

# Classification of ITU Recommendations and Reports Base on IMT-2020 High Frequency Candidate Band EMC Analysis

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## Abstract

This paper introduced ITU-R TG 5/1 task group, as well as the current research situation, especially illustrated some interference scenario. Based on 5G high frequency candidate band, radio communication services and the electromagnetic compatibility analysis work, we studied all recommendations and reports related to candidate sub bands, and then classified three very important sub-bands' recommendations and reports, which had played a positive role in promoting 5G high-frequency candidate band radio interference coexistence analysis research.

## Keywords

IMT-2020, Candidate Band, Recommendations, Reports, Classification

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## 1. Introduction

With the trend of globalizing of radio communication technology, almost all the counties focus on the international standardization of the technology. As an international standard in the world, the recommendations and reports from the International Telecommunication Union (ITU) is widely recognized, which are formulated by the ITU Radio communication sector (ITU-R) and stated by ITU members. Except the recommendations [1] cited in the Radio Regulation, others are not required to be carried out by the member countries. However, as ITU recommendations and reports are made by administrations, radio communication operators, equipment manufacturers and other relevant organizations' experts from all over the world, the recommendations and reports have extremely

high execution validity and are carried out by countries around the world more and more commonly.

There are thousands of recommendations and reports, covering all aspects of radio services. Therefore, it is difficult for the researchers to understand these recommendations and reports one by one and chose the appropriate proposal, which will affect the application of it. In order to facilitate better understanding and using of these recommendations and reports for experts, scholars and engineers who are engaged in electromagnetic compatibility analyze research as well as to fully play the guidance role. Based on 5G high frequency candidate band, radio communication services and the electromagnetic compatibility analysis work, we made statistical analysis and classified partial recommendations and reports related to 5G high frequency candidate sub-bands, which has a positive role in promoting 5G high-frequency candidate band radio interference coexistence analysis research.

## 2. ITU-R TG 5/1 Task Group

TG 5/1 is a special task group under ITU-R SG 5 (Terrestrial services) [2] [3], taking responsible for WRC-19 Agenda Item 1.13 “conducting the sharing and compatibility studies, in accordance with Resolution 238 [COM6/20] (WRC 15), to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis”. Studies [4] on frequency-related matters for International Mobile Telecommunications identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 24.25 and 86 GHz for the future development of International Mobile Telecommunications for 2020 and beyond.

## 3. ITU-R TG 5/1 Current Research Situation

The first meeting of the ITU-R TG5/1 task group was held in Geneva, Switzerland, on May 2016 23-25. All participant countries and organizations had been positive involved in the research work [5]-[10], relevant to the task group organization structure, management team election and work plan and so on. The meeting mainly aimed at the research content, especially in EMC analysis between IMT-2020 and other services. The candidate frequency band EMC research work was distributed into three working groups simultaneously: WG2-30 GHz (including 24.25-27.5 GHz, 31.8-3.4 GHz band), WG3-40/50 GHz (including 37-40.5 GHz, 40.5-42.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47-47.2 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz band), and WG4-70/80 GHz (including 66-76 GHz, 81-86 GHz band).

The main responsibilities of ITU-R TG 5/1 task group is to determine technical characteristics of existing services including protection criterion in the 5G candidate bands or adjacent bands. Therefore it is necessary to carry out a lot of analysis of the inter service protection criterion in these frequency bands. The research mainly focuses on the following radio interference scenarios (see **Table**

1). These research works would be completed in the next 2 to 3 years, and submitted to the WRC-19 for consideration.

## 4. Classification of Recommendations and Reports

### 4.1. Introduction of Recommendations and Reports

The Report is a technical, operational or procedural statement, prepared by a Study Group on a given subject related to a current Question or the results of studies [9]. The ITU-R Recommendations constitute a set of international technical standards developed by the Radio communication Sector (formerly CCIR) of the ITU [1]. According to different research areas, the ITU-R Recommendations are divided into 16 series and the ITU-Reports are divided into 13 series. In these reports, satellite news gathering, time signals and frequency standards emissions, vocabulary and related subjects series are not involved. Each series corresponds to the fixed study group (see **Table 2**).

**Table 1.** Focus on the study of radio interference scenarios.

Frequency bands (GHz)			Interference scenarios	Frequency bands (GHz)			Interference scenarios
Region 1	Region 2	Region 3		Region 1	Region 2	Region 3	
N/A	24.25 - 24.65		1) IMT BS→Radionavigation Radar 2) IMT UE→Radionavigation Radar 3) Radionavigation Radar→IMT BS 4) Radionavigation Radar→IMT UE		32.3 - 33		1) IMT BS→Satellite 2) IMT UE→Satellite 3) Satellite→IMT BS 4) Satellite→IMT UE
	24.45 - 24.75		1) IMT BS→Satellite 2) IMT UE→Satellite 3) Satellite→IMT BS 4) Satellite→IMT UE		37 - 38		1) IMT BS→SRS Earth Station 2) IMT UE→SRS Earth Station 3) SRS Satellite→IMT BS 4) SRS Satellite→IMT UE
	25.25 - 27.5						
24.65 - 25.25	24.75 - 25.25	24.65 - 25.25	1) IMT BS→FSS Space Station 2) IMT UE→FSS Space Station 3) FSS Earth Station→IMT BS 4) FSS Earth Station→IMT UE		40 - 40.5		1) IMT BS→SRS Satellite 2) IMT UE→SRS Satellite 3) SRS Earth Station→IMT BS 4) SRS Earth Station→IMT UE
N/A	27 - 27.5						
	25.5 - 27		1) IMT BS→SRS Earth Station 2) IMT UE→SRS Earth Station 3) SRS Satellite→IMT BS 4) SRS Satellite→IMT UE		37.5 - 40.5		1) IMT BS→FSS Earth Station 2) IMT UE→FSS Earth Station 3) FSS Space Station→IMT BS 4) FSS Space Station→IMT UE
	31.5 - 31.8		1) IMT BS→RAS station 2) IMT UE→RAS station		39.5 - 40.5		1) IMT BS→Mobile Earth Station 2) IMT UE→Mobile Earth Station 3) MSS Satellite→IMT BS 4) MSS Satellite→IMT UE
	31.8 - 32.3		1) IMT BS→SRS Earth Station 2) IMT UE→SRS Earth Station 3) SRS Satellite→IMT BS 4) SRS Satellite→IMT UE		40 - 40.5		1) IMT BS→EESS Satellite 2) IMT UE→EESS Satellite 3) EESS Earth Station→IMT BS 4) EESS Earth Station→IMT UE
	31.8 - 33.4		1) IMT BS→Radionavigation Radar 2) IMT UE→Radionavigation Radar 3) Radionavigation Radar→IMT BS 4) Radionavigation Radar→IMT UE				

**Table 2.** Corresponding table between series of recommendations or reports and study group.

Study Group	Series of recommendations or reports
SG1	SM series—Spectrum Management
SG3	P series—Radio Propagation S series—Fixed-satellite service SNG series—Satellite news gathering
SG4	SF series—Frequency sharing and coordination between fixed-satellite and fixed service systems M series—Mobile, radio determination, amateur and related satellite services BO series—Satellite delivery
SG5	F series—Fixed service BS series—Broadcasting service (sound)
SG6	BT series—Broadcasting service (television) BR series—Recording for production, archival and play-out; film for television RS series—Remote sensing systems TF series—Time signals and frequency standards emissions
SG7	SA series—Space applications and meteorology RA series—Radio astronomy V series—Vocabulary and related subjects

## 4.2. Statistical of Recommendations and Reports Relevant to 5G High Frequency Candidate Bands EMC Analysis

In this paper, we classified the 5G high frequency candidate bands according to the frequency bands and the service features. **Figure 1** shows the number of recommendations and reports in different frequency bands, where horizontal coordinates represent the frequency bands, and the longitudinal coordinates represent the number of recommendations and reports. Some recommendations and reports were used repeatedly in different frequency bands.

## 4.3. Classification of Recommendations and Reports

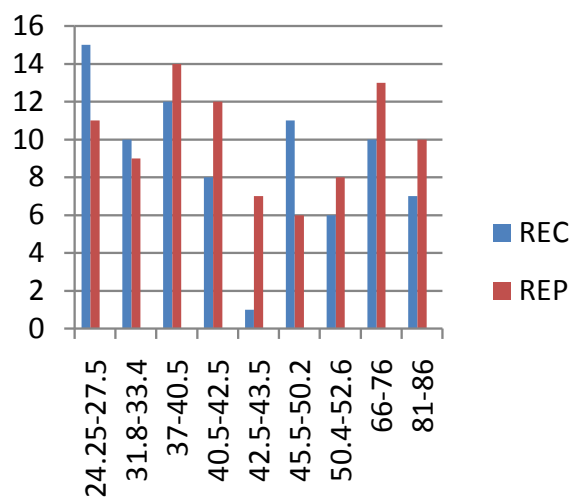
Based on above discussion, it is clarified that doing EMC analysis in this candidate sub-band is of more importance than other sub-band. PT1 ECC has been a primary research and we focus on the frequency bands of 24.25 - 27.5 GHz, 31.8 - 33.4 GHz and 40.5 - 42.5 GHz. Many countries may do EMC analysis first in this sub-band. So in this paper, we only show the classification of recommendations and reports in this sub-band due to page restricted (**Tables 3-5**).

## 5. Conclusion

In this paper, we introduced ITU-R TG 5/1 task group, as well as the current research situation. Based on 5G high frequency candidate band, radio communi-

**Table 3.** 24.25 - 27.5 GHz sub-band recommendations and reports.

Radio Communication Services	Sub-band (GHz)	Rec Number	Rep Number
Fixed	24.25 - 27.5	SA.1276	F.2108
			S.2150
			S.2223
Fixed-Satellite (Earth-to-Space)	24.65 - 25.25 27 - 27.5	S.1063	S.2261
		S.1323	S.2362
Inter-Satellite	25.25 - 27.5	F.1509	
		SA.1415	
Time Signals and Frequency Standards Emissions	25.25 - 27	TF.374	
Earth Exploration-Satellite (Space-to-Earth)	25.5 - 27	SA.1862	
		SA.1027	
		SA.1862	SA.2277
Space Research (Space-to-Earth)	25.5 - 27		SA.2166
			SA.2167
		SA.1415	SA.2177
			SA.2183
		F.748	F.2108
		F.1609	S.2150
		F.1607	S.2223
Fixed		F.1569	S.2261
Mobile	27.5 - 28.5	S.1063	
Fixed-Satellite (Earth-to-Space)		S.1323	
		S.1431	S.2362
		SF.1719	
		SF.1601	



**Figure 1.** Classification statistics for recommendations and reports in sub-bands.

**Table 4.** 31.8 - 33.4 GHz sub-band recommendations and reports.

Radio Communication Services	Sub-band (GHz)	Rec Number	Rep Number
			RA.2126
			RA.2188
Earth Exploration-Satellite (passive), Radio Astronomy, Space Research(passive), [fixed], [Mobile]	31.5 - 31.8	F.1570	SA.2166
			SA.2167
			SA.2177
			SA.2183
			RS.2260
		F.1765	F.2108
Fixed	31.8 - 33.4	F.1571	
		F.1520	S.2150
		M.1466	SA.2166
Space Research (deep space) (Space-to-Earth)	31.8 - 33.4	SA.1811	SA.2167
		SA.1157	SA.2177
			SA.2183
Radiodetermination	31.8 - 33.4	M.1466	
		S.1151	
Inter-Satellite	32.3 - 33	S.1591	
Radiodetermination	33.4 - 34.2	M.1640	

**Table 5.** 40.5 - 42.5 GHz sub-band recommendations and reports.

Radio Communication Services	Sub-band (GHz)	Rec Number	Rep Number
Earth Exploration-Satellite (Earth-to-Space), Fixed, Mobile, Mobile-Satellite			F.2108
			S.2150
(Space-to-Earth), Space Research (Earth-to-Space), Fixed-Satellite(Space-to-Earth)	40 - 40.5		SA.2166
			SA.2177
Radiodetermination			SA.2183
Fixed	40.5 - 42.5	F.2005	F.2108
		F.1669	S.2150
		F.2005	
Fixed-Satellite (Space-to-Earth)	40.5 - 42.5	S.1557	S.2150
			BO.215
			BO.2016
Broadcasting-Satellite	40.5 - 42.5	BO.1659	BO.2071
			BO.473
			BO.631
		RA.1031	RA.2126
Fixed, Fixed-Satellite		RA.314	RA.2188
(Earth-to-Space), Mobile, Radio Astronomy	42.5 - 43.5	RA.517	F.2108
		RA.611	
		F.2005	S.2150

cation services and the electromagnetic compatibility analysis work, we statistically analyzed all recommendations and reports relevant to candidate sub-bands, and then classified three very important sub-bands' recommendations and reports in three very important sub-bands, which had played a positive role in promoting 5G high-frequency candidate band radio interference coexistence analysis research.

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