International Telecommunication Union

ITU-R

Radiocommunication Sector of ITU

Recommendation ITU-R SM.2152-0
(09/2022)

Complementing current radio frequency delivery mechanisms using Optical Wireless Communication

SM Series
Spectrum management

International Telecommunication Union

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from http://www.itu.int/ITU-R/go/patents/en where the Guidelines for Implementation of the Common Patent Policy for ITU-T/ITU-R/ISO/IEC and the ITU-R patent information database can also be found.

Series of ITU-R Recommendations

(Also available online at http://www.itu.int/publ/R-REC/en)

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	**Spectrum management**
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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RECOMMENDATION ITU-R SM.2152-0

Complementing current radio frequency delivery mechanisms using optical wireless communication

(2022)

Scope

This Recommendation contains elements to be taken into account when implementing optical wireless communication (OWC) for broadband communications. Four main OWC variants can be distinguished: free space optical communications (long range point to point), wireless local area communications using light (short range, multiple access), optical camera communications (low date rate unidirectional), and ultra-violet (uv) communication.

Keywords

Optical wireless communication, free space optical communications, optical camera communications, light communication, radio frequency

Abbreviations/Glossary

D2D Device to device

EM Electromagnetic

ICU Intensive care unit

IEC International Electrotechnical Commission

IEEE Institute of Electrical and Electronics Engineers

IoT Internet of Things

M2M Machine to machine

nm Nanometre

OWC Optical wireless communication

RF Radio frequency

Related ITU Recommendations and Reports

Report ITU-R SM.2422 – Visible light for broadband communications

The ITU Radiocommunications Assembly,

considering

a) that the radio spectrum is a limited resource;

b) that electromagnetic waves above 3 000 GHz are not included in the ITU Radio Regulations;

c) that optical wireless communication (OWC) uses the visible spectrum (wavelengths between 390 nm and 750 nm) or infrared spectrum (wavelengths between 780 nm and 1 mm) or the ultraviolet spectrum (wavelengths between 200 nm and 280 nm) to provide wireless communications (these frequencies are commonly known as THz frequencies);

d) that OWC has the potential to ease pressure on lower frequency spectrum bands since light spectrum can be used as additional spectrum for broadband communications;

e) that OWC could be seen as complementary to existing broadband wireless access systems;

f) that OWC is subject to different propagation characteristics relative to the wavelengths;

g) that OWC could be especially useful in environments where the use of radio spectrum is (or will be) less feasible because of a combination of factors, e.g. spectrum scarcity, need for very high capacity, legislation, RF hostile environments and others;

h) that OWC based solutions may provide benefits over RF spectrum-based solutions with respect to suitability for dense employment, alleviation of current coexistence situations, enhanced security and more robustness against jamming;

i) that inside houses, offices, and buildings OWC might be an installed technology in the future;

j) that electromagnetic interference (EMI) sensitive environments (e.g. hospitals especially intensive care units (ICU), airplanes, certain industry applications) could benefit from OWC based solutions because they are not sensitive to the EM radiation from radio communication systems;

k) that OWC can also be applied for indoor navigation systems, connected cars, and autonomous vehicles in order to support Intelligent Transport System messaging, underwater communication, eHealth, IoT (M2M/D2D/smart factory),

noting

a) that with regard to eye-safety, due regard should be given to relevant safety limits information provided by several organizations, e.g. IEC 60825-12:2019 “Safety of laser products – Part 12: Safety of free space optical communication systems used for transmission of information”, IEC 62471 “Photobiological safety of lamps and lamp systems”, Recommendation ITU-T G.996 Amd.1, national standards of administrations and/or in Advisory Circulars as issued by several aviation authorities;

b) that Report ITU-R SM.2422 is on visible light for broadband communications;

c) that the IEEE 802.15 and the 802.11 Working Groups are responsible in IEEE 802 LMSC for the development of standards for optical wireless communication,

recommends

1 that OWC systems should comply with international standards and at the same time comply with the law and regulations of the individual countries where the systems and devices are used;

2 that, in order to improve acceptance and user deployment, OWC uses, as much as possible existing solutions and standards;

3 that, while designing and constructing road infrastructure, offices, public spaces, and houses, the potential of OWC should be considered to enhance and supplement the delivery of communications facilities in addition to the usual fixed (wired) infrastructure;

4 that the standardization bodies involved in OWC should collaborate with those in the traditional radio applications, and the ones involved in traditional radio applications should collaborate with those involved in OWC, in order to improve the potential of those technologies working together.