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| U.S. Radiocommunications Sector  Fact Sheet | |
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| **Purpose/Objective:** This is a Fact Sheet for a Working Document Towards a preliminary draft revision to Recommendation ITU-R F.1762 “Characteristics of enhanced applications for high frequency (HF) radiocommunication systems “that includes characteristics of systems that could be used to provide enhanced applications through high-speed digital networks within the 3 to 30 MHz frequency range. | |
| **Abstract:** The updates that are included in this document contain a list of additional enhanced services and system parameters that could facilitate the deployment of high-speed digital networks that support enhanced applications within the 3 to 30 MHz frequency range. | |

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| WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT REVISION TO RECOMMENDATION ITU-R F.1762 “CHARACTERISTICS OF ENHANCED APPLICATIONS FOR HIGH FREQUENCY (HF) RADIOCOMMUNICATION SYSTEMS” | |
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**Introduction**

The United States proposes to update the Recommendation ITU-R F.1762 “Characteristics of enhanced applications for high frequency (HF) radiocommunication systems “The updates include a list of additional enhanced applications along with updated system parameters that would support the deployment of enhanced applications through high-speed digital networks within the 3 to 30 MHz frequency range.

Attachment: 1

ATTACHMENT

Working Document Towards a Preliminary Draft Update to RECOMMENDATION ITU-R F.1762

Characteristics of enhanced applications for high frequency (HF) radiocommunication systems

(Question ITU-R 158/9)

(2006)

Scope

This Recommendation describes the technical characteristics of enhanced applications for high frequency (HF) radiocommunication systems to provide digital services.

The ITU Radiocommunication Assembly,

considering

a) that some high frequency (HF) systems can be used to provide enhanced applications for electronic messaging systems (e-mail), digital voice and large file transfer providing a communications path to the Internet for exchanging information;

b) that the increasing use of spectrum in the HF bands for enhanced applications such as electronic messaging systems, both with and without attachments, should be taken into account;

c) that such HF systems are not standardized in use and may have different operational technical characteristics;

d) that with electronic messaging, and other enhanced applications for HF systems, equipment interoperability is an important issue,

noting

a) that such HF systems are capable of providing routine and emergency public protection and disaster relief;

b) that HF digital networks utilizing increased channel bandwidths can be used as a mechanism for providing enhanced applications

c) that additional information on HF systems capable of providing enhanced applications can be found in ITU-R Report F.2062,

recommends

**1** that the technical characteristics of those HF systems providing enhanced applications, including electronic messaging and other Internet capability, described in Annex 1 should be considered representative of those systems operating in the HF frequency bands between 2 and 30 MHz.

Annex 1  
  
Characteristics of HF radio systems   
providing enhanced applications

# 1 Introduction

Typical enhanced applications that can be supported over HF include:

1. electronic mail, also known as e-mail,
2. voice over internet protocal, also known as voip

c) interactive Internet applications

d) file transfer

e) real-time video over HF ( i.e. UAS downlink), and

f) video file streaming

In the event of the collapse or overload of normal telecommunication operation due to natural disasters (e.g. earthquakes) and other emergencies, applications for enhanced HF systems using fixed, transportable and mobile stations could provide emergency links during the first phase of the alarm or during the coordination of the relief operation.

# 2 HF Transmiter/Reciever RF Technical characteristics

Tables 1, 2 and 3 contain technical characteristics of representative HF systems capable of providing enhanced voice and digital applications. These characteristics are sufficient for general calculation to assess the compatibility between these systems and systems operating in other services.

TABLE 1

Typical RF characteristics of HF systems Operating in the 2 to 30 kHz Frequency Band for Channel Bandwidth = 3 kHz

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | System | | |
| Mode of operation | Groundwave | Skywave (oblique) | NVIS Near vertical |
| Frequency band (MHz) | 2-10 | 3-30 | 2-10 |
| Necessary bandwidth and type of emission (kHz) | 3 | 3 | 3 |
| Transmitter power PX (dBW) | 10-30 | 0-26 | 10-26 |
| Feeder loss (dB) | 3 | 3 | 3 |
| Antenna gain (dBi) | 6 | 3 | 0 |
| Maximum e.i.r.p. (dBW) | 33 | 26 | 23 |
| Antenna polarization | Vertical/Horizontal | Vertical/  Horizontal | Horizontal |
| Receiver IF bandwidth (kHz) | 3 | 3 | 3 |
| Receiver RF bandwidth (kHz) | 3 | 3 | 3 |
| Receiver noise figure (dB) | 16 | 16 | 16 |
| Protection ratio PY (dB) | 21 | 28 | 10 |
| Signal-to-noise ratio ( Rec ITU-R F.339) | 21 | 28 | 10 |

TABLE 2

Example RF Characteristic of Enhanced HF Systems for Channel Bandwidths of 3 to 48 kHz (Transmitter)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Enhanced HF Transmitter Parameters** | Groundwave / Skywave | NVIS/ Groundwave | Skywave/NVIS/ Groundwave | Skywave |
| Frequency band (MHz) | 2.8-30 | 2.8-30 | 2.8-30 | 2.8-30 |
| Channel Bandwidth (kHz)[[1]](#footnote-1) |  |  |  |  |
| Variable (3kHz to 12.0kHz) | 12.0 | 12.0 | 12.0 | 12.0 |
| Variable (3kHz to 18.0kHz) | 18.0 | 18.0 | 18.0 | 18.0 |
| Variable (3kHz to 24.0kHz) | 24.0 | 24.0 | 24.0 | 24.0 |
| Variable (3kHz to 48kHz) | 48.0 | TBD | 48.0 | TBD |
| Transmitter Power (dBW) | 36 | 26 | 36 | 27 |
| Feeder Loss (dB) | 2.2 | 1.5 | 2.6 | 1.1 |
| Antenna Gain (dBi) | 14.15 | 4.15 | 11.15 | 2.15 |
| Antenna Height (m) | 64 | 3.65 | 28.04 | 1.21 |
| Antenna polarization | Vertical | Vertical | Vertical | Horizontal |
| Antenna Type | Broadband Omni | Narrowband Monopole | Broadband Dual Fan-Wire | Narrowband Dipole |
| Maximum e.i.r.p (dBW) | 34.2 | 24.2 | 35.7 | 26.7 |
| Modulation | AM/FM | AM/FM | FM | FM |
| Typical Minimum Path Length (km) | 161 | 48.2 | 38.6 | 19 |

TABLE 3

RF Characteristic of Enhanced HF Systems for Channel Bandwidths of 3 to 48 kHz (Receiver)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Enhanced HF Receiver Parameters | Groundwave / Skywave | NVIS/ Groundwave | Skywave/NVIS/ Groundwave | Skywave |
| Frequency band (MHz) | 2.5-60 | 2.5-30 | 2.5-60 | 2.5-30 |
| Channel Bandwidth (kHz)[[2]](#footnote-2) |  |  |  |  |
| Variable (3kHz to 12.0kHz) | 12.0 | 12.0 | 12.0 | 12.0 |
| Variable (3kHz to 18.0kHz) | 18.0 | 18.0 | 18.0 | 18.0 |
| Variable (3kHz to 24.0kHz) | 24.0 | 24.0 | 24.0 | 24.0 |
| Variable (3kHz to 48kHz) | 48.0 |  | 48.0 |  |
| Transmitter Power (dBW) | N/A | N/A | N/A | N/A |
| IF Filter Bandwidth (kHz) | 48 | 24 | 48 | 48 |
| Sensitivity (dBm) |  |  |  |  |
| SSB for 10dB SINAD | -113 | -113 | -113 | -113 |
| ISB for 10dB SINAD | -97 | -97 | -97 | -97 |
| CW for 10dB SINAD | -116 | -116 | -116 | -116 |
| Signal-to-noise ratio (dB) |  |  |  |  |
| PSK | 5 | 12 | 8 | 14 |
| FSK | 8 | 18 | 12 | 18 |
| QAM | 14 | 24 | 20 | 24 |
| OFDM | 16 | 26 | 26 | 30 |
| Feeder Loss (dB) | 2.2 | 1.5 | 2.6 | 1.1 |
| Antenna Gain (dBi) | 14.15 | 4.15 | 11.15 | 2.15 |
| Antenna Height (m) | 64 | 3.65 | 28.04 | 1.21 |
| Antenna polarization | Vertical | Vertical | Vertical | Horizontal |
| Typical Minimum Path Length (km) | 161 | 48.2 | 38.6 | 19 |
| Protection Criteria | TBD | TBD | TBD | TBD |

**3 Typical HF Antenna Patterns**

HF Systems utilize a varity of antenna types as a function of operational range. For short range applications conventional whip antenna are typically mounted on man-packs and vehicles. Medium range Skywave NVIS (Near Vertical Incidence Skywave) applications utilize loop, bent whips and diploes. Long range use large vertical whip antennas, yagi and log-periodic antennas. Dipoles that are higher above ground are also used for long range applications.

Antenna patterns for typical HF antenna types; Whip, Loop, Bent Whip, Dipole and Log-Periodic, can be found in Recommendation. ITU-R BS.705-1 “HF transmitting and receiving antennas characteristics and diagrams”. Additional antenna patterns can be found in APPENDIX 1 to Annex 1 of the Recommendation. and include; curtain antennas with different feeding arrangements and reflector types, tropical antennas, horizonal and vertical log-periodic, rhombic, quadrant, cross dipole and vertical monopoles.[[3]](#footnote-3) Additional information and data regarding HF Broadcasting antennas can be found in Recommendation ITU-R BS.80-3 “ Transmitting antennas in HF broadcasting”.

**4 Emission Characteristics (TBD)**

Figures 1 and 2 illustrate spcrtum masks that can be applicable to any system utilizating the channel bandwidths that are listed in Tables 1,2 and 3.

FIGURE 1

Spectrum Mask for System Utilizing Channel Bandwidths of 2 to 48 kHz

Diagram

Description automatically generated

**FIGURE 2**

Spectrum Mask for Systems with a 3 kHz Channel Bandwidth (Aeronatical Applications)

Diagram

Description automatically generated

1. Channel bandwidths of 24 kHz within the 3-30 MHZ frequency band have been recognized and defined in RECOMMENDATION ITU-R F.339-8 “Bandwidths, signal-to-noise ratios and fading allowances in HF fixed and land mobile radiocommunication systems” 1951-1953-1956-1963-1966-1970-1974-1978-1982-1986-2006-2013) Table 4a. [↑](#footnote-ref-1)
2. Channel bandwidths of 3,6,9,12,15,18,21,24,27,30,33,36,39,42,45 or 48 kHZ can also be applicable. As a function of the application. [↑](#footnote-ref-2)
3. In conjunction with Recommendation. ITU-R BS.705-1 the ITU has developed computer programs to calculate radiation patterns and gain for various antenna types. The output data includes the directivity gain, the relative gain for a particular azimuth and elevation angle, tables of relative gain referred to the maximum and a number of different graphic outputs. [↑](#footnote-ref-3)