

SLR-434M Command input and response timing

The [CR] [LF] code is always attached to the end of the command and response.

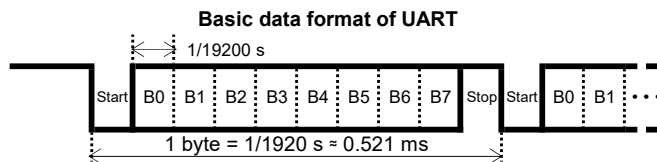
The command response time in this document shows the standard time required after inputting [LF] code at the end of the command.

The time required for command input via UART can be calculated as follows if the command is continuously input without any restrictions.

When the UART parameters are 19.2 kbps, Data=8 bits, Stop=1 bit, Party=None, the transmission time per 1 byte is 0.52 ms (0.57 ms when the stop bit is 2 bits).

Example) "@CH07"<Cr><Lf> = 7 bytes, approx.3.6 ms

"@DT05abcde"<Cr><Lf> = 12 bytes, approx. 6.2ms



Important note:

Every time the communication mode is reset by setting the INI terminal to Lo or whenever setting values are registered by using commands such as the "@MO##" command or "/W" option, the startup time and the command response/processing time will change.

When setting a timeout for the response output to the command input, make sure that the value has a sufficient margin for the maximum response/processing time.

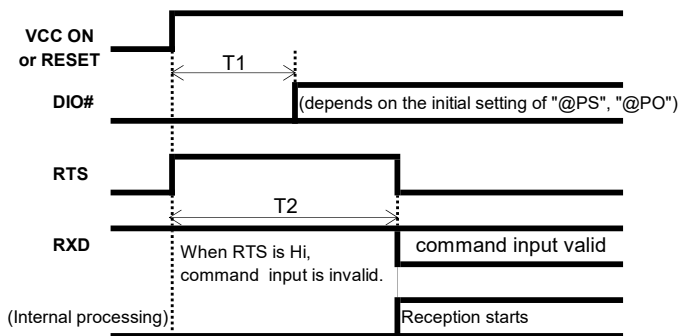
Startup time when turning on power or resetting

Item		Response/processing time (ms)		
		Min	Typ	Max
DIO initial setting	T1	62		115
RTS setup time (=Receiving starts)	T2	110		163

Immediately after startup, the RTS becomes Lo when a UART command is ready to be received.

If the RTS signal is not used, input the command after T2 (Max) or more has elapsed (180 ms recommended).

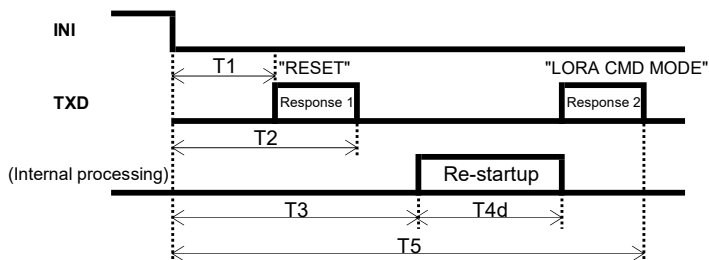
For input of the "@RA" command, since the RSSI value is not stable immediately after the start of reception, input it after T2 (Max) + 10 ms or more has elapsed.



When binary mode is reset with the INI terminal set to Lo

Item		Response/processing time (ms)		
		Min	Typ	Max
"Lo" detected at INI	T1	2000		3000
"RESET" response output	T2	2004		3004
(Reset delay)	T3	3586		4586
(Re-startup)	T4d	158		348
"LORA CMD MODE"	T5	3753		4943

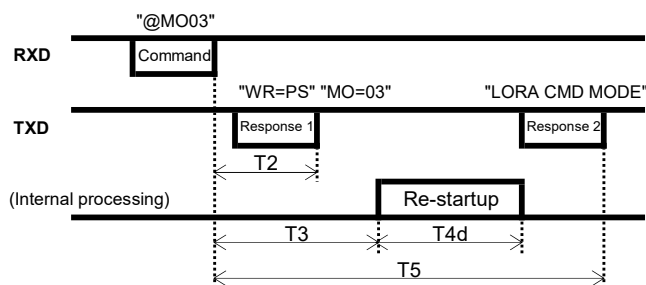
When the module is reset with the INI terminal set to Lo, it restarts in the command mode and outputs "LORA CMD MODE" or "FSK CMD MODE" (not output at normal startup).



Response time for radio communication mode setting command

Command example	Response example (or internal processing)		Response/processing time (ms)		
			Min	Typ	Max
"@MO03"	"*WR=PS" "*MO=03"	T2	59		111
	(Reset delay)	T3	1645		1697
	(Re-startup)	T4d	158		348
	"LORA CMD MODE"	T5	1812		2054

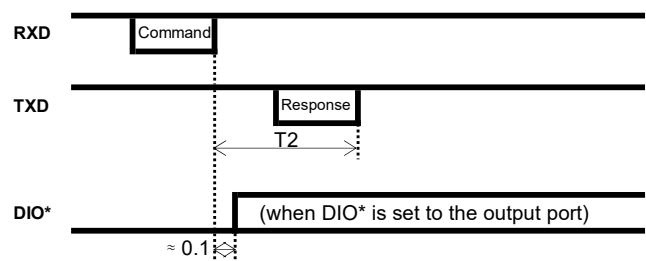
When a communication mode is set, the module outputs "*WR=PS" "*MO=##" and then restarts and outputs the response such as "LORA CMD MODE" (not output at normal startup).



Response time for input/output port control commands

Command example	Response example (or internal processing)		Response/processing time (ms)		
			Min	Typ	Max
"@PO"	"*PO=##"	T2		5.1	
"@PO##"	"*PO=##"	T2		5.2	
"@PO##/W"	"*WR=PS" "*PO=##"	T2	59		204

The timing for "@PS.." is the same as that for "@PO..".



Response time for other setting commands

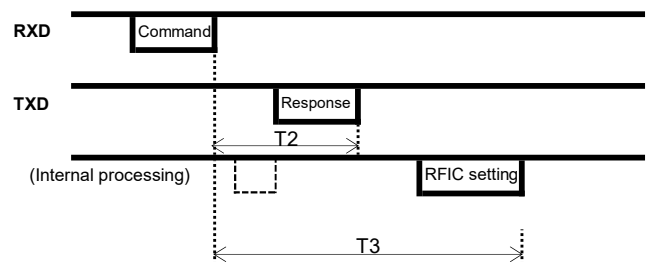
Command example	Response example (or internal processing)		Response/processing time (ms)		
			Min	Typ	Max
"@MO"	"*MO=##"	T2		5.2	
"@CH"	"*CH=##"	T2		5.2	
"@CH##"	"*CH=##"	T2		6.2	
"@CH##/W"	"*WR=PS" "*CH=##"	T2	59		198

The timing for "@SF.." is the same as that for "@CH..".

"@EI"	"*EI=##"	T2		5.2	
"@EI##"	"*EI=##"	T2		5.2	
"@EI##/W"	"*WR=PS" "*EI=##"	T2	59		198

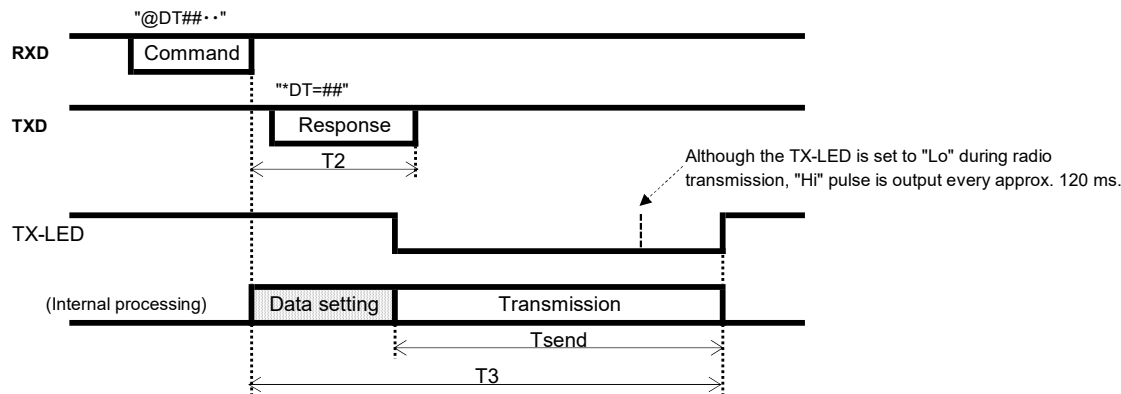
The timing for "@DI..", "@GI..", "@CI.." and "@PM.." is the same as that for "@EI..".

"@RA"	"*RA=###dBm"	(FSK)	T2		39.3
		(LoRa®)	T3 ^{*1}		52.3
"@RS"	"*RS=###dBm"	T2		8.1	
"@FV"	"*FV=#.###,SLR-434M"	T2		12	
"@SN"	"*SN=\$#####"	T2		8.5	
"@PI"	"*PI=#####"	T2		7.6	
"@PIC"	"*WR=PS" "*PI=000000"	T2	221		537
"@PIS"	"*WR=PS" "*PI=#####"	T2	221		537
"@PIR"	"*PI=Ready"	T2		6.8	



^{*1} Issuing "@RA" command in the FSK mode performs setting of the RFIC after the response is output. An error may occur if the next command is issued before RFIC setting is completed.

Data transmission and response time in the FSK command mode



Command example	Response example (or transmission result)		Response/processing time (ms)		
			Min	Typ	Max
"@DT05.." (transmission of 5 bytes)	"**DT=05"	T2		5.9	
	(Transmission time)	Tsend		77.6	
	(Transmission completed)	T3		80	
"@DT0A.." (transmission of 10 bytes)	"**DT=0A"	T2		6.1	
	(Transmission time)	Tsend		85.9	
	(Transmission completed)	T3		88	

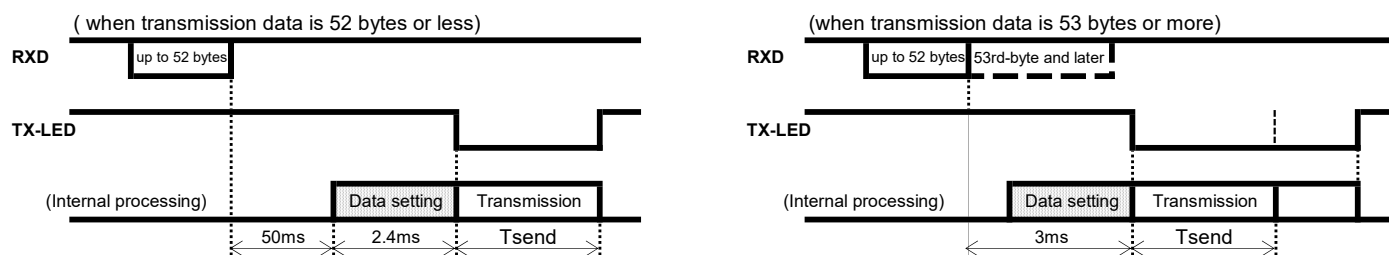
Command example	Response example (or transmission result)		Response/processing time (ms)		
			Min	Typ	Max
"@DT2D.." (transmission of 45 bytes)	"**DT=2D"	T2		6.7	
	(Transmission time)	Tsend		144	
	(Transmission completed)	T3		147	

"@PT" "@PT##"	"**PT=##"	T2	Refer to 'Timing for contact signal transmission with the @PT command'.
	(Transmission time)	Tsend	
	(Transmission completed)	T3	

FSK command mode Tsend :

$$\approx \text{Roundup} \{ (\text{number of data bytes} + 7) / 52, 0 \} * (34 * 8 / 4.8 + 0.9) + (\text{number of data bytes} + 7) * 8 / 4.8 \text{ [ms]}$$

Data transmission and response time in the FSK binary mode



In the FSK binary mode, when 50 ms elapsed after the data is input to the RXD or when the data of more than 52 bytes is input, radio transmission starts. There is no UART response such as 'Data received' or 'Transmission failure'.

FSK binary mode Tsend :

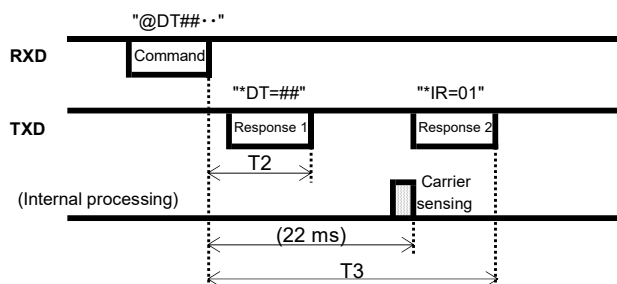
$$\approx \text{Roundup} \{ \text{number of data bytes} / 52, 0 \} * (34 * 8 / 4.8 + 0.9) + \text{number of data bytes} * 8 / 4.8 \text{ [ms]}$$

The transmission time in the binary mode is shorter by 7 bytes than in the command mode. In the binary mode, transmission of data exceeding 255 bytes is possible, however we do not provide support for the transmission time of data exceeding 255 bytes.

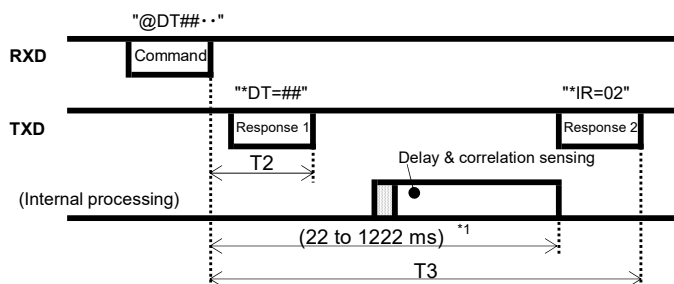
Data transmission and response time in the LoRa® command mode

Data transmission with LoRa 128 chips

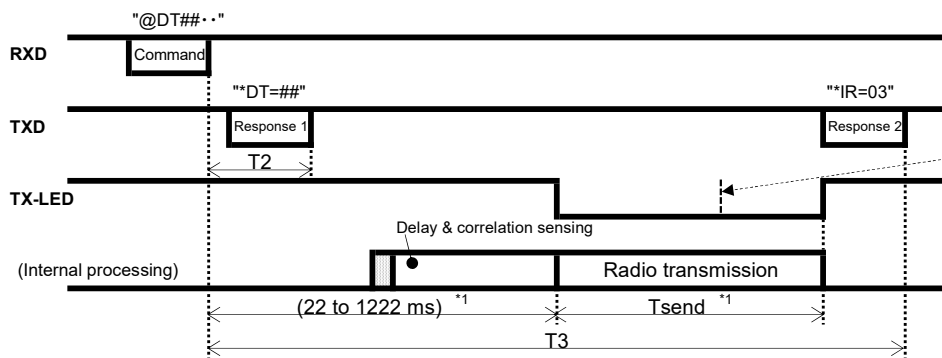
(when carrier sensing determines transmission is not possible)



(when correlation sensing determines transmission is not possible)



(when data transmission is normally done)



Although the TX-LED is set to "Lo" during radio transmission, "Hi" pulse is output every Tplmax ms.

Command example	Response example (or transmission result)		Response/processing time (ms)		
			Min	Typ	Max
"@DT05.." (transmission of 5 bytes)	"*DT=05"	T2		5.2	
	"*IR=01" (data was not sent by carrier sensing)	T3		26.7	
"@DT05.." (transmission of 5 bytes)	"*DT=05" (Transmission time)	Tsend		1069	
	"*IR=03" (Transmission completed)	T3	1096		2296
"@DT2D.." (transmission of 45 bytes)	"*DT=2D" (Transmission time)	Tsend		2384	
	"*IR=03" (Transmission completed)	T3	2411		3611

Command example	Response example (or transmission result)		Response/processing time (ms)		
			Min	Typ	Max
"@DT05.." (transmission of 5 bytes)	"*DT=05"	T2		5.2	
	"*IR=02" (data was not sent by correlation sensing)	T3	26.8		1227
"@DT0A.." (transmission of 10 bytes)	"*DT=0A" (Transmission time)	Tsend		1233	
	"*IR=03" (Transmission completed)	T3	1260		2463

"@PT" "@PT##"	"*PT=##"	T2		5.4	
	"*IR=01" (data was not sent by carrier sensing)	T3		26.7	
"@PT" "@PT##"	"*PT=##" (Transmission time)	Tsend	Refer to 'Timing for contact signal transmission with the @PT command'.		
	"*IR=03" (Transmission completed)	T3			

"@PT" "@PT##"	"*PT=##"	T2		5.4	
	"*IR=02" (data was not sent by correlation sensing)	T3	26.8		1228

*1 Time required for transmission with LoRa 128 chips. There is a transmission delay from 22 ms up to 1222 ms due to random number. For the time required for transmission with other number of chips, refer to 'Table of transmission time delay in LoRa mode'.

LoRa® command mode Tsend: (Refer to 'Table of transmission time delay in LoRa mode' for the values of Tplmax, SF and Tsym.)

When the number of data bytes is 1 to 235

$$N_{sym} = \text{Roundup} \{ (8 * (\text{number of data bytes} + 15) - 4 * SF + 44) / (4 * (SF - 2)), 0 \} * 5$$

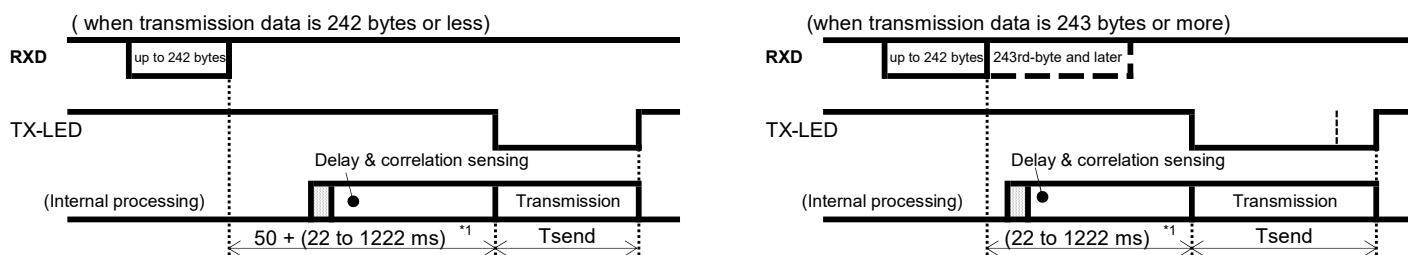
$$T_{send} = (20.25 + N_{sym}) * T_{sym} \text{ [ms]}$$

When the number of data bytes is 236 to 255

$$N_{sym} = \text{Roundup} \{ (8 * (\text{number of data bytes} + 8 - 235) - 4 * SF + 44) / (4 * (SF - 2)), 0 \} * 5$$

$$T_{send} = T_{plmax} + (20.25 + N_{sym}) * T_{sym} \text{ [ms]}$$

Data transmission and response time in the LoRa® binary mode



In the LoRa binary mode, when 50 ms elapsed after the data is input to the RXD or when the data of more than 242 bytes is input, carrier sensing and correlation sensing are performed after the elapse of transmission delay time, and radio transmission starts.

*1 There is a transmission delay due to random number as in the case of command mode.

LoRa® binary mode Tsend : (Refer to 'Table of transmission time delay in LoRa mode' for the values of Tplmax, SF and Tsym.)

When the number of data bytes is 1 to 242

$$N_{sym} = \text{Roundup}\{(8 * (\text{number of data bytes} + 8) - 4 * SF + 44) / (4 * (SF - 2)), 0\} * 5$$

$$T_{send} = T_{plmax} + (20.25 + N_{sym}) * T_{sym} \text{ [ms]}$$

When the number of data bytes is 243 to 255

$$N_{sym} = \text{Roundup}\{(8 * (\text{number of data bytes} + 1 - 235) - 4 * SF + 44) / (4 * (SF - 2)), 0\} * 5$$

$$T_{send} = T_{plmax} + (20.25 + N_{sym}) * T_{sym} \text{ [ms]}$$

The transmission time in the binary mode is shorter by 7 bytes than in the command mode. In the binary mode, transmission of data exceeding 255 bytes is possible, however we do not provide support for the transmission time of data exceeding 255 bytes.

Number of chips	Spreading factor SF	Tsym (ms)	Tplmax (ms)	Transmission delay (ms)
128	7	16.384	8606	22 to 1222
256	8	32.768	14426	22 to 1522
512	9	65.536	24920	22 to 3022
1024	10	131.072	43942	22 to 5222
2048	11	262.144	78709	22 to 9372
4096	12	524.288	141689	22 to 22022

Table of transmission time delay in LoRa mode

Important note:

The SLR-434M uses the packet communication function of the internal RF IC. The payload length of one packet is up to 60 bytes in the FSK mode and up to 250 bytes in the LoRa® mode.

When transmitting data in the command mode, since 15 bytes are added to the user data as Equipment ID, control commands and so on, the number of user data per packet is up to 45 bytes in the FSK mode and up to 235 bytes in the LoRa mode.

When transmitting data in the command mode, since 15 bytes are added to the user data as Equipment ID, control commands and so on, the number of user data per packet is up to 45 bytes in the FSK mode and up to 235 bytes in the LoRa mode.

For example, in the FSK mode, the user data of up to 45 bytes is sent in one packet, and the data of 46 to 90 bytes is sent in two packets. A 'Hi' pulse is output to the TXLED between packets.

Data transmission time

The transmission time in the binary mode is shorter by 7 bytes than in the command mode.

Binary mode	Command mode	FSK	LoRa						Binary mode	Command mode	FSK	LoRa					
			128 chips	256 chips	512 chips	1024 chips	2048 chips	4096 chips				128 chips	256 chips	512 chips	1024 chips	2048 chips	4096 chips
Data [byte]		Transmission time Tsend [ms]							Data [byte]		Transmission time Tsend [ms]						
1		59.2	741	1319	2310	4620	7930	15860	70	63	232	2953	5087	8864	15761	28901	52560
2		60.9	741	1319	2638	4620	9241	15860	71	64	233	3035	5087	8864	15761	28901	52560
3		62.6	823	1483	2638	4620	9241	18481	72	65	235	3035	5251	9191	16417	28901	52560
4		64.2	823	1483	2638	5276	9241	18481	73	66	237	3117	5251	9191	16417	28901	55181
5		65.9	823	1483	2638	5276	9241	18481	74	67	238	3117	5251	9191	16417	30212	55181
6		67.6	905	1647	2966	5276	10551	18481	75	68	240	3117	5415	9191	16417	30212	55181
7		69.2	905	1647	2966	5276	10551	18481	76	69	242	3199	5415	9519	17072	30212	55181
8	1	70.9	987	1647	2966	5931	10551	21103	77	70	243	3199	5415	9519	17072	30212	55181
9	2	72.6	987	1810	3293	5931	10551	21103	78	71	245	3281	5579	9519	17072	31523	57803
10	3	74.2	987	1810	3293	5931	10551	21103	79	72	247	3281	5579	9847	17072	31523	57803
11	4	75.9	1069	1810	3293	5931	11862	21103	80	73	248	3281	5579	9847	17727	31523	57803
12	5	77.6	1069	1974	3293	6586	11862	21103	81	74	250	3363	5743	9847	17727	31523	57803
13	6	79.2	1151	1974	3621	6586	11862	23724	82	75	252	3363	5743	9847	17727	31523	57803
14	7	80.9	1151	1974	3621	6586	11862	23724	83	76	253	3445	5743	10174	17727	32834	60424
15	8	82.6	1151	2138	3621	6586	13173	23724	84	77	255	3445	5906	10174	18383	32834	60424
16	9	84.2	1233	2138	3949	7242	13173	23724	85	78	257	3445	5906	10174	18383	32834	60424
17	10	85.9	1233	2138	3949	7242	13173	23724	86	79	258	3527	5906	10502	18383	32834	60424
18	11	87.6	1315	2302	3949	7242	13173	26345	87	80	260	3527	6070	10502	18383	34144	60424
19	12	89.2	1315	2302	3949	7242	13173	26345	88	81	262	3609	6070	10502	19038	34144	63046
20	13	90.9	1315	2302	4276	7897	14483	26345	89	82	263	3609	6070	10502	19038	34144	63046
21	14	92.6	1397	2466	4276	7897	14483	26345	90	83	265	3609	6234	10830	19038	34144	63046
22	15	94.2	1397	2466	4276	7897	14483	26345	91	84	267	3690	6234	10830	19038	34144	63046
23	16	95.9	1479	2466	4604	7897	14483	28967	92	85	268	3690	6234	10830	19694	35455	63046
24	17	97.6	1479	2630	4604	8552	15794	28967	93	86	270	3772	6398	11158	19694	35455	65667
25	18	99.2	1479	2630	4604	8552	15794	28967	94	87	272	3772	6398	11158	19694	35455	65667
26	19	101	1561	2630	4604	8552	15794	28967	95	88	273	3772	6398	11158	19694	35455	65667
27	20	103	1561	2793	4932	8552	15794	28967	96	89	275	3854	6562	11158	20349	36766	65667
28	21	104	1642	2793	4932	9208	15794	31588	97	90	277	3854	6562	11485	20349	36766	65667
29	22	106	1642	2793	4932	9208	17105	31588	98	91	278	3936	6562	11485	20349	36766	68289
30	23	108	1642	2957	5259	9208	17105	31588	99	92	280	3936	6726	11485	20349	36766	68289
31	24	109	1724	2957	5259	9208	17105	31588	100	93	282	3936	6726	11813	21004	36766	68289
32	25	111	1724	2957	5259	9863	17105	31588	101	94	283	4018	6726	11813	21004	38076	68289
33	26	113	1806	3121	5259	9863	18416	34210	102	95	285	4018	6889	11813	21004	38076	68289
34	27	114	1806	3121	5587	9863	18416	34210	103	96	287	4100	6889	11813	21004	38076	70910
35	28	116	1806	3121	5587	9863	18416	34210	104	97	288	4100	6889	12141	21660	38076	70910
36	29	118	1888	3285	5587	10519	18416	34210	105	98	348	4100	7053	12141	21660	39387	70910
37	30	119	1888	3285	5915	10519	18416	34210	106	99	349	4182	7053	12141	21660	39387	70910
38	31	121	1970	3285	5915	10519	19726	36831	107	100	351	4182	7053	12468	21660	39387	70910
39	32	123	1970	3449	5915	10519	19726	36831	108	101	353	4264	7217	12468	22315	39387	73531
40	33	124	1970	3449	5915	11174	19726	36831	109	102	354	4264	7217	12468	22315	39387	73531
41	34	126	2052	3449	6242	11174	19726	36831	110	103	356	4264	7217	12468	22315	40698	73531
42	35	128	2052	3613	6242	11174	21037	36831	111	104	358	4346	7381	12796	22315	40698	73531
43	36	129	2134	3613	6242	11174	21037	39453	112	105	359	4346	7381	12796	22970	40698	73531
44	37	131	2134	3613	6570	11829	21037	39453	113	106	361	4428	7381	12796	22970	40698	76153
45	38	133	2134	3777	6570	11829	21037	39453	114	107	363	4428	7545	13124	22970	42009	76153
46	39	134	2216	3777	6570	11829	21037	39453	115	108	364	4428	7545	13124	22970	42009	76153
47	40	136	2216	3777	6570	11829	22348	39453	116	109	366	4510	7545	13124	23626	42009	76153
48	41	138	2298	3940	6898	12485	22348	42074	117	110	368	4510	7709	13124	23626	42009	76153
49	42	139	2298	3940	6898	12485	22348	42074	118	111	369	4592	7709	13451	23626	42009	78774
50	43	141	2298	3940	6898	12485	22348	42074	119	112	371	4592	7709	13451	23626	43319	78774
51	44	143	2380	4104	7225	12485	23658	42074	120	113	373	4592	7873	13451	24281	43319	78774
52	45	144	2380	4104	7225	13140	23658	42074	121	114	374	4674	7873	13779	24281	43319	78774
53	46	203	2462	4104	7225	13140	23658	44696	122	115	376	4674	7873	13779	24281	43319	78774
54	47	205	2462	4268	7225	13140	23658	44696	123	116	378	4755	8036	13779	24281	44630	81396
55	48	207	2462	4268	7553	13140	23658	44696	124	117	379	4755	8036	13779	24936	44630	81396
56	49	208	2544	4268	7553	13795	24969	44696	125	118	381	4755	8036	14107	24936	44630	81396
57	50	210	2544	4432	7553	13795	24969	44696	126	119	383	4837	8200	14107	24936	44630	81396
58	51	212	2626	4432	7881	13795	24969	47317	127	120	384	4837	8200	14107	24936	44630	81396
59	52	213	2626	4432	7881	13795	24969	47317	128	121	386	4919	8200	14434	25592	45941	84017
60	53	215	2626	4596	7881	14451	26280	47317	129	122	388	4919	8364	14434	25592	45941	84017
61	54	217	2707	4596	7881	14451	26280	47317	130	123	389	4919	8364	14434	25592	45941	84017
62	55	218	2707	4596	8208	14451	26280	47317	131	124	391	5001	8364	14434	25592	45941	84017
63	56	220	2789	4760	8208	14451	26280	49938	132	125	393	5001	8528	14762	26247	47251	84017
64	57	222	2789	4760	8208	15106	26280	49938	133	126	394	5083	8528	14762	26247	47251	86639
65	58	223	2789	4760	8536	15106	27591	49938	134	127	396	5083	8528	14762	26247	47251	86639
66	59	225	2871	4923	8536	15106	27591	49938	135	128	398	5083	8692	15090	26247	47251	86639
67	60	227	2871	4923	8536	15106	27591	49938	136	129	399	5165	8692	15090	26903	47251	86639
68	61	228	2953	4923	8536	15761	27591	52560	137	130	401	5165	8692	15090	26903	48562	86639
69	62	230	2953	5087	8864	15761	28901	52560	138	131	403	5247	8856	15090	26903	48562	89260

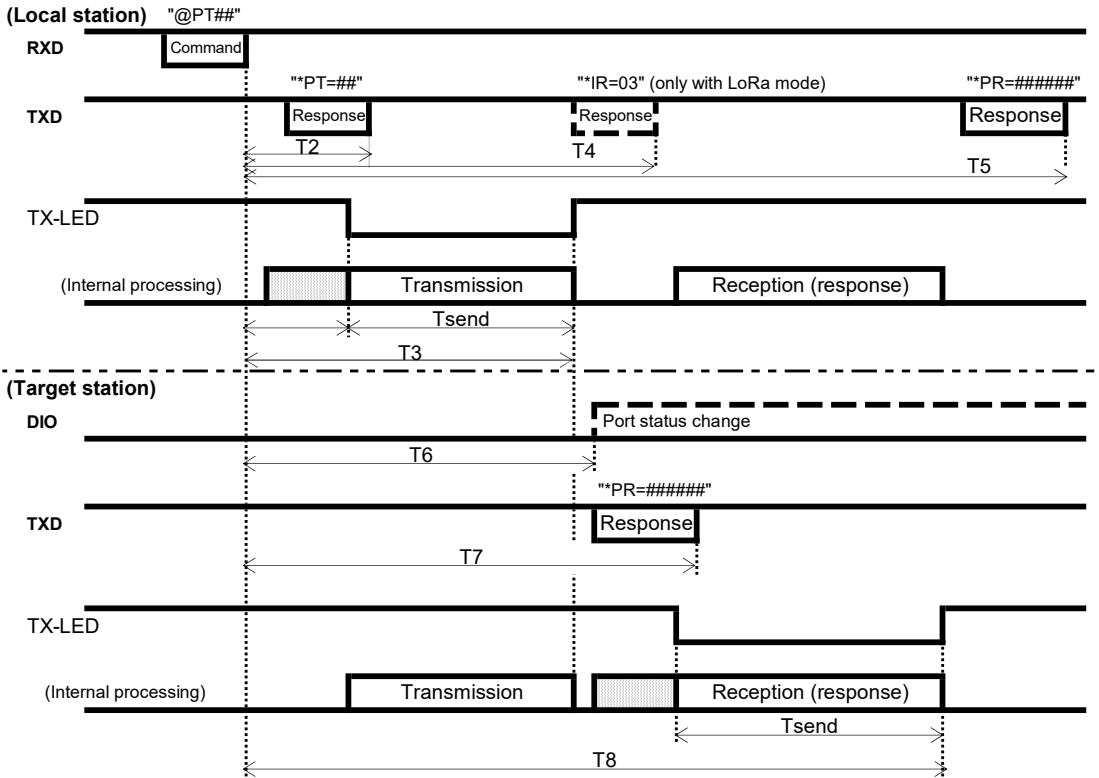
Binary mode	Command mode	FSK	LoRa					
			128 chips	256 chips	512 chips	1024 chips	2048 chips	4096 chips
Data [byte]		Transmission time Tsend [ms]						
139	132	404	5247	8856	15417	26903	48562	89260
140	133	406	5247	8856	15417	27558	48562	89260
141	134	408	5329	9019	15417	27558	49873	89260
142	135	409	5329	9019	15745	27558	49873	89260
143	136	411	5411	9019	15745	27558	49873	91881
144	137	413	5411	9183	15745	28213	49873	91881
145	138	414	5411	9183	15745	28213	49873	91881
146	139	416	5493	9183	16073	28213	51184	91881
147	140	418	5493	9347	16073	28213	51184	91881
148	141	419	5575	9347	16073	28869	51184	94503
149	142	421	5575	9347	16400	28869	51184	94503
150	143	423	5575	9511	16400	28869	52494	94503
151	144	424	5657	9511	16400	28869	52494	94503
152	145	426	5657	9511	16400	29524	52494	94503
153	146	428	5738	9675	16728	29524	52494	97124
154	147	429	5738	9675	16728	29524	52494	97124
155	148	431	5738	9675	16728	29524	53805	97124
156	149	433	5820	9839	17056	30179	53805	97124
157	150	492	5820	9839	17056	30179	53805	97124
158	151	494	5902	9839	17056	30179	53805	99746
159	152	495	5902	10002	17056	30179	55116	99746
160	153	497	5902	10002	17383	30835	55116	99746
161	154	499	5984	10002	17383	30835	55116	99746
162	155	500	5984	10166	17383	30835	55116	99746
163	156	502	6066	10166	17711	30835	55116	102367
164	157	504	6066	10166	17711	31490	56426	102367
165	158	505	6066	10330	17711	31490	56426	102367
166	159	507	6148	10330	17711	31490	56426	102367
167	160	509	6148	10330	18039	31490	56426	102367
168	161	510	6230	10494	18039	32145	57737	104989
169	162	512	6230	10494	18039	32145	57737	104989
170	163	514	6230	10494	18366	32145	57737	104989
171	164	515	6312	10658	18366	32145	57737	104989
172	165	517	6312	10658	18366	32801	57737	104989
173	166	519	6394	10658	18366	32801	59048	107610
174	167	520	6394	10822	18694	32801	59048	107610
175	168	522	6394	10822	18694	32801	59048	107610
176	169	524	6476	10822	18694	33456	59048	107610
177	170	525	6476	10985	19022	33456	60359	107610
178	171	527	6558	10985	19022	33456	60359	110232
179	172	529	6558	10985	19022	33456	60359	110232
180	173	530	6558	11149	19022	34111	60359	110232
181	174	532	6640	11149	19350	34111	60359	110232
182	175	534	6640	11149	19350	34111	61669	110232
183	176	535	6722	11313	19350	34111	61669	112853
184	177	537	6722	11313	19677	34767	61669	112853
185	178	539	6722	11313	19677	34767	61669	112853
186	179	540	6803	11477	19677	34767	62980	112853
187	180	542	6803	11477	19677	34767	62980	112853
188	181	544	6885	11477	20005	35422	62980	115474
189	182	545	6885	11641	20005	35422	62980	115474
190	183	547	6885	11641	20005	35422	62980	115474
191	184	549	6967	11641	20333	35422	64291	115474
192	185	550	6967	11805	20333	36078	64291	115474
193	186	552	7049	11805	20333	36078	64291	118096
194	187	554	7049	11805	20333	36078	64291	118096
195	188	555	7049	11969	20660	36078	65602	118096
196	189	557	7131	11969	20660	36733	65602	118096
197	190	559	7131	11969	20660	36733	65602	118096
198	191	560	7213	12132	20988	36733	65602	120717
199	192	562	7213	12132	20988	36733	65602	120717
200	193	564	7213	12132	20988	37388	66912	120717
201	194	565	7295	12296	20988	37388	66912	120717

Binary mode	Command mode	FSK	LoRa					
			128 chips	256 chips	512 chips	1024 chips	2048 chips	4096 chips
Data [byte]		Transmission time Tsend [ms]						
202	195	567	7295	12296	21316	37388	66912	120717
203	196	569	7377	12296	21316	37388	66912	123339
204	197	570	7377	12460	21316	38044	68223	123339
205	198	572	7377	12460	21643	38044	68223	123339
206	199	574	7459	12460	21643	38044	68223	123339
207	200	575	7459	12624	21643	38044	68223	123339
208	201	577	7541	12624	21643	38699	68223	125960
209	202	636	7541	12624	21971	38699	69534	125960
210	203	638	7541	12788	21971	38699	69534	125960
211	204	640	7623	12788	21971	38699	69534	125960
212	205	641	7623	12788	22299	39354	69534	125960
213	206	643	7705	12952	22299	39354	70844	128582
214	207	645	7705	12952	22299	39354	70844	128582
215	208	646	7705	12952	22299	39354	70844	128582
216	209	648	7786	13115	22626	40010	70844	128582
217	210	650	7786	13115	22626	40010	70844	128582
218	211	651	7868	13115	22626	40010	72155	131203
219	212	653	7868	13279	22954	40010	72155	131203
220	213	655	7868	13279	22954	40665	72155	131203
221	214	656	7950	13279	22954	40665	72155	131203
222	215	658	7950	13443	22954	40665	73466	131203
223	216	660	8032	13443	23282	40665	73466	133825
224	217	661	8032	13443	23282	41320	73466	133825
225	218	663	8032	13607	23282	41320	73466	133825
226	219	665	8114	13607	23609	41320	73466	133825
227	220	666	8114	13607	23609	41320	74777	133825
228	221	668	8196	13771	23609	41976	74777	136446
229	222	670	8196	13771	23609	41976	74777	136446
230	223	671	8196	13771	23937	41976	74777	136446
231	224	673	8278	13935	23937	41976	76087	136446
232	225	675	8278	13935	23937	42631	76087	136446
233	226	676	8360	13935	24265	42631	76087	139067
234	227	678	8360	14098	24265	42631	76087	139067
235	228	680	8360	14098	24265	42631	76087	139067
236	229	681	8442	14098	24265	43287	77398	139067
237	230	683	8442	14262	24592	43287	77398	139067
238	231	685	8524	14262	24592	43287	77398	141689
239	232	686	8524	14262	24592	43287	77398	141689
240	233	688	8524	14426	24920	43942	78709	141689
241	234	690	8606	14426	24920	43942	78709	141689
242	235	691	8606	14426	24920	43942	78709	141689
243	236	693	9347	15745	27230	48562	86639	157549
244	237	695	9347	15745	27558	48562	87950	157549
245	238	696	9429	15909	27558	48562	87950	160170
246	239	698	9429	15909	27558	49218	87950	160170
247	240	700	9429	15909	27558	49218	87950	160170
248	241	701	9511	16073	27886	49218	89260	160170
249	242	703	9511	16073	27886	49218	89260	160170
250	243	705	9593	16073	27886	49873	89260	162792
251	244	706	9593	16236	28213	49873	89260	162792
252	245	708	9593	16236	28213	49873	89260	162792
253	246	710	9675	16236	28213	49873	90571	162792
254	247	711	9675	16400	28213	50528	90571	162792
255	248	713	9757	16400	28541	50528	90571	165413
256	249	715	9757	16400	28541	50528	90571	165413
257	250	716	9757	16564	28541	50528	91882	165413
258	251	718	9839	16564	28869	51184	91882	165413
259	252	720	9839	16564	28869	51184	91882	165413
260	253	721	9921	16728	28869	51184	91882	168034
261	254	780	9921	16728	28869	51184	91882	168034
262	255	782	9921	16728	29196	51839	93192	168034

In the command mode, only 255 bytes can be sent at a time. In the binary mode, more than 255 bytes can be sent, however we do not provide support for the transmission time of data exceeding 255 bytes.

Note: Although the data input buffer of the UART has sufficient area of 256 bytes or more, if you input long data in the binary mode without using the RTS control signal, buffer over occurs and data may be discarded. It is recommended that the data length of one transmission is 256 bytes or less.

Timing for contact signal transmission with the @PT command



When transmitting in FSK mode

Item		Response/processing time (ms)					
		when Unique ID is not set (PI=000000)			When Unique ID is set (other than PI=000000)		
		Min	Typ	Max	Min	Typ	Max
"@PT##" command transmission							
"@PT##" command response	T2		5.9			5.9	
Radio transmission	Tsend		74.2			79.2	
Radio transmission completed	T3		76.2			81.2	
**IR=03" (Transmission completed)	T4						
**PR#####" (Response from target station)	T5		166			176	
Port status change (Target station)	T6		77.8			82.8	
**PR#####" (Target station)	T7		85.6			90.6	
Radio transmission completed (Target station)	T8		157			167	

Time required for contact data transmission with "@PT.." command (Tsend) is:

74.2 ms (equivalent to 3-byte data) when Unique ID is not set (PI=000000).

79.2 ms (equivalent to 6-byte data) when Unique ID is set (other than PI=000000).

When transmitting in LoRa 128 chips mode

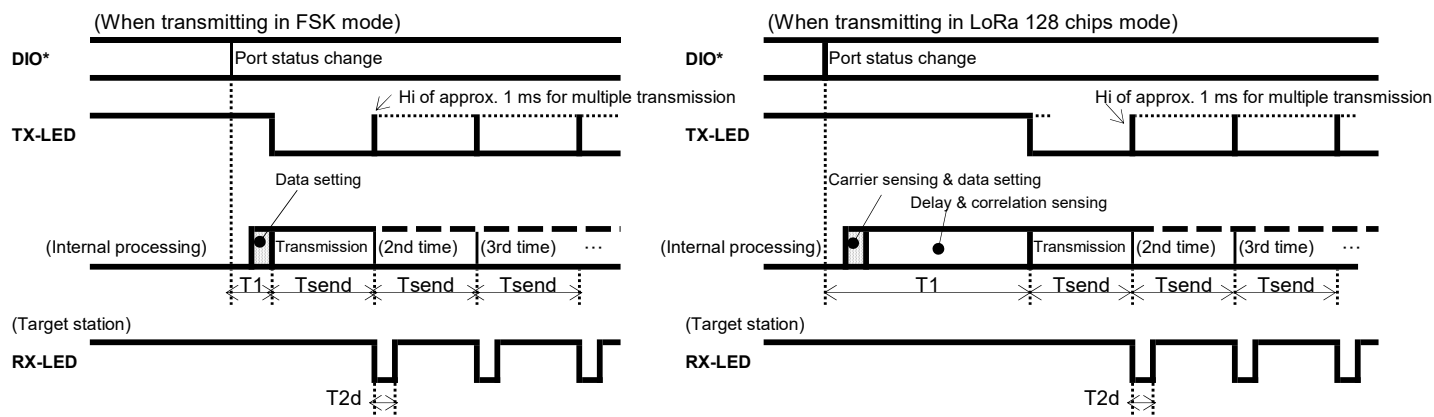
Item		Response/processing time (ms)					
		when Unique ID is not set (PI=000000)			When Unique ID is set (other than PI=000000)		
		Min	Typ	Max	Min	Typ	Max
"@PT##" command transmission							
"@PT##" command response	T2		5.6			5.6	
Radio transmission	Tsend		987			1151	
Radio transmission completed	T3	1009		2209	1173		2273
**IR=03" (Transmission completed)	T4	1014		2214	1178		2378
**PR#####" (Response from target station)	T5	2056		2269	2384		2433
Port status change (Target station)	T6	1021		2221	1185		2385
**PR#####" (Target station)	T7	1029		2229	1193		2393
Radio transmission completed (Target station)	T8	2036		2249	2364		2413

Time required for contact data transmission with "@PT.." command (Tsend) is:

987 ms (equivalent to 3-byte data) when Unique ID is not set (PI=000000).

1151 ms (equivalent to 6-byte data) when Unique ID is set (other than PI=000000).

Timing for transmission when changing input ports using @PM01 to @PM05 commands

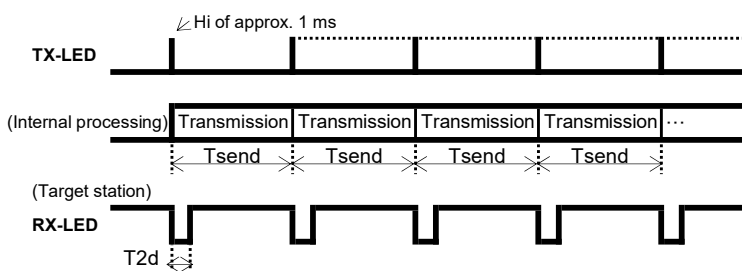


Item		Response/processing time (ms)		
		Min	Typ	Max
Transmission delay after DIO* status change	T1	1		21
Transmission time: Specified times transmission (TX-LED "Lo" output)	Tsend	74.2 / 79.2		
RX-LED response (Lo when receiving)	T2d		14.8	

Item		Response/processing time (ms)		
		Min	Typ	Max
Transmission delay after DIO* status change	T1	28		1248
Transmission time: Specified times transmission (TX-LED "Lo" output)	Tsend	987 / 1151		
RX-LED response (Lo when receiving)	T2d		100	

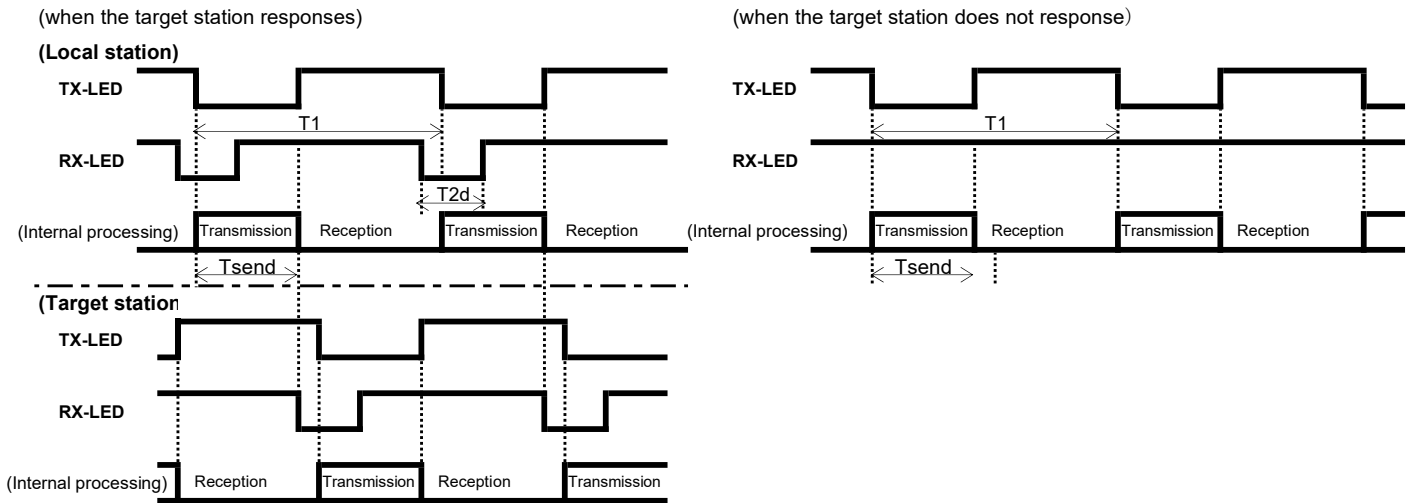
The transmission time (Tsend) depends on whether Unique ID is not set (PI=000000) or set (other than PI=000000).
 (The transmission time without Unique ID and with Unique ID is equivalent to 3 byte-data and 6-byte data in the command mode, respectively).

Timing for one-way continuous transmission with @PM10 command (FSK mode only)



Item		Response/processing time (ms)		
		Min	Typ	Max
Transmission repetition period	Tsend	74.2 / 79.2		
RX-LED response (Lo when receiving)	T2d		14.8	

Timing for two-way continuous transmission with @PM20 command (FSK mode only)



Item		Response/processing time (ms)		
		Min	Typ	Max
Transmission time	Tsend	74.2 / 79.2		
Period of transmission and reception	T1	162 / 172		
RX-LED response (Lo when receiving)	T2d		14.8	

Item		Response/processing time (ms)		
		Min	Typ	Max
Transmission time	Tsend	74.2 / 79.2		
Period of transmission and reception	T1		200	

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