB |
| 110 | BYYYBYYBYB |
| 111 | YYYYBYYBBY |
| 112 | BBBBYYYYBB |
| 113 | YBBBYYYBYY |
| 114 | BYBBYYYBYY |
| 115 | YYBBYYYBYB |
| 116 | BBYBYYYBYY |
| 117 | YBYBYYYBYB |
| 118 | BYYBYYYBYB |
| 119 | YYYBYYYBBY |
| 120 | BBBYYYYBYY |
| 121 | YBBYYYYBYB |
| 122 | BYBYYYYBYB |
| 123 | YYBYYYYBBY |
| 124 | BBYYYYYBYB |
| 125 | YBYYYYYBBY |
| 126 | BYYYYYYBBY |
| 127 | YYYYYYYBBB |

B = 0
Y = 1

order of bit transmission: bit 1 first.

TABLE II – *Packing table for decimal numbers into ten-unit signals*

| The digits for the | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Thousands of millions D2 | Hundreds of millions D1 | Tens of millions D2 | Millions D1 | Hundreds of thousands D2 | Tens of thousands D1 | Thousands D2 | Hundreds D1 | Tens D2 | Units D1 |
| Signal 5 | | Signal 4 | | Signal 3 | | Signal 2 | | Signal 1 | |

The digit sequence D2-D1 varies from 00 to 99 inclusive in each signal (signal 1 to 5 inclusive). The signal that represents a particular two-decimal figure is transmitted as the symbol number (see Table I) that is identical to that particular two-decimal figure. Signal 1 is the last signal transmitted.

When the number consists of an odd number of decimal digits, a zero shall be added in front of the most significant position to provide an integral number of ten-unit signals.