



Open Metering System Specification

Alternative Physical Layers for OMS

**Annex O to
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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



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O.1 OMS frequencies for non-868 MHz countries

Countries being members of CEPT (e.g. EU, EEA and more) shall use the frequencies (and channel parameters) specified in [EN 13757-4:2013] (here defined as PHY_A). These frequencies are based on CEPT/ERC/REC 70-03 (except Russia). Other countries where these frequencies are not allowed shall use the alternative frequencies (and channel parameters) defined as PHY_B to PHY_E in Table 1. All other parameters shall follow EN 13757-4.

As OMS only uses mode S, T and C, alternative frequencies for the other modes of [EN 13757-4:2013] are not defined.

Table 1 – PHY frequencies and radio parameters

Band	PHY_A 868 MHz			PHY_B 433 MHz			PHY_C 915 MHz	PHY_D 868 MHz (Russia)			PHY_E 865 MHz			Unit
	S	T	C	S	T	C	–	S	T	C	S	T	C	
Frequency (uplink ¹)	868,3	868,95	868,95	433,5	434,475	434,475	902 – 928 FH ²	868,95	868,95	868,95	865,5	n.a. ³	n.a. ³	MHz
Frequency (downlink ⁴)	868,3	868,3	869,525	433,5	433,5	433,5	902 – 928 FH ²	868,95	868,95	868,95				MHz
Frequ. accuracy (uplink ¹)	60	60	25	60	60	25	TBD	60	60	25	40			± ppm
Frequ. accuracy (downlink ⁴)	25	25	25	25	25	25	TBD	25	25	25	25			± ppm
Chip rate (uplink ¹)	32,768	100	100	32,768	100	100	TBD	32,768	100	100	32,768			kchip/s
Chip rate (downlink ⁴)	32,768	32,768	50	32,768	32,768	50	TBD	32,768	32,768	50	32,768			kchip/s
Chip rate tolerance (TX)	1,5 %	10 %	100 ppm	1,5 %	1 %	100 ppm	TBD	1,5 %	1 %	100 ppm	1,5 %			
Chip rate tolerance (RX)	2 %	12 %	100 ppm	2 %	1 %	100 ppm	TBD	2 %	1 %	100 ppm	2 %			
FSK deviation ⁵ for uplink (min/typ/max)	40/50/80	40/50/80	33,75/45/56,25	40/50/60 ⁶	40/50/60	33,75/45/56,25	TBD	40/50/60	40/50/60	33,75/45/56,25	25/35/45			± kHz

¹ Uplink: Meter to Other Device

² Frequency Hopping used to meet FCC regulations

³ A 100 kchip/s channel is not feasible due to 200 kHz channel bandwidth

⁴ Downlink: Other Device to Meter

⁵ Measured as rms value for PN9 sequence in the centre of the chip

⁶ Receiver acceptance window must be wider to ensure interoperability with KNX specifying 48/60/80 kHz



Band	PHY_A 868 MHz			PHY_B 433 MHz			PHY_C 915 MHz	PHY_D 868 MHz (Russia)			PHY_E 865 MHz			Unit
	S	T	C	S	T	C	-	S	T	C	S	T	C	
FSK deviation ⁵ for downlink (min/typ/max)	40/50/80	40/50/80	GFSK 18,75/25/ 31,25	40/50/60 ⁷	40/50/60	GFSK 18,75/25/ 31,25	TBD	40/50/60	40/50/60	GFSK 18,75/25/ 31,25	25/35/45			± kHz
Bandwidth (uplink ¹)	600 ⁸	500 ⁸	500 ⁸	600 ⁹	500 ⁹	500 ⁹	TBD	500 ⁸	500 ⁸	500 ⁸	200 ^{8,10}			kHz
Bandwidth (downlink ⁴)	600 ⁸	600 ⁸	250 ⁸	600 ⁹	600 ⁹	250 ⁹	TBD	500 ⁸	500 ⁸	250 ⁹	200 ^{10,10}			kHz
Output power (uplink ¹)	25	25	25	10	10	10	TBD	25	25	25	1000			mW
Output power (downlink ⁴)	25	25	500	10	10	10	TBD	25	25	25	1000			mW

⁷ Receiver acceptance window must be wider to ensure interoperability with KNX specifying 48/60/80 kHz
⁸ The given signal bandwidth is identical with the max. bandwidth of this sub-band (refer to Regulatory reference in Table 2)
⁹ The given signal bandwidth is smaller than the bandwidth of this sub-band (refer to Regulatory reference in Table 2).
¹⁰ Measured as 20 dB bandwidth

The maximum allowed output power and duty-cycle is country specific, as shown in Table 2.

Table 2 – Country specific limitations

Country	Frequency band	Max Power	Duty Cycle	Note / Regulatory reference
Europe (All EU-countries + EEA)	PHY_A	25 mW	S: 1% T: 0,1 % (uplink) T: 1% (downlink) C: 0,1 % (uplink) C: 10% (downlink)	ERC/REC 70-03
Australia	PHY_B	25 mW	1,0 % ¹¹	AS/NZS 4268:2003 433,05 to 434,79 MHz / 25 mW allowed, 915 – 928 MHz / 3 mW allowed
Brazil	PHY_B	10 mW	1,0 % ¹¹	Annex to resolution 365, of 10 May 2004. Article 9, paragraph 5 433 – 435 MHz: Max 10 mW <i>EIRP</i>
India	PHY_E	1 W	1,0 % ¹¹	Ministry of Communications and Information technology, G.S.R. 564(E). 865 – 867 MHz, 1 W or 4 W <i>ERP</i> , 200 kHz bandwidth
New Zealand	PHY_B	25 mW	1,0 % ¹¹	AS/NZS 4268:2003 433,05 to 434,79 MHz / 25 mW allowed, 915 – 928 MHz / 3 mW allowed
Russia	PHY_D	25 mW	0,1 %	ERC/REC 70-03 Only parts of the European 868-MHz-Band are allowed

O.1.1 Notes

PHY_B 433 MHz band is typically from 433,05 to 434,790 MHz.

PHY_B T mode channel is placed in the upper half of the band, avoiding the centre frequency where most SAW based devices operate. Also it is one half of the frequency of the 868 MHz channel for easy implementation.

PHY_C is reserved for use in USA and countries with similar regulations.

PHY_D is defined for Russia, as only the 868,7 – 869,2 MHz sub-band is license free.

KNX-RF has specified 433,500 MHz (S-mode). This specification is already approved in KNX, and this frequency is selected due to interoperation with KNX.

In the USA, the 270 – 470 MHz band can be used under certain conditions. Periodic signalling is not allowed. The maximum output power is -14 dBm *EIRP* at 433 MHz, but the output power can be increased for packet lengths less than 100 ms, by up to 20 dB at 10 ms. But there is also a limitation with regard to periodic transmissions. The 902 – 928 MHz band can be used with maximum output power -1 dBm *EIRP* if no spreading techniques are used, as for regular FSK modulation. Increased output power is only allowed using Frequency Hopping Spread Spectrum (FHSS) or Direct Sequence Spread Spectrum (DSSS) or other digital modulation with a BW above 500 kHz. PHY_C is hence reserved for using the 902 – 928 MHz band with Frequency Hopping. Frequency Hopping is the preferred spreading technique, to keep the hardware implementation as similar to the 868 MHz implementation as possible. Only one mode (or hop set) will be defined for 915 MHz.

¹¹ The duty cycle is not a regulatory limit, but a system requirement in OMS