Radio Evo
Radio Frame Description

English Version v1.0
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Frame types and content

Radio Evo allows the transmission of 2 frame types:
1) Short frame (current values and two billing date readouts)
2) Long frame (same data as short frame, plus 12 monthly values)

Both frame types follow EN 13757-3 regulation.

Radio Evo Short Frame structure

The table below shows the short frame structure, with a numerical example (no AES encryption for sake of clarity):

Layer	Function/Field	Description	Example (hex)
Link layer	L field	Data length (number of subsequent data bytes)	4E
	C field	Type of frame according to EN 13757-3	44
	Manufacturer	Manufacturer code 3-char binary representation (e.g. MAD)	24
			34
	Serial number	Device serial number (e.g. 16100175)	75
			01
			10
			16
	Version	Generation number, according to the manufacturer	50
	Medium	Meter measured medium code (e.g. Water)	07
Application layer	CI	Protocol type according to EN 13757-3 (always 7A - Short header)	7A
	Access Number	Transmission counter (incremented every radio transmission)	32
	Status	Status according to EN 13757-3	00
	Signature	Signature bytes according to EN 13757-3	00
			00
	AES verification	2F (Idle Filler)	2F
	AES verification	2F (Idle Filler)	2F
	Actual reading volume	DIF: 04 (actual reading, 4 bytes binary)	04
		VIF: 13 (volume, litre)	13
		value (e.g. 54321 litres = 0000D431)	31
			D4
			00
			00
	Actual date/time	DIF: 04 (actual reading, 4 bytes binary)	04
		VIF: 6D (date/time type "F")	6D
		value (e.g. 2013-10-11 14:52:00 = 1AAB0E34)	34

			0E
			AB
			1A
Alarms register (see **Error code encoding table**)	DIF: 04 (actual reading, 4 bytes binary)		04
	VIF: FD (VIF table extension)		FD
	VIFE: 17 (error flag)		17
	Error flag is		00
	Error flag was		00
	Reserved		00
			00
Water meter mechanical serial number	DIF: 0E (actual reading, 12 digit BCD)		0E
	VIF: 78 (fabrication number)		78
	value (e.g. serial 1234567890)		90
			78
			56
			34
			12
			00
Periodic reading volume (T1)	DIF: 44 (storage T1 value, 4 bytes binary)		44
	VIF: 13 (volume, litre)		13
	value (e.g. 0 l)		00
			00
			00
			00
Periodic reading date (T1)	DIF: 42 (storage T1 value, 2 bytes binary)		42
	VIF: 6C (date type G)		6C
	value (e.g. 2000-01-15 = 010F)		0F
			01
Periodic reading volume (T2)	DIF: 84 (storage T2 value, 4 bytes binary + DIFE extension)		84
	DIFE: 01 (storage T2)		01
	VIF: 13 (volume, litre)		13
	value (e.g. 0 l)		00
			00
			00
			00
Periodic reading date (T2)	DIF: 82 (storage T2 value, 2 bytes binary+ DIFE extension)		82
	DIFE: 01 (storage T2)		01
	VIF: 6C (date type G)		6C
	value (e.g. 2000-01-15 = 010F)		0F
			01
MAX forward flow rate (T3)	DIF: D3 (max, storage T3 value, 3 bytes binary + DIFE extension)		D3
	DIFE: 01 (storage T3)		01
	VIF: 3B (flow rate, litres /hour)		3B
	value (e.g. 1245 l/h=0004DD)		DD

			04
			00
MAX forward flow rate date/time (T3)	DIF: C4 (storage T3 value, 2 bytes binary + DIFE extension)		C4
	DIFE: 01 (storage T3)		01
	VIF: 6D (date type F)		6D
	value (e.g. 2013-10-11 14:52:00 = 1AAB0E34)		34
			0E
			AB
			1A

Radio Evo Long Frame structure

The table below shows the long frame structure, with a numerical example (no AES encryption for sake of clarity):

Layer	Function/Field	Description	Example (hex)
Link layer	L field	Data length (number of subsequent data bytes)	AC
	C field	Type of frame according to EN 13757-3	44
	Manufacturer	Manufacturer code 3-char binary representation (e.g. MAD)	24
			34
	Serial number	Device serial number (e.g. 16100175)	75
			01
			10
			16
	Version	Generation number, according to the manufacturer	50
	Medium	Meter measured medium code (e.g. Water)	07
Application layer	CI	Protocol type according to EN 13757-3 (always 7A - Short header)	7A
	Access Number	Transmission counter (incremented every radio transmission)	32
	Status	Status according to EN 13757-3	00
	Signature	Signature bytes according to EN 13757-3	00
			00
	AES verification	2F (Idle Filler)	2F
	AES verification	2F (Idle Filler)	2F
	Actual reading volume	DIF: 04 (actual reading, 4 bytes binary)	04
		VIF: 13 (volume, litre)	13
		value (e.g. 54321 litres = 0000D431)	31
			D4

		00
		00
Actual date/time	DIF: 04 (actual reading, 4 bytes binary)	04
	VIF: 6D (date/time type "F")	6D
	value (e.g. 2013-10-11 14:52:00 = 1AAB0E34)	34
		0E
		AB
		1A
Alarms register (see **Error code encoding table**)	DIF: 04 (actual reading, 4 bytes binary)	04
	VIF: FD (VIF table extension)	FD
	VIFE: 17 (error flag)	17
	Error flag is	00
	Error flag was	00
	Reserved	00
		00
Water meter serial number	DIF: 0E (actual reading, 12 digit BCD)	0E
	VIF: 78 (fabrication number)	78
	value (e.g. serial 1234567890)	90
		78
		56
		34
		12
		00
Periodic reading volume (T1)	DIF: 44 (storage T1 value, 4 bytes binary)	44
	VIF: 13 (volume, litre)	13
	value (e.g. 0 l)	00
		00
		00
		00
Periodic reading date (T1)	DIF: 42 (storage T1 value, 2 bytes binary)	42
	VIF: 6C (date type G)	6C
	value (e.g. 2000-01-15 = 010F)	0F
		01
Periodic reading volume (T2)	DIF: 84 (storage T2 value, 4 bytes binary + DIFE extension)	84
	DIFE: 01 (storage T2)	01
	VIF: 13 (volume, litre)	13
	value (e.g. 0 l)	00
		00
		00
		00
Periodic reading date (T2)	DIF: 82 (storage T2 value, 2 bytes binary+ DIFE extension)	82
	DIFE: 01 (storage T2)	01
	VIF: 6C (date type G)	6C
	value (e.g. 2000-01-15 = 010F)	0F

		01
MAX forward flow rate (T3)	DIF: D3 (max, storage T3 value, 3 bytes binary + DIFE extension)	D3
	DIFE: 01 (storage T3)	01
	VIF: 3B (flow rate, litres /hour)	3B
	value (e.g. 1245 l/h=0004DD)	DD
		04
		00
MAX forward flow rate date/time (T3)	DIF: C4 (storage T3 value, 2 bytes binary + DIFE extension)	C4
	DIFE: 01 (storage T3)	01
	VIF: 6D (date type F)	6D
	value (e.g. 2013-10-11 14:52:00 = 1AAB0E34)	34
		0E
		AB
		1A
Storage interval	DIF: 81 (storage T8, 1 byte binary + DIFE)	81
	DIFE: 04 (storage T8)	04
	VIF: FD (VIF table extension)	FD
	VIFE: 28 (storage interval in months)	28
	value (1 month)	01
Monthly reading date (T8)	DIF: 82 (storage T8 value, 2 bytes binary + DIFE extension)	82
	DIFE: 04 (storage T8)	04
	VIF: 6C (date type G)	6C
	value (e.g. 2000-01-01 = 0101)	01
		01
Monthly reading volume (T8)	DIF: 84 (storage T8 value, 4 bytes binary + DIFE extension)	84
	DIFE: 04 (storage T8)	04
	VIF: 13 (volume, litre)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading volume (T9)	DIF: C4 (storage T9 value, 4 bytes binary + DIFE extension)	C4
	DIFE: 04 (storage T)	04
	VIF: 13 (volume, litre)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading volume (T10)	DIF: 84 (storage T10 value, 4 bytes binary + DIFE extension)	84
	DIFE: 05 (storage T10)	05
	VIF: 13 (volume, litre)	13
	value (e.g. 0 l)	00
		00
		00

			00
Monthly reading volume (T11)	DIF: C4 (storage T11 value, 4 bytes binary + DIFE extension)		C4
	DIFE: 05 (storage T11)		05
	VIF: 13 (volume, litre)		13
	value (e.g. 0 l)		00
			00
			00
			00
Monthly reading volume (T12)	DIF: 84 (storage T12 value, 4 bytes binary + DIFE extension)		84
	DIFE: 06 (storage T12)		06
	VIF: 13 (volume, litre)		13
	value (e.g. 0 l)		00
			00
			00
			00
Monthly reading volume (T13)	DIF: C4 (storage T13 value, 4 bytes binary + DIFE extension)		C4
	DIFE: 06 (storage T13)		06
	VIF: 13 (volume, litre)		13
	value (e.g. 0 l)		00
			00
			00
			00
Monthly reading volume (T14)	DIF: 84 (storage T14 value, 4 bytes binary + DIFE extension)		84
	DIFE: 07 (storage T14)		07
	VIF: 13 (volume, litre)		13
	value (e.g. 0 l)		00
			00
			00
			00
Monthly reading volume (T15)	DIF: C4 (storage T15 value, 4 bytes binary + DIFE extension)		C4
	DIFE: 07 (storage T15)		07
	VIF: 13 (volume, litre)		13
	value (e.g. 0 l)		00
			00
			00
			00
Monthly reading volume (T16)	DIF: 84 (storage T16 value, 4 bytes binary + DIFE extension)		84
	DIFE: 08 (storage T16)		08
	VIF: 13 (volume, litre)		13
	value (e.g. 0 l)		00
			00
			00
			00
Monthly reading volume (T17)	DIF: C4 (storage T17 value, 4 bytes binary + DIFE extension)		C4

		DIFE: 08 (storage T17)	08
		VIF: 13 (volume, litre)	13
		value (e.g. 0 l)	00
			00
			00
			00
	Monthly reading volume (T18)	DIF: 84 (storage T18 value, 4 bytes binary + DIFE extension)	84
		DIFE: 09 (storage T18)	09
		VIF: 13 (volume, litre)	13
		value (e.g. 0 l)	00
			00
			00
			00
	Monthly reading volume (T19)	DIF: C4 (storage T19 value, 4 bytes binary + DIFE extension)	C4
		DIFE: 09 (storage T19)	09
		VIF: 13 (volume, litre)	13
		value (e.g. 0 l)	00
			00
			00
			00

Find here below some detailed explanation of some of the fields present in the application layer:

Alarms register

The two-byte value of the error flag is shown in the table below. Please note that the first and the second byte represent the very same error, in the so called "IS" and "WAS" flavour, with "IS" meaning that the alarm/error is currently present, while "WAS" meaning it was present at some time in the past.

Error code encoding table		
Bit	**Value**	**Description**
b0	Mechanical Fraud IS	Radio Evo is removed from the meter now
b1	Magnetic Fraud IS	A fraud with a magnet is detected now
b2	Suspected Leakage IS	A leakage could be present now
b3	Backflow IS	Reverse water flow exceeds the maximum threshold now
b4	Overflow IS	Maximum flow rate is exceeded now
b5	Meter Reversed IS	Meter could be mounted in the wrong verse
b6	No Consumption IS	Meter could show no water consumption now
b7	Reserved	Reserved
b8	Mechanical Fraud WAS	Radio Evo was removed from the meter in the past
b9	Magnetic Fraud WAS	A fraud with a magnet was detected in the past
b10	Suspected Leakage WAS	A leakage could have been present in the past
b11	Backflow WAS	Reverse water flow exceeded the maximum threshold in the past
b12	Overflow WAS	Maximum flow rate was exceeded in the past
b13	Meter Reversed WAS	Meter could have been mounted in the wrong verse in the past

b14	No Consumption WAS	Meter could have shown no water consumption in the past
b15	Not Used	Bit not used

Water meter mechanical serial number

The value stores the serial number of the mechanical water meter underlying Radio Evo module. This data can be used to couple the water meter with the Radio Evo transmitting unit mounted on it.

Periodic reading volume and date (T1 and T2)

Radio Evo allows to store the meter volume in two billing dates, T1 and T2, that can be set during module programming. For each of the billing dates, both volume and date are stored and transmitted in the radio frame.

Monthly storage interval and Monthly reading volume (T8 to T19, long frame only)

While transmitting the long frame, Radio Evo sends 12 monthly values (T8 to T19), representing the reading volume stored each month. The day and month of the first reading (T8) are expressed in the Monthly reading date (T8). One must assume that the following monthly readings are done each one month apart, back in time. So, for example, if T8 is the reading dated 15th November, T9 readout has been made on 15th October, T10 on 15th September and so on, rolling on previous year if necessary.