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| **Radiocommunication Study Groups** |  |
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| Annex 15 to Working Party 5A Chairman’s Report |
| Elements for a WORKING DOCUMENT TOWARDS A PRELIMINARYDRAFT new REPORT ITU-R M.[252-296 GHZ.LMS.FS.COEXIST] |
| Coexistence between land-mobile and fixed service applications operatingin the frequency range 252-296 GHz |

(Question ITU-R 256-1/5)

*[Editor’s note: This document was briefly discussed and is not yet agreed in WP 5A meeting #24.]*

*[Editor’s note: During the discussion it was asked whether such a report would be needed or could be included in an existing report.]*

# 1 Introduction

Radio Regulations No. **5.565** identifies the specific frequency bands for the radio astronomy service, the earth exploration satellite service (passive), and the space research service (passive) in the frequency range 275-1 000 GHz. Although the use of the frequency range 275-1 000 GHz by the passive services does not preclude the use of this range by active services, administrations wishing to make frequencies in the 275-1 000 GHz range available for active service applications are urged to take all practicable steps to protect these passive services from harmful interference.

WRC-19 modified RR above 275 GHz in accordance with the results of WRC-19 agenda item 1.15. The new footnote RR No. **5.564A** was added in the Table of Frequency Allocations to identify the frequency bands 275-296 GHz, 306-313 GHz, 318-333 GHz and 356-450 GHz for use by administrations for the implementation of land mobile service (LMS) and fixed service (FS) applications, where no specific conditions are necessary to protect Earth exploration-satellite service (passive) applications.

In the Table of Frequency Allocations, the frequency bands 252-265 GHz and 265-275 GHz have already been allocated for mobile and fixed services. If these bands and the newly identified band 275-296 GHz are simultaneously used for mobile and fixed service applications, coexistence operation of those applications in the total frequency band of 44 GHz should be examined using the technical and operational characteristics provided by Reports ITU-R M.2417 and ITU-R F.2416.

# 2 Scope

This Report provides the coexistence scenarios between LMS and FS applications operating in the frequency range 252-296 GHz for possible operation in the co-frequency and adjacent frequency bands.

# 3 Related Recommendations and Reports

|  |  |
| --- | --- |
| Recommendation ITU-R F.758 | System parameters and considerations in the development of criteria for sharing or compatibility between digital fixed wireless systems in the fixed service and systems in other services and other sources of interference |
| Report ITU-R F.2416 | Technical and operational characteristics and applications of the point-to-point fixed service applications operating in the frequency band 275-450 GHz |
| Report ITU-R M.2417 | Technical and operational characteristics of land-mobile service applications in the frequency range 275-450 GHz |
| Report ITU-R SM.2450 | Sharing and compatibility studies between land-mobile, fixed and passive services in the frequency range 275-450 GHz |

# 4 List of acronyms and abbreviations

|  |  |
| --- | --- |
| BBU | Baseband unit |
| CPMS | Close proximity mobile system |
| FS | Fixed service |
| LMS | Land mobile service |
| RRH | Remote radio head |

# 5 Technical and operational characteristics

## 5.1 Technical and operational characteristics of LMS applications operating in the frequency range 252-296 GHz

*[Japan’s note: The characteristics in Report ITU-R M.2417 may be applied to the frequency range 252-275 GHz, but Japan proposes to send a liaison statement to external organizations to confirm possibility to use the same characteristics for the frequency range 252-275 GHz.]*

TABLE 1

Technical and operational characteristics of land mobile service applications
operating in the frequency range 252-296 GHz

| Parameters | Values |
| --- | --- |
| Frequency band (GHz) | 252-296 |
| Tx output power density (dBm/GHz) | −3.8….6.9 |
| Max. e.i.r.p. density(dBm/GHz) | 26.2…...36.9 |
| Duplex Method | FDD/TDD |
| Modulation | OOK/BPSK/QPSK/16QAM/64QAMBPSK-OFDM/QPSK-OFDM/ 16QAM-OFDM/32QAM-OFDM/64QAM-OFDM |
| Average distance between CPMS fixed and mobile devices (m) | 0.1 |
| Maximum distance between CPMS fixed and mobile devices (m) | 1 |
| Antenna height (m) | 1…2 |
| Antenna beamwidth (degree) | 3…10 |
| Antenna elevation (degree) | ±90 |
| Frequency reuse  | 1 |
| Antenna type | Horn |
| Antenna pattern  | Gaussian |
| Antenna polarization  | Linear |
| Indoor CPMS fixed device deployment (%) | 100 |
| Feeder loss (dB) | 2 |
| Maximum CPMS fixed/mobile device output power (dBm) | 10 |
| Channel bandwidth (GHz) | 2.16/4.32/8.64/12.96/17.28/ 25.92/51.8 |
| Transmitter spectrum mask  | see Section 5.3 |
| Maximum CPMS fixed device antenna gain (dBi) | 30 |
| Maximum CPMS mobile device antenna gain (dBi) | 15 |
| Maximum CPMS fixed device output power (e.i.r.p.) (dBm) | 40 |
| Maximum CPMS mobile device output power (e.i.r.p.) (dBm) | 25 |
| Average activity factor (%) | 0.76 |
| Average CPMS fixed device power (dBm (e.i.r.p)) | 20 |
| Receiver noise figure typical (dB) | 15 |

## 5.2 Technical and operational characteristics of FS operating in the frequency range 252-296 GHz

*[Japan’s note: The following characteristics provided by Report ITU-R F.2416 should be reviewed by WP 5C.]*

TABLE 2

Technical and operational characteristics of the fixed service applications planned to operate

| Parameter | Values |
| --- | --- |
| Frequency band (GHz) | 252-296 |
| Duplex Method | FDD/TDD |
| Modulation  | BPSK/QPSK/8PSK/8APSK/16QAM/32QAM/64QAMBPSK-OFDM/QPSK-OFDM/ 16QAM-OFDM/32QAM-OFDM/64QAM-OFDM |
| Channel bandwidth (GHz)  | 2…..25 (FDD)2…..50 (TDD) |
| Spectrum mask | See Section 5.3 |
| Tx output power range (dBm)  | 0….20 |
| Tx output power density range (dBm/GHz) | −17……17 |
| Feeder/multiplexer loss range (dB)  | 0 … 3 |
| Antenna gain range (dBi)  | 24 … 50 |
| e.i.r.p. range (dBm) | 44…..70 |
| e.i.r.p. density range (dBm/GHz)  | 30……67 |
| Antenna pattern | Recommendation ITU-R F.699 |
| Antenna type | Parabolic Reflector |
| Antenna height (m) | 6-25 |
| Antenna elevation (degree) | ±20 (typical) |
| Receiver noise figure typical (dB)  | 15 |
| Receiver noise power density typical (dBm/GHz) | −69 |
| Normalized Rx input level for 1 × 10-6 BER (dBm/GHz) | −61 … −54 |
| Link length (m) | 100 … 300 |
| I/N protection criteria | Recommendation ITU-R F.758 |

# 6 Interference scenarios from LMS to FS applications operating in the frequency range 252-296 GHz

## 6.1 Interference scenarios from LMS to FS applications operating in the band 252‑296 GHz

The two interference scenarios between LMS and FS applications are listed in Table 3 and shown in Figure 1. Since the close proximity mobile system is one of LMS applications indicated in Report ITU-R M.2417, this section studies the interference-to-noise ratio value of FS receivers which will be used for backhaul/fronthaul applications indicated in Report ITU-R F.2416. Table 3 summarizes interference scenarios between CPMS and fronthaul applications. The fronthaul consists of RRH covering a small cell and BBU accomplishing baseband signal processing functions of radio access networks. Since the interference to RRH from CPMS may be worse than that of BBU from CPMS due to a lower antenna height of RRH than that of BBU in general, the study focuses on the interference from CPMS to RRH.

TABLE 3

Interference scenarios

|  |  |  |  |
| --- | --- | --- | --- |
| Scenario | Interfering | Interfered | Propagation model |
| A1 | CPMS MT | RRH | Rec. ITU-R P.452, P.676, P.2108, P.2109 |
| A2 | CPMS FS | RRH | Rec. ITU-R P.452, P.676, P.2108, P.2109 |
| B1 | RRH | CPMS MT | Rec. ITU-R P.452, P.676, P.2108, P.2109 |
| B2 | RRH | CPMS FS | Rec. ITU-R P.452, P.676, P.2108, P.2109 |
| CPMS MT: Close proximity mobile system – Mobile terminalCPMS FS: Close proximity mobile system – Fixed stationRRH: Remote Radio HeadBBU: Base band unit |

FIGURE 1

Illustration of interference scenarios between LMS and FS applications



## 6.2 Protection criterion for coexistence studies in the frequency range 252-296 GHz

#### 6.2.1 Protection criterion for FS applications

Recommendation ITU-R F.758-7 provides an interference-to-noise ratio (*I/N*) value of -10 dB as the long-term (no more than 20% of the time) interference protection criterion for the FS in the frequency bands of above 3 GHz.

*[Japan’s note: This Section 6.2.1 is also reviewed by WP 5C.]*

#### 6.2.2 Protection criterion for LMS applications

Protection criterion of *I*/*N* values of –6 dB which are widely used for mobile service devices are applied for LMS applications operating in the frequency range 252-296 GHz. The specified tolerable *I*/*N* is referenced to the mobile receiver input and requires taking into account all sources of interference.

## 6.3 Simulation results

### 6.3.1 Methodology of interference calculations

The interference has been calculated using the following equations:

(a) For scenarios A1 and A2: $I/N=P\_{LMS}+G\_{LMS\rightarrow FS}+G\_{FS\rightarrow LMS}-PL\left(d\_{0}\right)-N\_{FS}$

(b) For scenarios B1 and B2: $I/N=P\_{FS}+G\_{FS\rightarrow LMS}+G\_{LMS\rightarrow FS}-PL\left(d\_{0}\right)-N\_{LMS}$

where:

 *P*LMS: power of LMS transmitter in the bandwidth of FS receiver;

 *P*FS: power of FS transmitter in the bandwidth of LMS receiver;

 *G*LMS→FS: gain of LMS antenna in the direction of FS receiver;

 *G*FS→LMS: gain of FS antenna in the direction of LMS receiver;

 *G*FS→LMS: gain of FS antenna in the direction of LMS transmitter;

 *G*LMS→FS: gain of LMS antenna in the direction of FS transmitter;

 *PL:* includes atmospheric loss, path loss, clutter loss, polarization loss, and BEL where appropriate;

 *NFS:* thermal noise power of FS receiver.

 *NLMS:* thermal noise power of LMS receiver.

The clutter loss and BEL are provided from Annexes 1 and 2.

#### 6.3.2 CPMS interfering scenario with/without BEL and clutter loss

#### 6.3.2.1 Co-channel analysis

*[TBD]*

#### 6.3.2.2 Adjacent channel analysis

*[TBD]*

#### 6.3.3 FS interfering scenario with/without BEL and clutter loss

#### 6.3.3.1 Co-channel analysis

#### 6.3.3.1.1 Co-channel analysis without BEL and clutter loss

According to interference scenarios illustrated in Figure 1, *I/N* of CPMS MT receiver is calculated using the equations in section 6.3.1. Figure 2 shows the relationship between *I/N* of CPMS MT receiver and distance between RRH transmitter and CPMS MT receiver. It is clearly calculated that the peak *I/N* of CPMS MT receiver is determined from the distance between RRH transmitter and CPMS MT receiver and the height difference of RRH transmitter and CPMS MT receiver.

FIGURE 2

*I/N* of CPMS MT receiver as a function of distance between RHH and CPMS MT whose antenna heights are 6 m and 2 m, respectively, at the frequencies of 252 GHz, 275 GHz and 296 GHz.

(a) f=252 GHz



(b) f=275 GHz



(c) f=296 GHz



#### 6.3.232 Adjacent channel analysis

*[TBD]*

# 7 Summary

*[TBD]*

Annex 1

Extrapolation of building entry loss from Recommendation ITU-R P.2109

This Annex estimates the median building entry loss (BEL) using extrapolation of the results of Recommendations [ITU-R P.2109](http://www.itu.int/rec/R-REC-P.2109/en). Figure A1-1 shows the extrapolated building loss in the frequency range 10-1 000 GHz. Those values may be used for coexistence studies between LMS and FS applications in the frequency range 252-296 GHz, in accordance with advices from Study Group 3 (Doc. [5A/1067](https://www.itu.int/md/R15-WP5A-C-1067/en)).

FIGURE A1-1

Extrapolated median building entry loss using Recommendation ITU-R P.2109



Annex 2

Extrapolation of clutter loss from Recommendation ITU-R [P.2108](http://www.itu.int/rec/R-REC-P.2108/en)

This Annex estimates the clutter loss for terrestrial paths using extrapolation of the results of Recommendations [ITU-R P.2108](http://www.itu.int/rec/R-REC-P.2108/en). Figure A2-1 shows the extrapolated clutter loss in the distance range 0.05-1.0 km.

*[Japan’s note: Applicability of the clutter loss in the distance range 0.05-0.25 km as well as in the frequency range 252-296 GHz should be reviewed by SG3.]*

FIGURE A2-1

Extrapolated clutter loss for the terrestrial path using Recommendation ITU-R P.2108

