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| **Radiocommunication Study Groups** |  |
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| Annex 23 to Working Party 5A Chairman’s Report | |
| WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT REVISION OF RECOMMENDATION ITU-R M.1808[[1]](#footnote-1)\* | |
| Technical and operational characteristics of conventional and trunked  land mobile systems operating in the mobile service allocations below 869 MHz to be used in sharing studies | |

(Questions ITU-R 1-3/8 and ITU-R 7-5/8)

(2007)

Scope

This Recommendation provides technical and operational characteristics of conventional and trunked land mobile systems to be used in sharing studies. Given the variety of those systems within the mobile service below 869 MHz, a range of parameters and typical values are provided for different analogue as well as digital systems. This Recommendation is not intended to deal with characteristics of digital cellular land mobile systems or IMT systems.

Keywords

Land Mobile Systems

Abbreviations/Glossary

BER Bit Error Rate

ENG Electronic News Gathering

EFP Electronic Field Production

LNA Low Noise Amplifier

PPDR Public Protection and Disaster Relief

SINAD Signal Plus Noise Plus Distortion to Noise Plus Distortion Ratio

TVOB Television Outside Broadcast

Related ITU Recommendations, Reports

− Recommendation ITU‑R [M.478](https://www.itu.int/rec/R-REC-M.478/en) – Technical characteristics of equipment and principles governing the allocation of frequency channels between 25 and 3 000 MHz for the FM land mobile service

− Recommendation ITU‑R [M.1073](https://www.itu.int/rec/R-REC-M.1073/en) – Digital cellular land mobile telecommunication systems

− Recommendation ITU‑R [M.1033](https://www.itu.int/rec/R-REC-M.1033/en) – Technical and operational characteristics of cordless telephones and cordless telecommunication systems

− Report ITU‑R [M.2014](https://www.itu.int/pub/R-REP-M.2014) – Digital land mobile systems for dispatch traffic

− Recommendation ITU‑R [SM.329](https://www.itu.int/rec/R-REC-SM.329/en) – Unwanted emissions in the spurious domain

− Recommendation ITU‑R [SM.1541](https://www.itu.int/rec/R-REC-SM.1541/en) – Unwanted emissions in the out-of-band domain

− Recommendation ITU‑R [SM.1539](https://www.itu.int/rec/R-REC-SM.1539/en) – Variation of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU‑R SM.1541 and ITU‑R SM.329

− Recommendation ITU‑R [SM.1540](https://www.itu.int/rec/R-REC-SM.1540/en) – Unwanted emissions in the out-of-band domain falling into adjacent allocated bands

− Report ITU-R [BT.2069](https://www.itu.int/pub/R-REP-BT.2069) – Tuning ranges and operational characteristics of terrestrial electronic news gathering (ENG), television outside broadcast (TVOB) and electronic field production (EFP) systems

− Recommendation ITU-R [P.1546](https://www.itu.int/rec/R-REC-P.1546/en) – Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 3 000 MHz

− Recommendation ITU-R [P.452](https://www.itu.int/rec/R-REC-P.452/en) – Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz

− Recommendation ITU-R [P.372](https://www.itu.int/rec/R-REC-P.372/en) – Radio noise

The ITU Radiocommunication Assembly,

considering

*a)* that the bands below 470 MHz allocated to the mobile service are heavily used for conventional and trunked land mobile systems;

*b)* that there is a need for technical and operational characteristics of conventional and trunked land mobile systems to be used in sharing studies;

*c)* that some mobile bands below 960 MHz are used for public protection systems;

*d)* that the use of digital mobile radio systems is increasing;

*e)* that the minimum receiver performance figures contained in equipment standards are not necessarily those on which systems are planned;

*f)* that receiver performance characteristics for digital equipment differ from those for analogue;

*g)* that previous radiocommunication conferences have invited ITU‑R to continue its studies for all services,

*[****Editor’s note:*** *The below text is in brackets as a proposal to move the “noting” and following text to the “Related ITU Recommendations, Reports” section above.]*

[noting

that some countries have deployed systems below 960 MHz with specifications that are set out in Recommendation ITU‑R M.1457 and with characteristics similar to those described in Report ITU‑R M.2039,]

recommends

1 that for interservice and intraservice frequency sharing studies in bands below 960 MHz the representative technical and operational characteristics of conventional and trunked land mobile systems given in Annex 1 should be used.

Annex 1  
  
Representative technical and operational characteristics of conventional  
and trunked land mobile systems operating in the mobile service  
allocations below 869 MHz to be used in sharing studies

# 1 Introduction

The bands below 869 MHz that are allocated to the mobile service are often used for conventional and trunked land mobile systems. These bands are also heavily used by public safety agencies, governmental agencies, utilities and transportation companies because the propagation characteristics at these frequencies allow large area coverage with little infrastructure.

Due to the wide variety of conventional and trunked land mobile systems and equipment, it is difficult to use a single specific value for many characteristics, therefore a range of values, along with typical values are provided. When sharing studies are developed, appropriate consideration of the variable conditions encountered in the operating environment should be taken into account when choosing the characteristics for the land mobile station under study. To the extent possible, the actual performance and implementation specific characteristics of systems under consideration should be used.

# 2 Technical characteristics of conventional and trunked land mobile systems

When performing sharing studies, the following technical characteristics of conventional and trunked land mobile systems should be used.

## 2.1 Interference criteria

There are many methodologies used to ensure coexistence between conventional and trunked land mobile systems (e.g. field-strength contours, carrier-to-interference, etc. For simplicity, an *I*/*N* of −6 dB could be used to determine the impact of interference. For applications with greater protection requirements, such as public protection and disaster relief (PPDR), an *I*/*N* of −10 dB may be used to determine the impact of interference.

## 2.2 Consideration of the Operating Environment

When considering the radio-frequency noise contribution from the operating environment to determine the noise level, N, for land mobile systems pertinent to this Recommendation, Recommendation ITU-R P.372 should be used.

For carrier-to-interference analysis, Recommendation ITU-R P.1546 and/or ITU-R P.452 should be used to estimate carrier and interference levels in the operating environment for land mobile systems pertinent to this Recommendation.

## 2.3 Performance criteria

Conventional and trunked land mobile systems are designed to meet certain performance criteria. For analogue systems this criteria is usually a SINAD value (dB). For digital systems a bit error rate (BER) is used (%).

SINAD[[2]](#footnote-2) is the ratio of the total received power (signal + noise + distortion) to the received unwanted power (noise + distortion). It is measured at the receiver audio output and provides a quantitative measurement of the quality of an audio signal. Report ITU‑R M.358-5 suggests that a SINAD ratio of 12 dB is convenient for establishing degradation protection for land mobile systems but SINAD values between 12 and 20 dB are often used when designing these systems.

For digital modulation schemes, SINAD is inappropriate; therefore a BER is commonly used. This parameter is critical because, unlike analogue systems, there is no graceful degradation. There is a breakpoint beyond which errors cannot be corrected which can result in a total loss of intelligibility. Conversely, a decrease in overall BER can yield an increase in intelligibility. Typically, conventional and trunked land mobile systems are designed to achieve a BER of 2-5%.

## 2.4 Conventional and trunked land mobile equipment characteristics

The technical characteristics for conventional and trunked land mobile base stations and mobile stations that should be used in sharing studies are provided in Tables 1 and 2 of Attachment 1 of this Annex.

# 3 Operational characteristics of land mobile systems

In performing sharing studies, the following operational characteristics of conventional and trunked land mobile systems should be taken into account.

## 3.1 Conventional systems

Conventional systems allow a user the use of only one channel. If that assigned channel is already in use then the user must wait until the channel becomes available. Management of the channels used in a conventional system is done by the users.

## 3.2 Trunked systems

Trunked systems employ access control techniques to share channel capacity among multiple users. In a trunked system a control channel is used and the decision as to which channel is used is invisible to the user. The design of a trunked system allows it to support more users on fewer channels than a conventional system.

High capacity mobile systems use trunking to increase the overall statistical traffic capacity. Interference cannot only affect an in-progress communication, but may also cause unused channels in a trunking group to be unavailable for subsequent legitimate uses, thereby limiting the capacity of the system for the duration of the interference. Interference to the control channel may result in loss of access to all channels on the trunked system.

## 3.3 Simulcast deployment

Simulcast refers to a technique that uses multiple base stations or repeaters with overlapping coverage, transmitting simultaneously and using the same frequency at every site. This technique is used to conserve frequencies.

## 3.4 Multicast deployment

Multicast refers to a technique that uses multiple base stations or repeaters with overlapping coverage, transmitting simultaneously and using different frequencies at each site. Frequencies are reused in cellular pattern which ensures that the same frequency is never used in an adjacent cell. This technique is used where frequency availability is not a problem.

## 3.5 Repeater operation

Many land mobile systems involve the use of a high elevation repeater site to increase system coverage and/or overcome geographic propagation obstacles that prohibit line-of-sight communication. In practice, the source transmits to a repeater where the received signal is decoded and analysed to ensure it isvalid for the system. If valid, the signal is encoded and retransmitted on a separate frequency to be received by the target, such as a fleet of mobiles or another repeater. Interference experienced early in this chain of events, can be retransmitted throughout the repeater system. Sharing studies involving repeater systems should consider whether there will be interference to the mobiles or the repeaters.

## 3.6 Voting receiver systems

Voting is a technique used to provide reception over a wide area, to enhance talk-in performance, especially in public safety systems. Multiple receivers are deployed throughout an area, to enable a portable radio to access a repeater or a base station anywhere in the coverage area.

Typically, a signal is received by many receivers and a decision is made to use the best signal. Interference to any one of these receivers may block the wanted signal.

# 4 Antenna system

## 4.1 Antenna height

Generally, in conventional and trunked land mobile systems the system coverage increases when the antenna height is increased. These systems usually consist of mobile and portable units located at or near ground level that communicate with base stations located at higher elevations. Base station receive antennas are situated at much greater elevations than the mobile stations, especially for some wide-area systems with hill-top or building-top sites. Base stations at high elevations will likely receive greater interfering signals and be more susceptible to aggregate interference than a mobile unit.

## 4.2 Tower-top low noise amplifier (LNA)

Mast-top LNAs are used to enhance received signal strength at base station receivers which effectively increases system coverage. Commercial amplifiers are generally designed to have a broad bandwidth usually encompassing entire frequency bands and employ little to no filtering. Sharing studies must consider that unwanted signals will also be amplified indiscriminately. These unwanted amplified signals can also increase the incidence of (third-order) intermodulation interference in receivers and reduce the overall system receive sensitivity, also called desensitization.

ATTACHMENT 1  
(to Annex 1)

TABLE 1

Base station characteristics for frequency sharing below 400 MHz

| Frequency band (MHz) | 30 to 88 | | 138 to 174 | | 223 to 328.6 | 335.4 to 399.9 |
| --- | --- | --- | --- | --- | --- | --- |
| Type of emission | Analog | Digital | Analogue | Digital | Digital | Digital |
| *System-wide* |  |  |  |  |  |  |
| Channel bandwidth (kHz) | 16 | 25/75 | 12.5/15/25/30 | 6.25/7.5/12.5/15 | 25 to 1250 | 25 to 1250 |
| Modulation type | FM | CPM, 4CPM, 8CPM, BPSK, QPSK, 8-PSK,  16-QAM,64-QAM | FM | C4FM | CPM, 4CPM, 8CPM, BPSK, QPSK, 8-PSK,  16-QAM,64-QAM | CPM, 4CPM, 8CPM, BPSK, QPSK, 8-PSK,  16-QAM,64-QAM |
| Type of operation | Simplex/duplex | Simplex/duplex | Simplex/duplex | Duplex | Simplex/duplex | Simplex/duplex |
| Typical SINAD (dB) or BER (%) | 10 dB | 5% | 12 dB | 5% | 5% | 5% |
| *Transmitter* |  |  |  |  |  |  |
| Output power (W) | 0.4 to 50 | 0.4 to 50 | 5 to 125 (30) (100) | 20 to 125 (60) (100) | 0.4 to 50 | 0.4 to 50 |
| e.r.p. (dBW) | -1.8 to 19 | -1.8 to 19 | 7 to 26 (19) (24) | 13 to 26 (18) (24) | -1.8 to 19 | -1.8 to 19 |
| Necessary bandwidth (kHz) | 16 | 25/75 | 11/11/16/16 | 5.5/5.5/8.1/8.1 | 25 to 1250 | 25 to 1250 |
| Coverage radius (km) | 1 to 200 | 1 to 200 | 1 to 75 (50) | 1 to 75 (50) | 1 to 200 | 1 to 200 |
| Antenna gain (dBd) | 0 | 0 | 0 to 9 (6) | 0 to 9 (6) | 0 to 11 | 0 to 11 |
| Antenna height (m) (relative to ground level) | 5 to 10  (8) | 5 to 10  (8) | 10 to 150 (60) | 10 to 150 (65) | 5 to 10 | 5 to 10 |

TABLE 1 (*end*)

| Frequency band (MHz) | 30 to 88 | | 138 to 174 | | 223 to 328.6 | 335.4 to 399.9 |
| --- | --- | --- | --- | --- | --- | --- |
| Type of emission | Analog | Digital | Analogue | Digital | Digital | Digital |
| Radiation pattern | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional |
| Antenna polarization | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical |
| Total loss (dB) | 1 | 1 | 0 to 7 (2) | 3 to 9 (6) (2) | 3 | 3 |
| *Receiver* |  |  |  |  |  |  |
| Noise figure (dB) | 5 to 12 (8) | 5 to 12 (8) | 6 to 12 (7) | 6 to 12 (7) | 5 to 12  (7) | 5 to 12  (7) |
| IF filter bandwidth (kHz) | 16 | 25/75 | 8/11/12.5/16 | 5.5/5.5/5.5/5.5 | 25 to 1250 | 25 to 1250 |
| Sensitivity (dBm) | −112 | −112 to −121 (−115) | −116 to −121 (−119) | −116 to −121 (−119) | −95 to −121 | −95 to −121 |
| Antenna gain (dBd) | 0 | 0 | 0 to 9 (6) | 0 to 9 (8) | 0 to 11 | 0 to 11 |
| Antenna height (m) (relative to ground level) | 5 to 10  (8) | 5 to 10  (8) | 10 to 150 (60) | 10 to 150 (65) | 5 to 10 | 5 to 10 |
| Radiation pattern | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional |
| Antenna polarization | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical |
| Total loss (dB) | 1 | 1 | 0 to 6 (3) | 0 to 6 (3) | 3 | 3 |
| NOTE 1 – Simplex systems use the same frequency for both the base station and mobile station to transmit.  NOTE 2 – Frequency division duplex systems have different frequencies for the base station and mobile station which allows simultaneous communications.  NOTE 3 – Typical values are shown in parenthesis. In some instances, more than one typical value is provided.  NOTE 4 – e.r.p. is equal to the output power (dBW) plus antenna gain (dBd) minus total losses (dB). | | | | | | |

Base station characteristics for frequency sharing between 406.1 MHz and 869 MHz

| Frequency band (MHz) | 406.1 to 470 | | | | 746-806 | 806-869 | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Type of emission | Analogue | Digital | Digital | Digital | Digital | Analogue | Digital |
| *System-wide* |  |  |  |  |  |  |  |
| Channel bandwidth (kHz) | 12.5/25 | 6.25/12.5 | 1 250 | 25 to 1250 | 6.25/12.5/25 | 12.5/25 | 12.5 |
| Modulation type | FM | C4FM | BPSK, QPSK, 8-PSK,  16-QAM | CPM, 4CPM, 8CPM, BPSK, QPSK, 8-PSK,  16-QAM,64-QAM | C4FM,  F4GFSK | FM | C4FM |
| Type of operation | Simplex/ duplex | Duplex | Duplex | Simplex /duplex | Simplex/ duplex | Simplex /duplex | Duplex |
| Typical SINAD (dB) or BER (%) | 12 dB | 5% | 2-5% | 5% | 5% | 12 dB | 5% |
| *Transmitter* |  |  |  |  |  |  |  |
| Output power (W) | 5 to 125 (25) (100) | 1 to 125 (30) (100) | 1 to 125 (20) | 0.4 to 50 | 1 to 125 (100) | 5 to 125 (100) | 1 to 125 (100) |
| e.r.p. (dBW) | 3 to 27 (20) (26) | 3 to 27 (20) (25) | 3 to 27  (22 ) | -1.8 to 19 | 3 to 27  (24) | 3 to 27  (24) | 3 to 27  (24) |
| Necessary bandwidth (kHz) | 11/16 | 5.5/8.1 | 1 250 | 25 to 1250 | 6/8.1/12.5 | 11/16 | 8.1 |
| Coverage radius (km) | 1 to 60 (50) | 1 to 60 (50) | 1 to 60 (50) | 1 to 200 | 1 to 60 (50) | 1 to 60 (50) | 1 to 60 (50) |
| Antenna gain (dBd) | 0 to 11 (9) | 0 to 11 (9) | 0 to 15 (12) | 0 to 11 | 0 to 13 (9) | 0 to 13 (9) | 0 to 13 (9) |
| Antenna height (m) (relative to ground level) | 10 to 150 (60) | 10 to 150 (60) | 10 to 150 (30) | 5 to 10 | 10 to 150 (60) | 10 to 150 (60) | 10 to 150 (60) |

TABLE 2 (*end*)

| Frequency band (MHz) | 406.1 to 470 | | | | | 746-806 | 806-869 | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of emission | Analogue | Digital | Digital | Digital | | Digital | Analogue | Digital |
| Radiation pattern | Omnidirectional | Omnidirectional | Omnidirectional/sectorized | Omnidirectional | | Omnidirectional | Omnidirectional | Omnidirectional |
| Antenna polarization | Vertical | Vertical | Vertical | Vertical | | Vertical | Vertical | Vertical |
| Total loss (dB) | 0 to 9 (3) | 0 to 9 (4) | 0 to 9 (3) | 3 | | 0 to 9 (5) | 0 to 9 (5) | 0 to 9 (5) |
| *Receiver* |  |  |  |  |  |  |  |  |
| Noise figure (dB) | 6 to 12 (7) | 6 to 12 (7) | 5 to 12 (5) | 5 to 12  (7) | | 6 to 12 (7) | 6 to 12 (7) | 6 to 12 (7) |
| IF filter bandwidth (kHz) | 8/12.5 | 5.5/5.5 | 1 250 | 25 to 1250 | | 5.5/5.5/12.5 | 8/12.5 | 5.5 |
| Sensitivity (dBm) | −115 to −120 (−119) | −115 to −120 (−119) | −115 to −120 (−117) | −95 to −121 | | −115 to −120 (−119) | −115 to −120 (−119) | −115 to −120 (−119) |
| Antenna gain (dBd) | 0 to 11 (9) | 0 to 11 (9) | 0 to 15 (12) | 0 to 11 | | 0 to 13 (9) | 0 to 13 (9) | 0 to 13 (9) |
| Antenna height (m) (relative to ground level) | 10 to 150 (60) | 10 to 150 (60) | 10 to 150 (30) | 5 to 10 | | 10 to 150 (60) | 10 to 150 (60) | 10 to 150 (60) |
| Radiation pattern | Omnidirectional | Omnidirectional | Omnidirectional/ sectorized | Omnidirectional | | Omnidirectional | Omnidirectional | Omnidirectional |
| Antenna polarization | Vertical | Vertical | Vertical | Vertical | | Vertical | Vertical | Vertical |
| Total loss (dB) | 0 to 9 (3) | 0 to 9 (4) | 0 to 9 (3) | 3 | | 0 to 9 (5) | 0 to 9 (5) | 0 to 9 (5) |
| NOTE 1 – Simplex systems use the same frequency for both the base station and mobile station to transmit.  NOTE 2 – Frequency division duplex systems have different frequencies for the base station and mobile station which allows simultaneous communications.  NOTE 3 – Typical values are shown in parenthesis. In some instances, more than one typical value is provided.  NOTE 4 – e.r.p. is equal to the output power (dBW) plus antenna gain (dBd) minus total losses (dB). | | | | | | | | |

TABLE 3

Land Mobile station characteristics for frequency sharing below 400 MHz

| Frequency band (MHz) | 30 to 88 | | | | 138 to 174 | | | | 223 to 328.6 | | 335.4 to 399.9 | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of emission | Analog | | Digital | | Analogue | | Digital | | Digital | | Digital | |
| *System-wide* |  | |  | |  | |  | |  | |  | |
| Channel bandwidth (kHz) | 16 | | 25/75 | | 12.5/15/25/30 | | 6.25/7.5/ 12.5/15 | | 25 to 1250 | | 25 to 1250 | |
| Modulation type | FM | | CPM, 4CPM, 8CPM, BPSK, QPSK, 8-PSK,  16-QAM,64-QAM | | FM | | C4FM | | CPM, 4CPM, 8CPM, BPSK, QPSK, 8-PSK,  16-QAM,64-QAM | | CPM, 4CPM, 8CPM, BPSK, QPSK, 8-PSK,  16-QAM,64-QAM | |
| Type of operation | Simplex/ duplex | | Simplex/ duplex | | Simplex/duplex | | Duplex | | Simplex/  duplex | | Simplex/  duplex | |
| Typical SINAD (dB) or BER (%) | 10 dB | | 5% | | 12 dB | | 5% | | 5% | | 5% | |
| *Transmitter* |  |  | |  | |  | |  | |  | |  |
| Output power (W) | H : 0.2 to 10  V : 0.4 to 50 | | H : 0.2 to 10  V : 0.4 to 50 | | 1 to 100 (H: 5 V: 30, 50) | | 1 to 100 (H: 5 V: 30, 50) | | H : 0.2 to 10  V : 0.4 to 50 | | H : 0.2 to 10  V : 0.4 to 50 | |
| e.r.p. (dBW) | H : -17 to 0  V : -7 to 14 | | H : -17 to 0  V : -7 to 14 | | −3 to 18 (H: −3 V: 14, 16) | | −3 to 18 (H: −3 V: 14, 16) | | H : -12 to 5  V : -7 to 14 | | H : -12 to 5  V : -7 to 14 | |
| Necessary bandwidth (kHz) | 16 | | 25/75 | | 11/11/16/16 | | 5.5/5.5/8.1/8.1 | | 25 to 1250 | | 25 to 1250 | |
| Antenna gain (dBd) | H : -12.15  V : -5.15 | | H : -12.15  V : -5.15 | | −10 to 4 (H: −10, V: 0) | | −10 to 4 (H: −10, V: 0) | | H : -7.15  V : -2.15 | | H : -7.15  V : -2.15 | |
| Antenna height (m) (relative to ground level) | H : 1.5  V : 2 to 5 | | H : 1.5  V : 2 to 5 | | (2) | | (2) | | H : 1.5  V : 2.5 to 5 | | H : 1.5  V : 2.5 to 5 | |
| Radiation pattern | Omnidirectional | | Omnidirectional | | Omnidirectional | | Omnidirectional | | Omnidirectional | | Omnidirectional | |
| Antenna polarization | Vertical | | Vertical | | Vertical | | Vertical | | Vertical | | Vertical | |

TABLE 3 (*end*)

| Frequency band (MHz) | 30 to 88 | | 138 to 174 | | 223 to 328.6 | 335.4 to 399.9 |
| --- | --- | --- | --- | --- | --- | --- |
| Type of emission | Analog | Digital | Analogue | Digital | Digital | Digital |
| Total loss (dB) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 3 (H: 0, V: 3) | 0 to 3 (H: 0, V: 3) |
| *Receiver* |  |  |  |  |  |  |
| Noise figure (dB) | 5 to 12  (8) | 5 to 12  (8) | 6 to 12 (7) | 6 to 12 (7) | 5 to 12  (7) | 5 to 12  (7) |
| **IF filter bandwidth (kHz)** | 16 | 25/75 | 8/11/12.5/16 | 5.5/5.5/5.5/5.5 | 25 to 1250 | 25 to 1250 |
| Sensitivity (dBm) | -112 | -112 to -121 (-115) | −116 to −121 (−119) | −116 to −121 (−119) | −95 to −121 | −95 to −121 |
| Antenna gain (dBd) | H : -12.15  V : -5.15 | H : -12.15  V : -5.15 | −10 to 4 (H: −10, V: 0) | −10 to 4 (H: −10, V: 0) | H : -7.15  V : -2.15 | H : -7.15  V : -2.15 |
| Antenna height (m) (relative to ground level) | H : 1.5  V : 2 to 5 | H : 1.5  V : 2 to 5 | (2) | (2) | H : 1.5  V : 2.5 to 5 | H : 1.5  V : 2.5 to 5 |
| Radiation pattern | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional |
| Antenna polarization | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical |
| Total loss (dB) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 3 (H: 0, V: 3) | 0 to 3 (H: 0, V: 3) |
| NOTE 1 – Simplex systems use the same frequency for both the base station and mobile station to transmit.  NOTE 2 – Frequency division duplex (FDD) systems have different frequencies for the base station and mobile station which allows simultaneous communications.  NOTE 3 – Typical values are shown in parenthesis, “H:” represents the value for handheld mobile stations and “V:” represents the value for vehicular mobile stations. In some instances, more than one typical value is provided.  NOTE 4 – e.r.p. is equal to the output power (dBW) plus antenna gain (dBd) minus total losses (dB).  NOTE 5 – For Handheld and Vehicular mobile stations, the Antenna polarization could slightly differ from pure Vertical. | | | | | | |

TABLE 4

Land Mobile station characteristics for frequency sharing between 406.1 and 869 MHz

| Frequency band (MHz) | 406.1 to 470 | | | | 746-806 | 806-869 | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Type of emission | Analogue | Digital | Digital | Digital | Digital | Analogue | Digital |
| *System-wide* |  |  |  |  |  |  |  |
| Channel bandwidth (kHz) | 12.5/25 | 6.25/12.5 | 1 250 | 25 to 1250 | 6.25/12.5/25 | 12.5/25 | 12.5 |
| Modulation type | FM | C4FM | BPSK, QPSK, 8-PSK,  16-QAM | CPM, 4CPM, 8CPM, BPSK, QPSK, 8-PSK,  16-QAM,64-QAM | C4FM, F4GFSK | FM | C4FM |
| Type of operation | Simplex/ duplex | Duplex | Duplex | Simplex/ duplex | Simplex/ duplex | Simplex/ duplex | Duplex |
| Typical SINAD (dB) or BER (%) | 12 dB | 5% | 2-5% | 5% | 5% | 12 dB | 5% |
| *Transmitter* |  |  |  |  |  |  |  |
| Output power (W) | 1 to 50 (H: 4 V: 40, 50) | 1 to 50 (H: 4 V: 40, 50) | 0.1 to 40 (0.2) | H : 0.2 to 10  V : 0.4 to 50 | 1 to 40 (H: 3, 5 V: 30) | 1 to 40 (H: 3, 5 V: 30) | 1 to 40 (H: 3, 5 V: 30) |
| e.r.p. (dBW) | 0 to 20 (H: 0 V: 15, 16) | 0 to 20 (H: 0 V: 15, 16) | −7 to 20 (−7) | H : -12 to 5  V : -7 to 14 | 0 to 20 (H: 3, 5 V: 14) | 0 to 20 (H: 3, 5 V: 14) | 0 to 20 (H: 3, 5 V: 14) |
| Necessary bandwidth (kHz) | 11/16 | 5.5/8.1 | 1 250 | 25 to 1250 | 6/8.1/12.5 | 11/16 | 8.1 |
| Antenna gain (dBd) | −6 to 4 (H: −6, V: 0) | −6 to 4 (H: −6, V: 0) | 0 to 4 (0) | H : -7.15  V : -2.15 | −2 to 4 (H: −2, V: 0) | −2 to 4 (H: −2, V: 0) | −2 to 4 (H: −2, V: 0) |
| Antenna height (m) (relative to ground level) | (2) | (2) | (1.5) | H : 1.5  V : 2 to 5 | (2) | (2) | (2) |
| Radiation pattern | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional |
| Antenna polarization | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical |

TABLE 4 (*end*)

| Frequency band (MHz) | 406.1 to 470 | | | | | 746-806 | 806-869 | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of emission | Analogue | Digital | Digital | Digital | | Digital | Analogue | Digital |
| Total loss (dB) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 1 (0) | 0 to 3 (H: 0, V: 3) | | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) |
| *Receiver* |  |  |  |  |  |  |  |  |
| Noise figure (dB) | 6 to 12 (7) | 6 to 12 (7) | 6 to 12 (8) | 6 to 12  (7) | | 6 to 12 (7) | 6 to 12 (7) | 6 to 12 (7) |
| **IF filter bandwidth (kHz)** | 8/12.5 | 5.5/5.5 | 1250 | 25 to 1250 | | 5.5/5.5/12.5 | 8/12.5 | 5.5 |
| Sensitivity (dBm) | −115 to −120 (−118) | −115 to −120 (−118) | −115 to −120 (−120) | −95 to −121 | | −115 to −120 (−118) | −115 to −120 (−118) | −115 to −120 (−118) |
| Antenna gain (dBd) | −6 to 4 (H: −6, V: 0) | −6 to 4 (H: −6, V: 0) | 0 to 4 (0) | H : -7.15  V : -2.15 | | −2 to 4 (H: −2, V: 0) | −2 to 4 (H: −2, V: 0) | −2 to 4 (H: −2, V: 0) |
| Antenna height (m) (relative to ground level) | (2) | (2) | (1.5) | H : 1.5  V : 2.5 to 5 | | (2) | (2) | (2) |
| Radiation pattern | Omnidirectional | Omnidirectional | Omnidirectional | Omnidirectional | | Omnidirectional | Omnidirectional | Omnidirectional |
| Antenna polarization | Vertical | Vertical | Vertical | Vertical | | Vertical | Vertical | Vertical |
| Total loss (dB) | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0, V: 1) | 0 to 1 (0) | 0 to 3 (H: 0, V: 3) | | 0 to 1 (H: 0, V: 1) | 0 to 1 (H: 0,V: 1) | 0 to 1 (H: 0, V: 1) |
| NOTE 1 – Simplex systems use the same frequency for both the base station and mobile station to transmit.  NOTE 2 – Frequency division duplex (FDD) systems have different frequencies for the base station and mobile station which allows simultaneous communications.  NOTE 3 – Typical values are shown in parenthesis, “H:” represents the value for handheld mobile stations and “V:” represents the value for vehicular mobile stations. In some instances, more than one typical value is provided.  NOTE 4 – e.r.p. is equal to the output power (dBW) plus antenna gain (dBd) minus total losses (dB). | | | | | | | | |

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1. \* In case of discrepancy between the values in this Recommendation and the output of the Regional Radiocommunication Conference 2006 (RRC-06), the latter will prevail for the parties to the RRC‑06 Agreement. [↑](#footnote-ref-1)
2. SINAD is also used to measure the performance of land mobile equipment. Receiver parameters such as sensitivity and adjacent channel rejection are usually measured with respect to a 12 dB SINAD. [↑](#footnote-ref-2)