Open Metering System Specification

Alternative Physical Layers for OMS

Annex O to
Volume 2 Primary Communication
Issue 5.0.1

Release C (2025-12)

Document History

Version	Date	Comment	Editor
A 0.1.0	2011-01-26	Action #30-03 Overview about possible frequencies and their technical specifications	P. M. Evjen
A 0.2.0	2011-04-13	Further specification of frequencies	P. M. Evjen
A 0.3.0	2011-05-23	Action #32-19; example definition PHY for 433 MHz; 2 tables for better reading	P. M. Evjen
A 0.5.0	2012-03-27	Action #33-07 revision,based on the discussion during meeting #37	P. M. Evjen
A 0.6.0	2012-05-16	Actions #37-08 to #37-11; Modulation hub, approval referencies	P. M. Evjen
A 0.6.1	2012-05-31	Action #38-16, comments D. Matussek; action #38-17	P. M. Evjen
A 0.7.0	2012-09-26	Action #39-14	P. M. Evjen
A 0.8.0	2012-10-19	Editorial changes	P. M. Evjen
A 1.0.0	2012-10-19	Action #39-15	P. M. Evjen
A 1.0.1	2013-04-02	Editorial changes and fitted into OMS template	A. Bolder
A 1.0.1	2013-05-15	Editorial changes due to to-do list AG1 #43	A. Bolder
A 1.0.2	2013-05-17	Editorial changes as Annex to OMSS Vol. 2	A. Bolder
A 1.0.3	2013-06-26	Inclusion of Mode C1 and C2	D. Matussek, P. M. Evjen
A 1.0.4	2013-07-18	Distinguation uplink/downlink	D. Matussek, U. Pahl
A 1.0.5	2013-08-21	Editorial changes acc to DIN 820-2	A. Bolder
A 1.0.6	2013-09-04	Corrections during meeting OMS AG1#46	A. Bolder
A 1.0.7	2013-09-26	Corrections during meeting OMS-AG1#47	U. Pahl
A 1.0.8	2013-10-15	New note on bandwidth	P. M. Evjen, U. Pahl
A 1.1.0	2014-01-17	Update of Notes according P.M.Evjen	U. Pahl
A 1.1.1	2014-01-25	Release A	U. Pahl
B 1.1.2	2022-12	Introduction of term “OMS end-device”, as in OMS-S2; general editorial lookover Copyright remark added to front page Editorial changes Release B	A. Bolder A. Reissinger
C 2.0.0	2025-10-29 2025-11-04	Restructured Document Mode-T and Mode-S removed Add OMS-LPWAN Remove Country Russia Added PHY-E Added PHY-F Extended country list Editorial improvements Release candidate C	 T. Kauppert J. Hofni P.M. Evjen U. Pahl M. Aebli A. Reissinger
C 2.0.1	2025-12-18	Consideration of review comments Release C	A. Reissinger

Content

Tables

O.1 OMS Frequencies for different countries

The regulation of the use of radio frequencies is specific to each country or region. This annex defines different physical layers (PHY) for wireless communication of OMS end-devices applicable in different countries of the world.

Countries that are members of CEPT (e.g. EU, EEA and more) use the frequencies (and channel parameters) specified in [EN 13757-4:2019] (for Mode C) and [OMS-S2], Annex Q (for OMS-LPWAN). These frequencies and channels are based on CEPT/ERC/REC 70-03 and are defined here as PHY_A.

For other countries or regions, this specification can be used to select an appropriate PHY. The use of any of the PHY's specified in this document is not required. However, if the manufacturer declares the use of a specific PHY, all specified parameters shall be implemented.

NOTE 1: This specification does not cover all countries in the world.

NOTE 2: National regulations are subject to change. Please note that this document reflects the status of the regulations at the time of publication of the document. It is necessary to check the current national regulations before placing radio equipment on the market in the country concerned. The regulatory requirements take precedence over the requirements of this specification.

O.2 Physical Layers (PHY) for Wireless M-Bus Mode-C

O.2.1 Properties of PHY_A

Refer to [EN 13757-4:2019], Clause 9.

O.2.2 Properties of PHY_B

Use [EN 13757-4:2019], Clause 9 for parameters which are not defined in this subclause.

Table O.1 - Basic parameters of Mode-C, PHY_B

Direction	**Chip rate** [kcps]	**Centre frequency** [MHz]	**Transmitted power** [a] [mW]	**Duty Cycle** [a] [%]
Uplink (UL)	100	434,475	10	10
Downlink (DL)	50	433,5	10	10
[a] Maximum value; see country specific exceptions in Table O.16				

Table O.2 - Uplink transmitter parameters of Mode-C, PHY_B

Characteristic	Symbol	min.	nom.	max.	Unit	Note
Centre frequency tolerance		-25	0	+25	ppm	
FSK chip rate tolerance	f_{chip}	-100	0	+100	ppm	
FSK deviation [a]	f_{dev}	33,75	45	56,25	kHz	
[a] Measured as RMS (root mean square) value for PN9 sequence in the centre of the chip						

Table O.3 - Downlink transmitter parameters of Mode-C, PHY_B

Characteristic	Symbol	min.	nom.	max.	Unit	Note
Centre frequency tolerance		-25	0	+25	ppm	
GFSK chip rate tolerance	f_{chip}	-100	0	+100	ppm	
GFSK deviation [a]	f_{dev}	18,75	25	31,25	kHz	
[a] Measured as RMS value for PN9 sequence in the centre of the chip						

O.2.3 Properties of PHY_E

Use [EN 13757-4:2019], Clause 9 for parameters which are not defined in this subclause.

Table O.4 – Basic parameters of Mode-C, PHY_E

Direction	Chip rate [kcps]	Centre frequency [MHz]	Transmitted power [a] [mW]	Duty Cycle [a] [%]
Uplink (UL)	100	865,5	25	1
Downlink (DL)	50	866,0	25	1
[a] Maximum value; see country specific exceptions in Table O.16				

Table O.5 - Uplink transmitter parameters of Mode-C, PHY_E

Characteristic	Symbol	min.	nom.	max.	Unit	Note
Centre frequency tolerance		-25	0	+25	ppm	
FSK chip rate tolerance	f_{chip}	-100	0	+100	ppm	
FSK deviation [a]	f_{dev}	33,75	45	56,25	kHz	
[a] Measured as RMS value for PN9 sequence in the centre of the chip						

Table O.6 - Downlink transmitter parameters of Mode-C, PHY_E

Characteristic	Symbol	min.	nom.	max.	Unit	Note
Centre frequency tolerance		-25	0	+25	ppm	
GFSK chip rate tolerance	f_{chip}	-100	0	+100	ppm	
GFSK deviation [a]	f_{dev}	18,75	25	31,25	kHz	
[a] Measured as RMS value for PN9 sequence in the centre of the chip						

O.3 Physical Layers (PHY) for OMS-LPWAN

O.3.1 Properties of PHY_A

Refer to [OMS-S2], Annex Q, Q.2.

O.3.2 Properties of PHY_B

The specific requirements for frequency bands are given in Table O.7 and Table O.8. Use [OMS-S2], Annex Q for parameters which are not defined in this subclause.

Table O.7 - OMS LPWAN, PHY_B, Channel properties, Uplink

Characteristic	Min.	Max.	Unit
Frequency band	433,05	434,79	MHz
Transmitted power		10[a]	mW
Transmitter duty cycle		10[a]	%
[a] Maximum value; see country specific exceptions in Table O.16			

Table O.8 - OMS LPWAN, PHY_B, Channel properties, Downlink

Characteristic	Min.	Max.	Unit
Frequency band	433,05	434,79	MHz
Transmitted power		10[a]	mW
Transmitter duty cycle		10[a]	%
[a] Maximum value; see country specific exceptions in Table O.16			

Table O.9 - OMS LPWAN, PHY_B, Technology and frequencies

Direction	Technology	PHY-index	Chip rate [kcps]	Centre frequency [MHz]	Sub-carrier range
Uplink (UL)	B	1 [a]	10	$433{,}850 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		2 [a]	10	$434{,}190 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		3 [b]	10	$434{,}300 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		4	125	434,030	n.a.
	S	1 [a]	2,380371	434,300	n.a.
		2 [a]	2,380371	434,200	n.a.
		3 [b]	2,380371	433,860	n.a.
Downlink (DL)	B	1	2	$434{,}665 + (n-2) \cdot 0{,}040$	$0 \le n \le 4$
		2	4	$434{,}665 + (n-2) \cdot 0{,}040$	$0 \le n \le 4$
		3	8	434,665	n.a.
		4	24	434,665	n.a.
	S	1	2,380371	434,725	n.a.
		2	2,380371	434,625	n.a.
		3	4,760742	434,675	n.a.
		4	19,042969	434,675	n.a.

[a] Dual channel usage (for Splitting Mode according to [ETSI 103 357]).

[b] Optional extension sub-mode to be used by OMS end-devices only if requested by the NW-Manager.

O.3.3 Properties of PHY_E

The specific requirements for frequency bands are given in Table O.10 and Table O.11. Use [OMS-S2], Annex Q for parameters which are not defined in this subclause.

Table O.10 - OMS LPWAN, PHY_E, Channel properties, Uplink

Characteristic	Min.	Max.	Unit
Frequency band	865,000	868,000	MHz
Transmitted power		500	mW
Transmitter duty cycle		2,5	%

Table O.11 - OMS LPWAN, PHY_E, Channel properties, Downlink

Characteristic	Min.	Max.	Unit
Frequency band	865,000	868,000	MHz
Transmitted power		500	mW
Transmitter duty cycle		10/2,5[a]	%
[a] 10% for network access points, otherwise 2,5% (see reference document for India in Table O.16 for details)			

Please be aware that APC (Adaptive Power Control) down to 7 dBm shall be used for uplink and downlink with PHY_E. It can be applied by implementing [OMS-S2], Annex Q, Q.3.7 (MAC services).

Table O.12 - OMS LPWAN, PHY_E, Technology and frequencies

Direction	Technology	PHY-index	Chip rate [kcps]	Centre frequency [MHz]	Sub-carrier range
Uplink (UL)	B	1[a]	10	$866{,}885 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		2[a]	10	$866{,}775 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		3[b]	10	$866{,}665 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		4	125	866,500	n.a.
	S	1[a]	2,380371	867,875	n.a.
		2[a]	2,380371	867,775	n.a.
		3[b]	2,380371	866,675	n.a.
Downlink (DL)	B	1	2	$865{,}130 + (n-2) \cdot 0{,}036$	$0 \le n \le 4$
		2	4	$865{,}130 + (n-2) \cdot 0{,}036$	$0 \le n \le 4$
		3	8	865,130	n.a.
		4	24	865,130	n.a.
	S	1	2,380371	865,180	n.a.
		2	2,380371	865,080	n.a.
		3	4,760742	865,130	n.a.
		4	19,042969	865,130	n.a.

[a] Dual channel usage (for Splitting Mode according to [ETSI 103 357]).

[b] Optional extension sub-mode to be used by OMS end-devices only if requested by the NW-Manager.

O.3.4 Properties of PHY_F

The specific requirements for frequency bands are given in Table O.13 and Table O.14. Use [OMS-S2], Annex Q for parameters which are not defined in this subclause.

Table O.13 - OMS LPWAN, PHY_F, Channel properties, Uplink

Characteristic	Min.	Max.	Unit
Frequency band	470,000	510,000	MHz
Transmitted power		50	mW
Transmitter duty cycle		No limit [a]	%
[a] Maximum continuous transmission time is 1 second (see reference document for China in Table O.16 for details)			

5

Table O.14 - OMS LPWAN, PHY_F, Channel properties, Downlink

Characteristic	Min.	Max.	Unit
Frequency band	470,000	510,000	MHz
Transmitted power		50	mW
Transmitter duty cycle		No limit [a]	%
[a] Maximum continuous transmission time is 1 second (see reference document for China in Table O.16 for details)			

Table O.15 - OMS LPWAN, PHY_F, Technology and frequencies

Direction	Technology	PHY-index	Chip rate [kcps]	Centre frequency [MHz]	Sub-carrier range
Uplink (UL)	B	1 [a]	10	$494{,}110 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		2 [a]	10	$494{,}000 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		3 [b]	10	$493{,}890 + (n-2) \cdot 0{,}015$	$0 \le n \le 4$
		4	125	493,725	n.a.
	S	1 [a]	2,380371	494,100	n.a.
		2 [a]	2,380371	494,000	n.a.
		3 [b]	2,380371	493,900	n.a.
Downlink (DL)	B	1	2	$486{,}050 + (n-2) \cdot 0{,}036$	$0 \le n \le 4$
		2	4	$486{,}050 + (n-2) \cdot 0{,}036$	$0 \le n \le 4$
		3	8	486,050	n.a.
		4	24	486,050	n.a.
	S	1	2,380371	486,100	n.a.
		2	2,380371	486,000	n.a.
		3	4,760742	486,050	n.a.
		4	19,042969	486,050	n.a.

[a] Dual channel usage (for Splitting Mode according to [ETSI 103 357]).

[b] Optional extension sub-mode to be used by OMS end-devices only if requested by the NW-Manager.

O.4 Country specific parameters

The maximum allowed output power and duty-cycle is country specific, as shown in Table O.16.

Table O.16 - Country specific limitations

Country	Frequency band	Max Power UL/DL [mW ERP]	Max Duty Dycle UL/DL [%]	Informative regulatory reference and notes
Europe (CEPT Countries)	PHY_A	25/500	0,2[b] /10	EN 300-200 ERC/REC 70-03
Angola	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
Argentine	PHY_B	25/25	0,2[b]/10	Norma Técnica ENACOM-Q2-60.14 V21.1
Australia	PHY_B	25/25	0,2[b] /10 [b]	AS/NZS 4268:2017
Bahrain	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	IGA -The Regulations of "Type Approval for Short-Range Devices"
Brazil	PHY_B	10/10	0,2[b]/10	Resolution 680 (formerly 506) Ato nº 14448, de 04 de dezembro de 2017, chapter 4
Botswana	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
Chile	PHY_B	10/10	0,2[b]/10	SUBTEL - NORMA TÉCNICA DE EQUIPOS DE ALCANCE REDUCIDO (Resolución Exenta N° 1985 de 2017, modificada por Res. N° 1517, de 2018, y N° 855, de 2019)
China	PHY_F	25/50	0,2[b]/10 [e]	工业和信息化部：进一步规范微功率短距离无线电发射设备的生产、进口、销售和使用 微功率短距离无线电发射设备目录和技术要求
Colombia	PHY_B	10/10	0,2[b]/10	ANE - Resolution No. 105 of 27/03/2020
Democratic Republic of Congo	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
Egypt	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	NTRA - Radio Spectrum Guidelines Short-range Devices (SRD), Nov. 2024
Hong Kong	PHY_B	10/10	0,2[b]/10	OFCA - HKTA 1061, Issue 1, May 2011

Table O.16 - Country specific limitations (cont.)

Country	Frequency band	Max Power UL/DL [mW ERP]	Max Duty Dycle UL/DL [%]	Informative regulatory reference and notes
India	PHY_E	25/25 [c] 500/500 [d]	2,5 [b]/10[a]	Gazette of India, Ministry of Communications Notification, 10th December 2021: Use of Low Power Equipment in the Frequency Band 865-868 MHz for Short Range Devices (Exemption from Licence) Rules, 2021
Indonesia	PHY_B	100/100	0,2[b]/10	SDPPI - Decree of the Minister of Communication and Information of the Republic of Indonesia Number 260 of 2024 about Technical Standards of Short-Range Devices
Kingdom of Saudi Arabia	PHY_A PHY_B	25/25 10/10	0,2[b]/10 0,2[b]/10	CST - Specification for Short Range Devices (SRD) Document Number: RI054, Rev: Issue 05, Date: October
Kuwait	PHY_B	10/10	0,2[b]/10	CITRA - Ultra-Wide Band and Short-Range Devices (SRD) - Issue 2018
Lebanon	PHY_B	6/6	0,2[b]/10	Lebanon TRA - Requirements for Non-Specific Short Range Devices (SRD), Version 1.0, Oct. 2007 Max 10 mW EIRP
Malawi	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
Malaysia	PHY_B	60/60	0,2[b]/10	MCMC - MTSFB TC T007:2020 Max 100 mW EIRP
Mozambique	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
Namibia	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
New Zealand	PHY_B	25/25	0,2[b] /10 [b]	AS/NZS 4268:2017
Nigeria	PHY_B	10/10	0,2[b]/10	NCC - Guidelines on the use of short range devices in Nigeria
Philippines	PHY_B	10/10	0,2[b]/10	NTC - MEMORANDUM CIRCULAR NO. 03-05-2007
Pakistan	PHY_B	60/60	0,2[b]/10	PTA - SHORT RANGE RADIO COMMUNICATION DEVICES, Regulatory Framework For SRD, JULY 8, 2021, PTA H/Q F-5/1,

Table O.16 - Country specific limitations (cont.)

Country	Frequency band	Max Power UL/DL [mW ERP]	Max Duty Dycle UL/DL [%]	Informative regulatory reference and notes
Qatar	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRA - Class License for Short Range Devices (SRD) Version No. (4) April 22, 2021
Singapore	PHY_B	10/10	0,2[b]/10	IMDA - TS SRD Issue 1 Revision 3, Sep 2023
South Africa	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
Sri Lanka	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	TRCSL - RTTE Type Approval Rules in the Extraordinary Gazette No. 2196/51 of 09/10/2020
Tanzania	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
Thailand	PHY_B	10/10	0,2[b]/10	NBTC - TS 1010-2560
UAE	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	UAE TRA - Ultra-Wide Band and Short Range Devices Version 4.0 Document Date: 21 Dec. 2020
Vietnam	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	QCVN - 73:2013/BTTTT
Zambia	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020
Zimbabwe	PHY_A PHY_B	25/500 10/10	0,2[b]/10 0,2[b]/10	CRASA - Framework for the Harmonisation of Frequency Radio Spectrum for Short-Range Devices (SRDs) in SADC, Edition 2020

[a] 10% for network access points, otherwise 2,5%

[b] The duty cycle is not a regulatory limit, but a recommended limit set by OMS

[c] The limit applies for Mode-C

[d] The limit applies for OMS LPWAN

[e] The band has a maximum continuous transmission time of 1 second