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| **Radiocommunication Study Groups** |  |
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| Source: Document 5A/TEMP/139 | **Annex 10 to**  **Document 5A/306-E** |
| **3 June 2013** |
| **English only** |
| Annex 10 to Working Party 5A Chairman’s Report | |
| Working document towardS a preliminary draft new Report ITU-R М.[5 MHz COMPAT] | |
| Compatibility analysis of possible amateur systems with fixed, land mobile, maritime mobile and radiolocation services in the frequency band  5 250-5 450 kHz and the aeronautical mobile service in an adjacent band | |

# 1 Introduction

The frequency band 5 250-5 450 kHz is allocated to the fixed and mobile services excluding aeronautical mobile), and in the band 5 250-5 275 kHz to the radiolocation service for oceanographic radar purposes on a non-interference basis to the allocated services in accordance with Resolution **612 (Rev.WRC-12).**

Resolution **807 (WRC-12)** includes, as Agenda item 1.4 for WRC-15 “1.4 to consider possible new allocation to the amateur service on a secondary basis within the band 5 250-5 450 kHz in accordance with Resolution **649 (WRC-12)**”.

This Report discusses compatibility aspects for frequency use in this band.

# 2 Related ITU‑R Recommendations and Reports

*Editor’s note: Extracted from doc 254*

Recommendation ITU-R [F.339-8](http://www.itu.int/rec/R-REC-F.339-8-201302-I/en) – Bandwidths, signal-to-noise ratios and fading allowances in HF fixed and land mobile radiocommunication systems

Recommendation ITU-R [P.368-9](http://www.itu.int/rec/R-REC-P.368-9-200702-I/en) – Ground-wave propagation curves for frequencies between 10 kHz and 30 MHz

Recommendation ITU-R [P.372-10](http://www.itu.int/rec/R-REC-P.372-10-200910-I/en) – Radio noise

Recommendation ITU-R [P.525-2](http://www.itu.int/rec/R-REC-P.525-2-199408-I/en) – Calculation of free-space attenuation

Recommendation ITU-R [P.533-11](http://www.itu.int/rec/R-REC-P.533-11-201202-I/en) – Method for the prediction of the performance of HF circuits

Recommendation ITU-R [P.832-3](http://www.itu.int/rec/R-REC-P.832-3-201202-I/en) – World Atlas of Ground Conductivities

Recommendation ITU-R [F.1610](http://www.itu.int/rec/R-REC-F.1610-0-200302-I/en) – Planning, design and implementation of HF fixed service radio systems

Recommendation ITU-R [M.1732-1](http://www.itu.int/rec/R-REC-M.1732-1-201203-I/en) − Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies

Recommendation ITU-R [F.1761](http://www.itu.int/rec/R-REC-F.1761-0-200602-I/en) – Characteristics of HF fixed radiocommunication systems

Recommendation ITU-R [F.240](http://www.itu.int/rec/R-REC-F.240/recommendation.asp?lang=en&parent=R-REC-F.240-7-200602-I)-7 – Signal to interference protection ratios for various classes of emissions in the fixed service below about 30 MHz

Recommendation ITU-R [F.162](http://www.itu.int/rec/R-REC-F.162/recommendation.asp?lang=en&parent=R-REC-F.162-3-199203-I)-3 – Use of directional transmitting antennas in the fixed service operating in bands below about 30 MHz

Recommendation ITU-R [BS.705-1](http://www.itu.int/rec/R-REC-BS.705/recommendation.asp?lang=en&parent=R-REC-BS.705-1-199510-I) – HF transmitting and receiving antennas characteristics and diagrams

Recommendation ITU-R [M.1874](http://www.itu.int/rec/R-REC-M.1874/recommendation.asp?lang=en&parent=R-REC-M.1874-1-201302-I) – Technical and operational characteristics of oceanographic radars operating in sub-bands within the frequency range 3-50 MHz

Report ITU-R [M.2234](http://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2234) – The feasibility of sharing sub-bands between oceanographic radars operating in the radiolocation service and fixed and mobile services within the frequency   
band 3-50 MHz

ITU-R Handbook – Ionosphere and its Effects on Radiowave Propagation Handbook, Edition 1998

## *Editor’s note: Any other documents that should be added?*

# 3 Abbreviations

*Editor’s note: Extracted from Doc.* [*5A/254*](http://www.itu.int/md/R12-WP5A-C-0254/en)

AS Amateur service

FS Fixed service

SNR S/N, Signal-to-Noise Ratio

SNIR S/(N+I), Signal-to-Noise plus Interference Ratio

SSB Single-Sideband Suppressed Carrier Analogue Voice Transmission

SSN Sunspot Number

UTC Coordinated Universal Time

# 4 Background

*Editor’s note: Extracted from Doc.* [*5A/254*](http://www.itu.int/md/R12-WP5A-C-0254/en)

The frequency range 5 250-5 450 kHz is allocated to fixed and mobile (except aeronautical mobile) services in all three Regions on a primary basis. Radiolocation services are also allocated in the range 5 250 to 5 275 kHz as a secondary service in Regions 1 and 3 and Primary in Region 2.

*Editor’s note: Indication of incumbent usage could go here if desired*

# 5 Characteristics of fixed service stations used in the compatibility study

*Editor’s note: The following is an extract from liaison statement* [**5A/77-**](http://www.itu.int/md/R12-WP5A-C-0077/en)E

Appropriate fixed service characteristics for sharing studies between fixed service and amateur service stations can be found in Recommendations ITU-R F.1761, ITU-R F.1762 and ITU‑R F.1821.

*Editor’s note: Other information to be added if required*

# 6 Characteristics of amateur service stations that might be used in the 5 250-5 450 kHz frequency band

*Editor’s note: Extracted from Doc.*[*5A/237*](http://www.itu.int/md/R12-WP5A-C-0257/en)

WP 5A has developed a draft Report ITU-R M.[5 MHz CHAR] which contains the list of possible amateur service station parameters in this frequency band. In accordance with this draft Report the majority of commercial amateur equipment has output power of 100-150 W and uses near-omnidirectional antennae.

Therefore in the compatibility study it was assumed that amateur station uses omnidirectional antenna and transmitter with output power of 100 W (20 dBW).

*Editor’s note: Other information to be added if required*

# 7 Scenarios for the possible impact upon the fixed service by stations of the amateur service

*Editor’s note: For each of the methods the geographic details of the modeled fixed service and potential amateur service stations should go here. As far as possible the links should be representative of real situations.*

## 7.1 Scenarios for study method 1 (Russian)

## 7.2 Scenarios for study method 2 (Canadian)

## 7.3 Scenarios for study method 3 (China)

# 8 Methodology of interference impact assessment from amateur service stations on the fixed/land mobile service, aeronautical and oceanographic radar services

## 8.1 Methodology of interference impact assessment proposed by WP 5C

## *Editors note: Russian & Canadian input*

### 8.1.1 Interference impact assessment from amateur service stations on the fixed/land mobile service

*Editor’s note: The following is from liaison statement* **5A/77-E**

Recommendation ITU-R P.533 and the associated software model should be used for performing required sharing and compatibility studies.

Fixed HF systems typically use directional antennas but are not limited to such design. Therefore studies should take into account a mixture of directional systems using yagi antennas at the maximum gain listed, and omni-directional whip antennas using a gain of 0 dB.

*Editor’s note: presumably whip antennas are only used for short range links?*

The impact from the amateur station transmission reference link should be calculated by determining the reference link S/N ratio (in dB) for the worst month for the amateur station using a relative sunspot number for portions of the sunspot cycle corresponding to both low sunspot activity and high sunspot activity.

A reference link signal level should also be determined for the fixed service link as an actual S/N level (in dB). The amateur reference link S/N ratio should be used to reduce the fixed service reference link S/N ratio to determine S/I and compared to the required S/N levels found in Recommendations ITU-R F.1761, ITU-R F.1762 and ITU‑R F.1821 for all three transmission types to determine if it can still meet the required S/N level for all three types of service. This will determine the long-term effects of any amateur allocation.

The fixed/mobile service transmissions modes to be studied are:

300 HF1B telegraphy from F.339 using both stable & fading S/N criteria

3k00J3E Single Sideband analogue voice F.339 using both stable & fading S/N criteria

[3k00J2E] Digital voice F.1821 & F.339 using both stable & fading S/N criteria

*Editorial note: check designation for digital voice*

The amateur service transmissions modes to be used is any mode with a bandwidth up to 2.8 kHz

This would provide results for a number of scenarios as shown in the example table below:

Fixed reference links for evaluating potential interference from amateur allocations at 5 MHz

|  |  |  |
| --- | --- | --- |
| Fixed reference link | Antenna | Sunspot number |
| <Transmit> to <Receive> | Yagi | <Minimum value> |
| <Transmit> to <Receive> | Yagi | <Maximum value> |
| <Transmit> to <Receive> | Omni-Directional | <Minimum value> |
| <Transmit> to <Receive> | Omni-Directional | <Maximum value> |

Systems from all three characteristic Recommendations should be evaluated.

*Editor’s note: The following paragraph is useful for clarity & is from Doc*[*.5A/257*](http://www.itu.int/md/R12-WP5A-C-0257/en)

In accordance with the protection criteria specified in Recommendation ITU-R F.339 the calculation of the indicated values is carried out for the reference bandwidth of 1 Hz.

### 8.1.2 Interference impact assessment on the aeronautical service

### 8.1.3 Interference impact assessment on oceanographic radar systems

## 8.2 Methodology of interference impact assessment from amateur service stations on the fixed/land mobile service based on I/N criteria.

## *Editor’s note: Chinese contribution*

# 9 Parameters used for compatibility study

*Editor’s note 1: metadata is fundamental to a full and proper analysis of the results so this section should contain the parameters/settings used for the REC 533 software. If there is no agreement on the particular details, there will be multiple subsections under this topic.*

*Editor’s note 2: Need to consider the link reliability figure. While 50% may be suitable for an amateur link, is it suitable for a fixed link?*

# 10 Result of studies

*Editor’s note: Tables etc. showing the results of the various conditions i.e. SSN, antenna type, transmissions modes etc. will go here.*

# 11 Analysis of the results

*Editor’s note: Analysis of the results e.g. link availability with & without interference from the amateur service, impacts of antenna types & Smoothed Sunspot Numbers etc. Hopefully with some statistical or probability analysis of likely impact and some indication of uncertainties associated with the propagation models and any other relevant calculations.*

# 12 Conclusion

It’s complicated…

*Editor’s note: no doubt there will be multiple sections here…*

## Attachments

*Editor’s note: Each input contribution will be attached or embedded here as annexes to this study:*

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| 5A/242 (Canada) | 5A/250 (USA) | 5A/254 (Canada) |
| 5A/280 (China) | 5A/289  (UK, Netherlands, Norway) | 5A/237 (Russian Federation) |
| 5A/253 (Canada) |  |  |