

Application Note 155/12 v01

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Extension of the KNX RF Communication Medium with the additional frequency sub bands of 433 MHz and 865 MHz for use in further geographical regions.

Documents

Modified

- [01] Chapter 3/2/5 "Radio Frequency" v1.6.01 AS
- [02] Chapter 8/2/5 "RF Physical and Link Layer Tests" v1.2 DP

Referred

None.

Document updates

Version	Date	Modifications
AN155-01	2012.08.08	Creation of the Draft Proposal.
AN155-02	2013-05-08	Resolution of voting comments

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1 KNX RF2

 This table shall be added to [01] clause 4 Table 2.

Region examples	Frequency sub-band	KNX RF Ready	KNX RF Multi	KNX RF BiBat	KNX RF Bibat 2
Russia, Australia, Arab countries, Europe	433 MHz	KNX RF2.R	KNX RF2.M	Not defined	Not defined

1.1 Physical Layer type RF Multi, 433 MHz band

This clause shall be added to clause 5.2.2 of [01].

1.1.1 KNX RF2 channel definitions for RF channels F1, F2 and F3

Table 1 - RF channel definitions for RF2 channels F1, F2 and F3


Parameter	Value		Comment
Tx centre frequency	Channel F1	433,500 MHz	KNX Tx to KNX Rx ^b Tx : ±25 ppm Rx : ±25 ppm
	Channel F2	434,000 MHz	
	Channel F3	434,500 MHz	
TX radiated power	Typical: 0 dBm Min: -3 dBm Max: 10 dBm		
Deviation	± (45 ±11,25) kHz		Typical 45 kHz, 75% to 125 % tolerance. Measured in centre of chip (frequency vs. time eye opening) transmitting PN9 sequence, min/max based on rms error value.
Max allowed bandwidth	400 kHz		For F1, F2 and F3
Tx max duty cycle	10 %		Duty Cycle is 100 % up to a maximum radiated power of 1 mW ERP or -13 dBm/10kHz
Tx chip rate	32 768 chips per second		
Maximum Tx chip rate tolerance	± 0,5%		
Maximum Tx jitter per transition	± 5 µs		
Sensitivity max	-95 dBm typical -80 dBm min		Radiated test ^d BER : 10 ⁻⁴
Minimal Rx chip rate tolerance	± 0,5%		± 2 % if interoperation with KNX-RF2 Ready
Preamble length	247x chip sequence “01”		~15 ms, number of preamble chips is not checked by Rx
Receiver blocking performance	Minimum category 2		Category 2 according EN 300 220, is not a regulatory requirement, but KNX specific
Minimal operating range	0°C to 45°C ^e		
^a N.A.			
^b This frequency tolerance includes tolerances due to temperature variations within the operating temperature range and tolerances due to crystal aging.			
^c N.A.			
^d At Bit Error Rate (BER) 10 ⁻⁴ in optimum antenna direction.			
^e KNX Physical Layer parameters shall be met on the entire product temperature range declared by the manufacturer. (e.g. : -10°C to 70°C for outdoor usage)			

1.1.2 KNX RF2 channel definitions for RF channels S1 and S2, 433 MHz band

Table 2 - RF channel definitions for RF2 Multi channels S1 and S2

Parameter	Value		Comment
Tx centre frequency	Channel S1	434,500 MHz	Tx: ±25 ppm ^a Rx: ±25 ppm
	Channel S2	433,175 MHz	
Tx radiated power	Typical: 0 dBm Min: -3 dBm Max: 10 dBm		
Deviation	± (33 ±8,25) kHz		Typical 33 kHz, 75% to 125% tolerance. Measured in centre of chip (frequency vs. time eye opening) transmitting PN9 sequence, min/max based on rms error value.
Max allowed bandwidth	250 kHz		For S1& S2
Tx max duty cycle	10 %		Duty Cycle is 100 % up to a maximum radiated power of 1 mW ERP or -13 dBm/10kHz
Tx chip rate	16 384 chips per second		
Maximum Tx chip rate tolerance	± 0,5%		
Maximum Tx jitter per transition	±5 µs		
Sensitivity max	-95 dBm typical -80 dBm min		Radiated test ^b BER = 10 ⁻⁴
Minimal Rx chip rate tolerance	± 0,5%		
Preamble length	4 111 chip sequence “01”		~500 ms, number of preamble chips is not checked by Rx
Receiver blocking performance	Minimum category 2		Category 2 according EN 300 220, is not a regulatory requirement, but KNX specific
Minimal operating range	0°C to 45°C ^c		
^a This frequency tolerance includes tolerances due to temperature variations within the operating temperature range and tolerances due to crystal aging.			
^b At Bit Error Rate (BER) 10 ⁻⁴ in optimum antenna direction.			
^c KNX Physical Layer parameters shall be met on the entire product temperature range declared by the manufacturer. (e.g. : -10°C to 70°C for outdoor usage)			

1.2 Test specifications


 *This clause shall be integrated in [02] clause 3.1 "Physical Layer tests".*

1.2.1 EMC and ERM related test

 *This clause shall be integrated in [02] clause 3.1.3 "EMC- and ERM related tests".*

EMC and ERM related test for RF2 if used outside Europe, shall be performed according to the local standards where the equipment is intended to be used.

1.2.2 Testing of Tx Centre Frequency Tolerance

 *This clause shall be integrated in [02] clause 3.1.3 "Testing of Tx Centre Frequency Tolerance".*

Requirements:

RF2.M, channel F1: 433,500 MHz


1.2.3 Testing of Duty Cycle

 *This clause shall be integrated in [02] clause 3.1.5 "Testing of Duty Cycle".*

Requirements:

RF2.M: 10 %

1.2.4 Testing of FSK Deviation

 *This clause shall be integrated in [02] clause 3.1.6 "Testing of FSK Deviation".*

Requirements:

RF2.M Fast channels: 45 kHz -11,25 kHz to 11,25kHz. Measured in centre of chip (frequency vs. time eye opening) transmitting PN9 sequence, min/max based on rms error value.

RF2.M Slow channels: 33 kHz -8,25 kHz to 8,25kHz. Measured in centre of chip (frequency vs. time eye opening) transmitting PN9 sequence, min/max based on rms error value.

1.2.5 Testing of Chip Rate

 *This clause shall be integrated in [02] clause 3.1.8 "Testing of Tx Chip Rate".*

Requirements:

RF2.M Fast channels: 32 768 cps - 0,5 % to 32 768 cps+0,5%

RF2.M Slow channels: 16 384 cps - 0,5 % to 16 384 cps+0,5%

1.2.6 Testing of Rx Frequency Tolerance

 *This clause shall be integrated in [02] clause 3.1.11 "Testing of Rx Frequency Tolerance".*

Testing:

RF2.M, channel F1: Centre frequency 433,500 MHz.

Requirement: 433,500MHz - 25 ppm to 433.500MHz +25ppm.

1.2.7 Testing of Rx Chip Rate Tolerance

 *This clause shall be integrated in [02] clause 3.1.12 "Testing of Rx Chip Rate Tolerance".*

Testing:

RF2.M: Test at TX chiprate-0,5% and TX chiprate +0,5%

2 KNX RF5

 *This table shall be added to [01] clause 4 Table 2.*

Region examples	Frequency sub-band	KNX RF Ready	KNX RF Multi	KNX RF BiBat	KNX RF Bibat 2
India	865 MHz	Not defined	KNX RF5.M	Not defined	Not defined

2.1 Physical Layer type RF Multi, 865 MHz band

 This clause shall be added to clause 5.2.2 of [01].

2.1.1 KNX RF5 channel definitions for RF channels F1, F2 and F3

Table 3 - RF channel definitions for RF5 channels F1, F2 and F3

Parameter	Value		Comment
Tx centre frequency	Channel F1	865,500 MHz	KNX Tx to KNX Rx ^b Tx : ±25 ppm Rx : ±25 ppm
	Channel F2	865,900 MHz	
	Channel F3	866,500 MHz	
TX radiated power	Typical: 0 dBm Min: -3 dBm Max: 17 dBm		The TX radiated power is not a regulatory requirement, but to ensure KNX system operation. The maximum regulatory allowed power is 1 W, and 4 W ERP.
Deviation	± (33 ±8,25) kHz		Typical 33 kHz, 75% to 125% tolerance. Measured in centre of chip (frequency vs. time eye opening) transmitting PN9 sequence, min/max based on rms error value.
Max allowed bandwidth	200 kHz		For F1, F2 and F3 Measured as 20 dB (99%) bandwidth.
Tx max duty cycle	10 %		
Tx chip rate	32 768 chips per second		
Maximum Tx chip rate tolerance	± 0,5%		
Maximum Tx jitter per transition	±5 µs		
Sensitivity max	-95 dBm typical -80 dBm min		Radiated test ^d BER : 10 ⁻⁴
Minimal Rx chip rate tolerance	± 0,5 %		
Preamble length	247x chip sequence “01”		~15 ms, number of preamble chips is not checked by Rx
Receiver blocking performance	Minimum category 2		Category 2 according EN 300 220, is not a regulatory requirement, but KNX specific
Minimal operating range	0°C to 45°C ^e		
^f N.A.			
^g This frequency tolerance includes tolerances due to temperature variations within the operating temperature range and tolerances due to crystal aging.			
^h N.A.			
ⁱ At Bit Error Rate (BER) 10 ⁻⁴ in optimum antenna direction.			
^j KNX Physical Layer parameters shall be met on the entire product temperature range declared by the manufacturer. (e.g. : -10°C to 70°C for outdoor usage)			

2.1.2 KNX RF5 channel definitions for RF channels S1 and S2, 865 MHz band

Table 4 - RF channel definitions for RF5 Multi channels S1 and S2

Parameter	Value		Comment
Tx centre frequency	Channel S1	865,100 MHz	Tx: ±25 ppm ^a
	Channel S2	866,900 MHz	Rx: ±25 ppm
Tx radiated power	Typical: 0 dBm Min: -3 dBm Max: 17 dBm		The TX radiated power is not a regulatory requirement, but to ensure KNX system operation. The maximum regulatory allowed power is 1 W, and 4 W ERP.
Deviation	± (33 ±8,25) kHz		Typical 33 kHz, 75% to 125% tolerance. Measured in centre of chip (frequency vs. time eye opening) transmitting PN9 sequence, min/max based on rms error value.
Max allowed bandwidth	200 kHz		For S1 and S2. Measured as 20 dB (99%) bandwidth.
Tx max duty cycle	10 %		
Tx chip rate	16 384 chips per second		
Maximum Tx chip rate tolerance	± 0,5%		
Maximum Tx jitter per transition	±5 µs		
Sensitivity max	-95 dBm typical -80 dBm min		Radiated test ^b BER = 10 ⁻⁴
Minimal Rx chip rate tolerance	± 0,5%		
Preamble length	4 111 chip sequence “01”		~500 ms, number of preamble chips is not checked by Rx
Receiver blocking performance	Minimum category 2		Category 2 according EN 300 220, is not a regulatory requirement, but KNX specific
Minimal operating range	0°C to 45°C ^c		
^a This frequency tolerance includes tolerances due to temperature variations within the operating temperature range and tolerances due to crystal aging.			
^e At Bit Error Rate (BER) 10 ⁻⁴ in optimum antenna direction.			
^f KNX Physical Layer parameters shall be met on the entire product temperature range declared by the manufacturer. (e.g. : -10°C to 70°C for outdoor usage)			

2.2 Test specifications

This clause shall be integrated in [02] clause 3.1 "Physical Layer tests".

2.2.1 EMC and ERM related test

This clause shall be integrated in [02] clause 3.1.3 "EMC- and ERM related tests".

EMC and ERM related test for RF5 shall be performed according to the local standards in India.

2.2.2 Testing of Tx Centre Frequency Tolerance

This clause shall be integrated in [02] clause 3.1.3 "Testing of Tx Centre Frequency Tolerance".

Requirements:

RF5.M, channel F1: 865,500 MHz

2.2.3 Testing of Duty Cycle

This clause shall be integrated in [02] clause 3.1.5 "Testing of Duty Cycle".

Requirements:

RF5.M: 10 %

2.2.4 Testing of FSK Deviation

This clause shall be integrated in [02] clause 3.1.6 "Testing of FSK Deviation".

Requirements:

RF5.M Fast and Slow channels: 33 kHz -8,25 kHz to 8,25kHz. Measured in centre of chip (frequency vs. time eye opening) transmitting PN9 sequence, min/max based on rms error value).

2.2.5 Testing of Chip Rate

This clause shall be integrated in [02] clause 3.1.8 "Testing of Tx Chip Rate".

Requirements:

RF5.M Fast channels: 32 768 cps - 0,5 % to 32 768 cps+0,5%

RF5.M Slow channels: 16 384 cps - 0,5 % to 16 384 cps+0,5%

2.2.6 Testing of Rx Frequency Tolerance

This clause shall be integrated in [02] clause 3.1.11 "Testing of Rx Frequency Tolerance".

Testing:

RF5.M, channel F1: Centre frequency 865,500 MHz

Requirement: 865,500 MHz- 25 ppm to 865,500 MHz+25ppm

2.2.7 Testing of Rx Chip Rate Tolerance

This clause shall be integrated in [02] clause 3.1.12 "Testing of Rx Chip Rate Tolerance".

Testing:

RF5.M: Test at TX chiprate+0,5% and TX chiprate -0,5%