

FX.25 KISS TNC development and Proposed extensions to the standard

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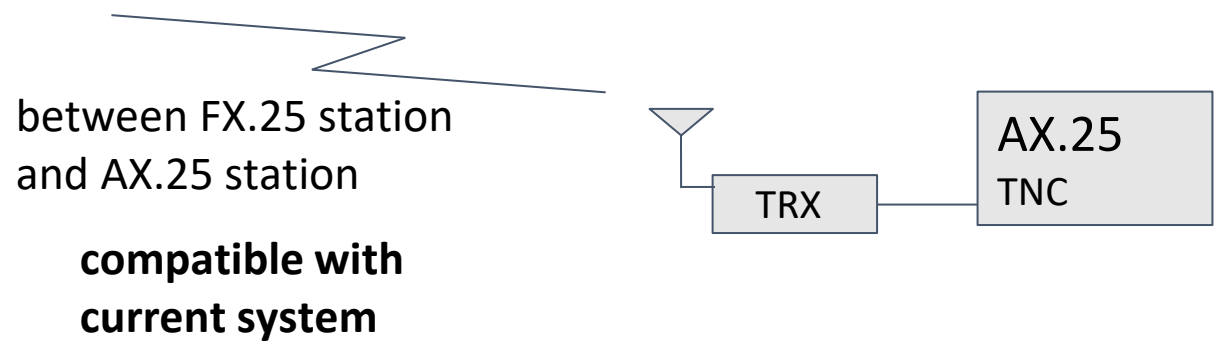
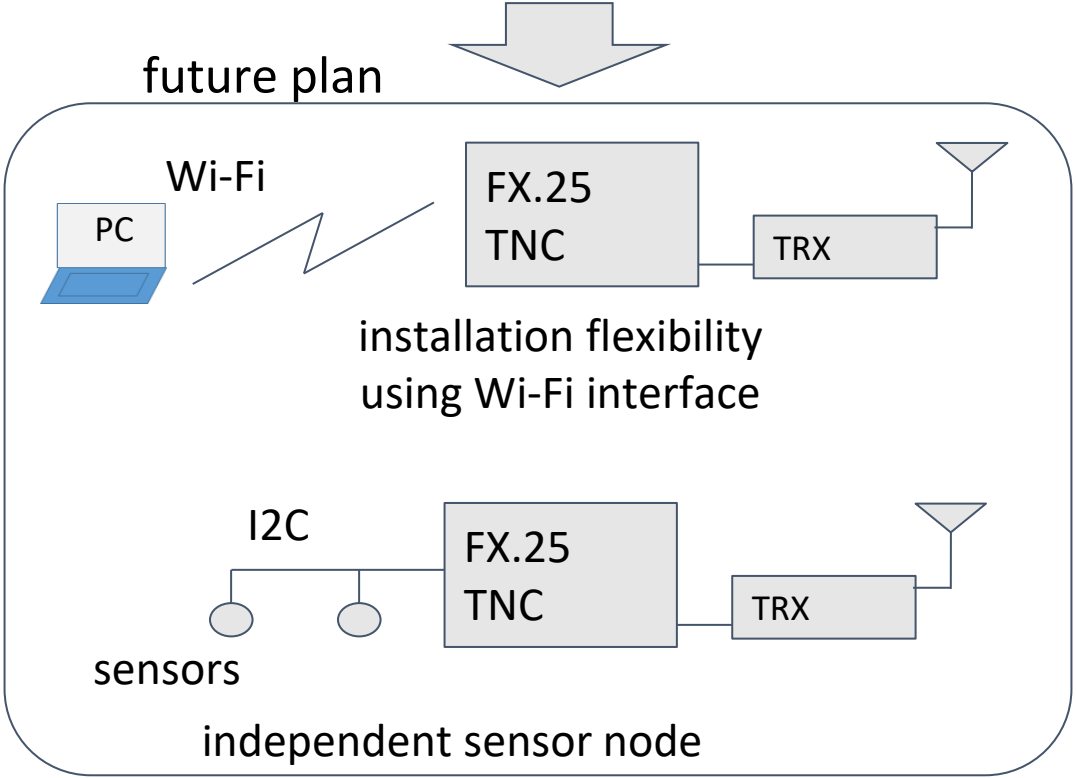
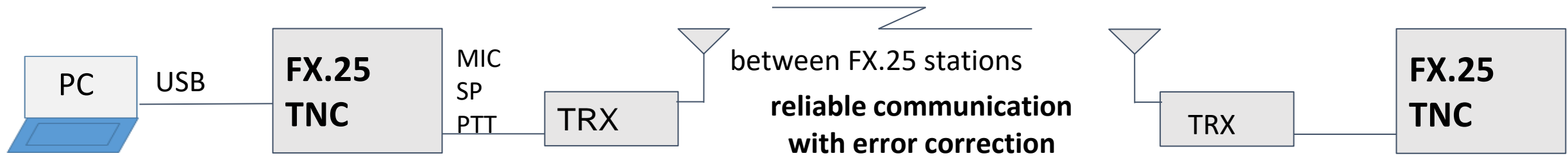
PRUG (Packet Radio Users' Group)

PRUG is a non-profit, voluntary organization in Japan.
It was established in 1985.

The purpose of PRUG is to promote the use of packet radio and to research the latest technologies in amateur radio.

Current status of FX.25 KISS TNC development

Use of FX.25 KISS TNC and future plan



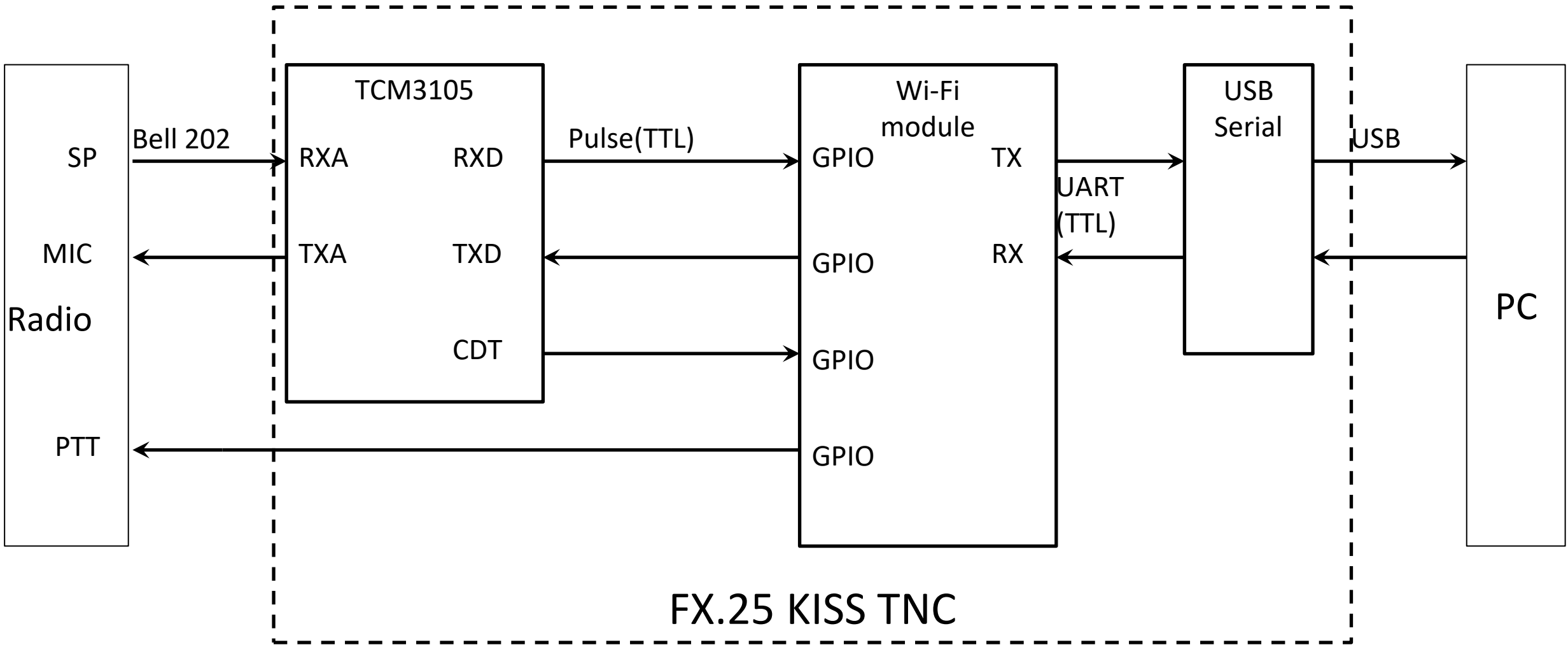
*Now experimenting in the 430MHz band as APRS nodes.
Look for JK1MLY*

Features of FX.25 KISS TNC

- Using TI TCM3105 Bell 202 modem chip
 - Implements software modem on next version
- Using ESP-WROOM-32 Wi-Fi module
 - Dual core 32bit RISC CPU, clock 80-240MHz
 - RAM 520kB, flash ROM 4MB
- Host interface is USB serial and TCP/IP on Wi-Fi
- KISS mode only
- supports full FX.25 draft spec.
 - http://www.stensat.org/docs/FX-25_01_06.pdf
- can receive AX.25 packet, too



FX.25 KISS TNC hardware



Structure of TNC software

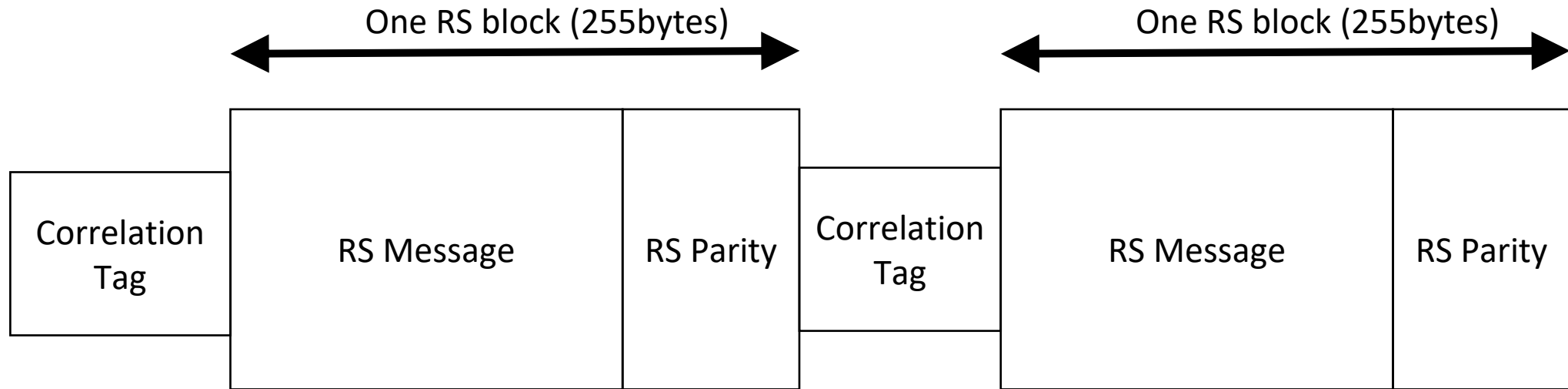
- Implemented by C language
- Running on FreeRTOS
- Each functions implemented as tasks of OS
- Using queues inter task communication
- Using interrupt to read RXD signal of modem
- Using infra red I/F to send the data to modem
- Implements software modem on next version
 - The TNC software is available on GitHub
 - <https://github.com/amedes/fx25-kiss-tnc>

Proposed extensions to the Fx.25 standard

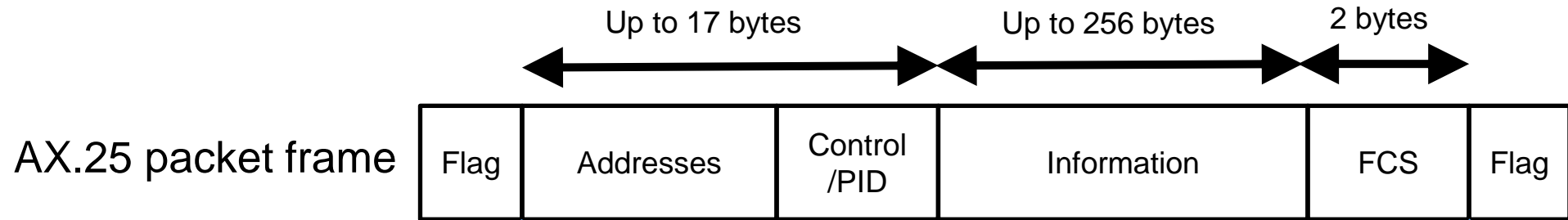
Add a function to FX.25 draft.

- One large FX.25 frame by combining multiple blocks.
- Long packet can be sent in a single frame of FX.25 without splitting it up.
- Any higher level protocols can use the FEC with relative ease.
- More resistant to further burst errors.
- Compatibility with the existing AX.25 facilities is maintained.

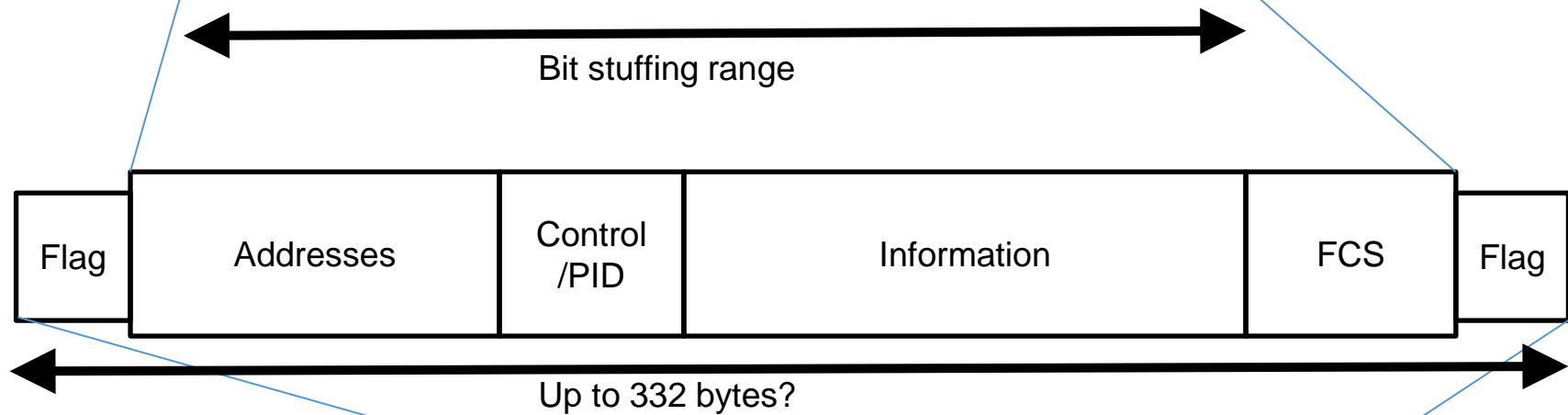
Frame structure of FX.25 drafts:



If you want to fix N bytes error in a block, the message size will be up to $255-2N$ bytes.

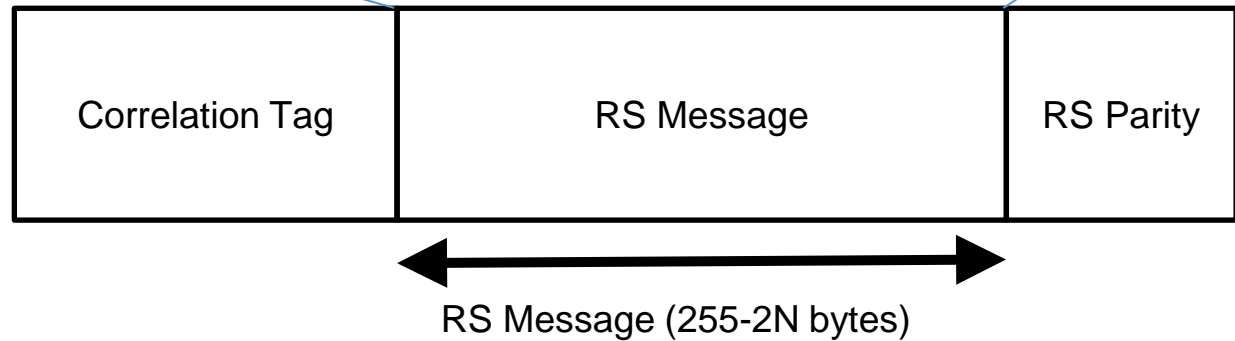


Complete bit pattern when transmitting AX.25



Umm. I cannot stuff to The Packet.

FX.25 packet frame

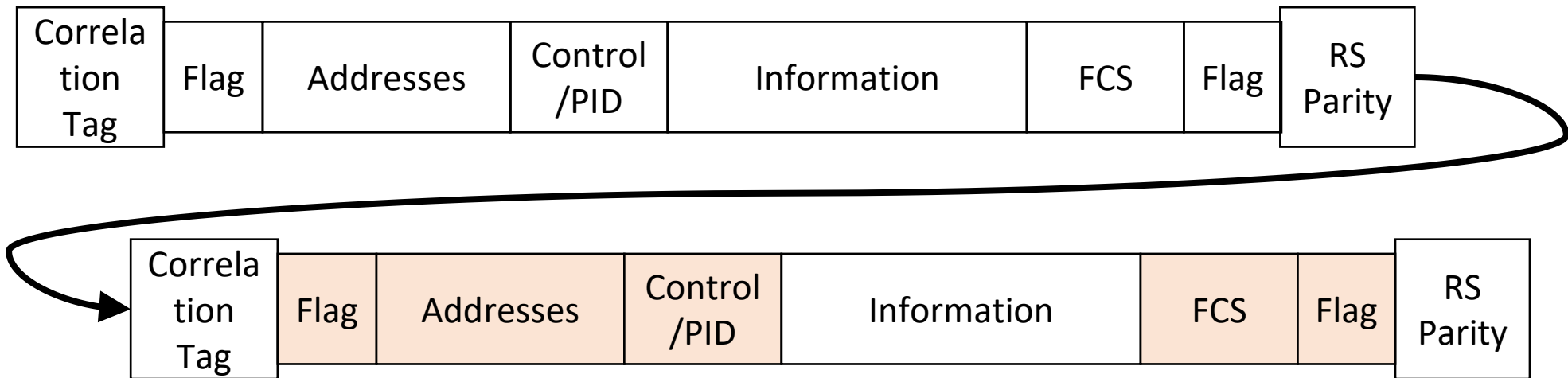


Need to re-framing :

AX25

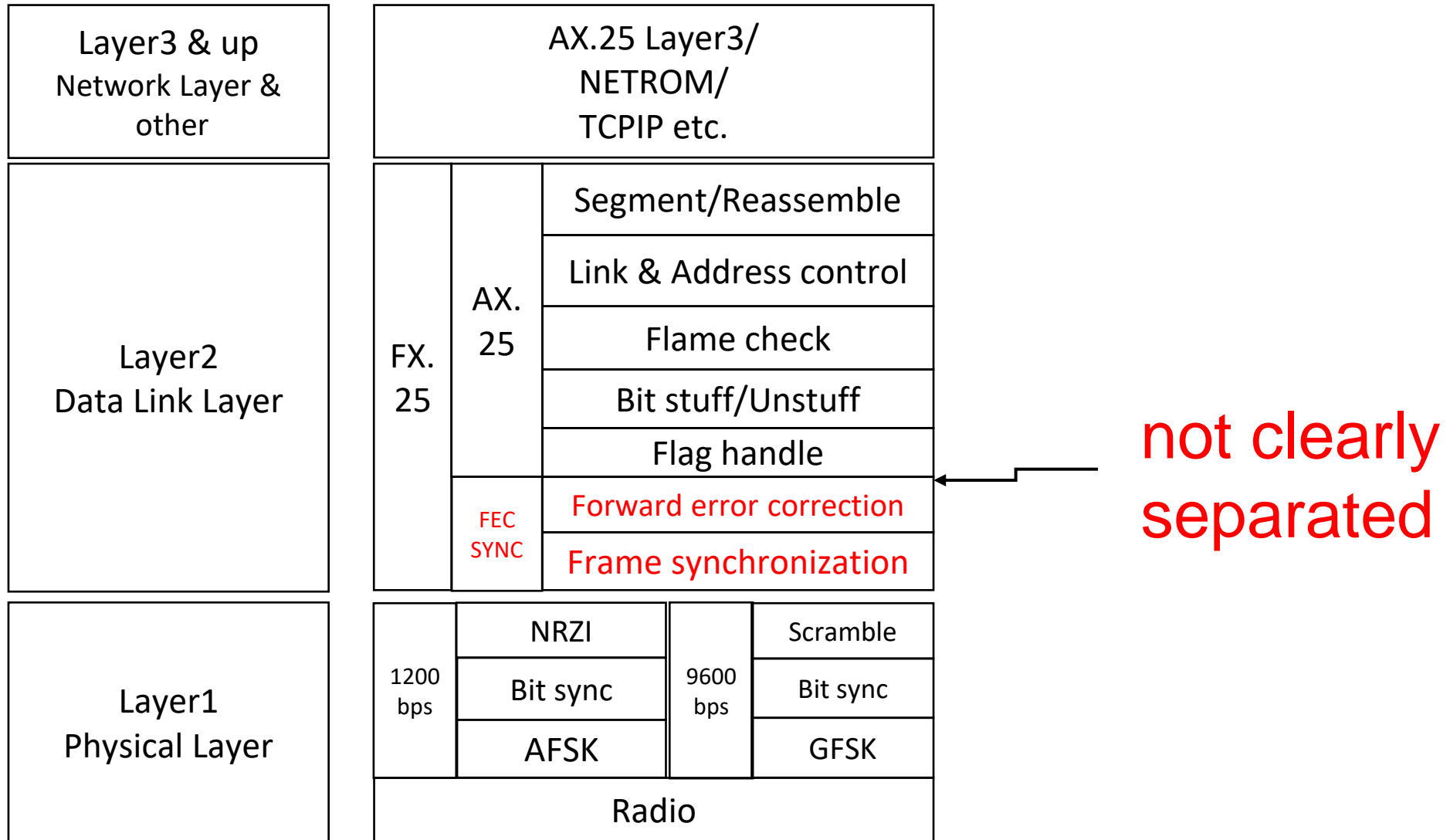


FX25



 Data increased by packet division

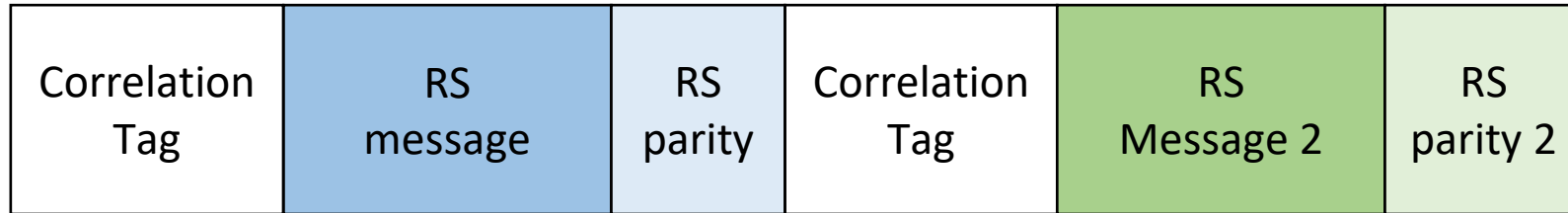
The position of FX.25 in the OSI protocol layers



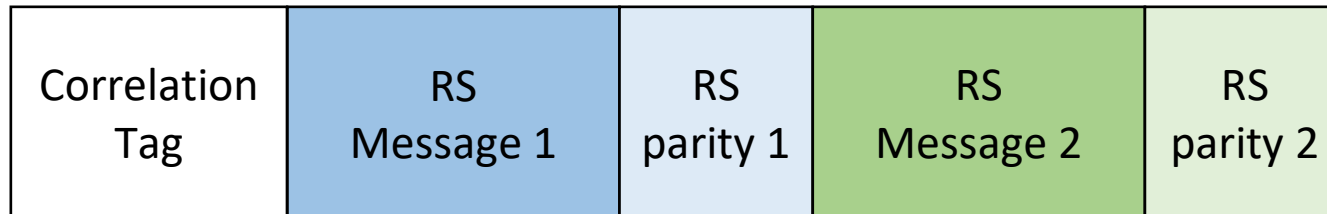
Solution: One large FX.25 frame by combining multiple blocks.

- It enables FX.25 to send long messages.
- You don't need to split the frame.
- The problems presented in the previous section will be solved.

Multiple RS blocks in one FX.25 frame



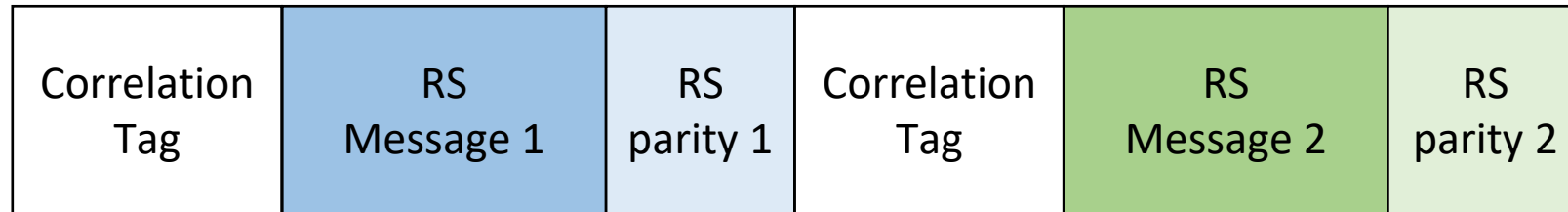
If we simply put the blocks in order...



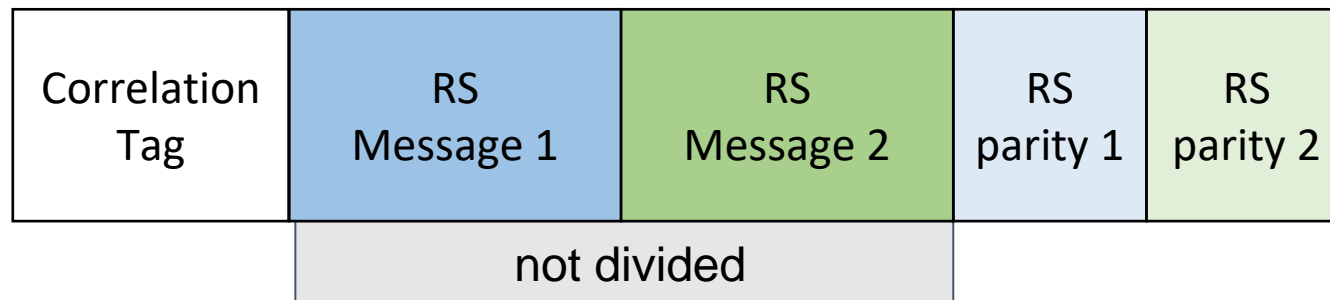
NG

In this case, the message is divided by parity, and the packet cannot be sent in a way that can be decoded by the existing AX.25 TNC without any overhead.

Maintaining AX.25 compatibility in multiple block frames



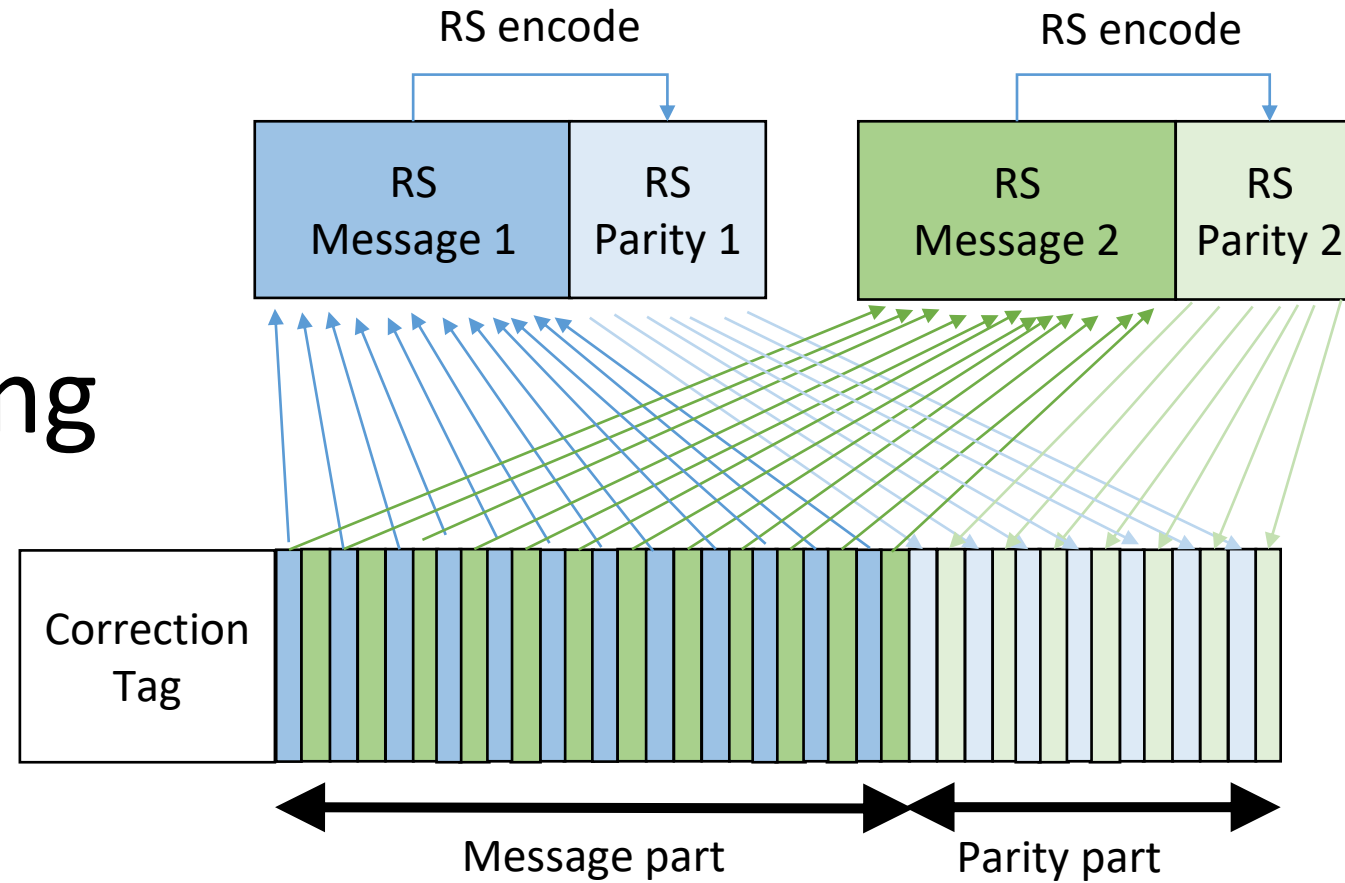
Arrange the message parts so that they are contiguous.



OK

Messages are not divided by parity. Packets whose message length exceeds the original RS message length can be sent without splitting.

Interleaving



By interleaving :

1. Improved burst error resistance.
2. Ensuring continuity of the message part in a form that is easy to process by software.

Correlation Tag Exhaustion by Expansion

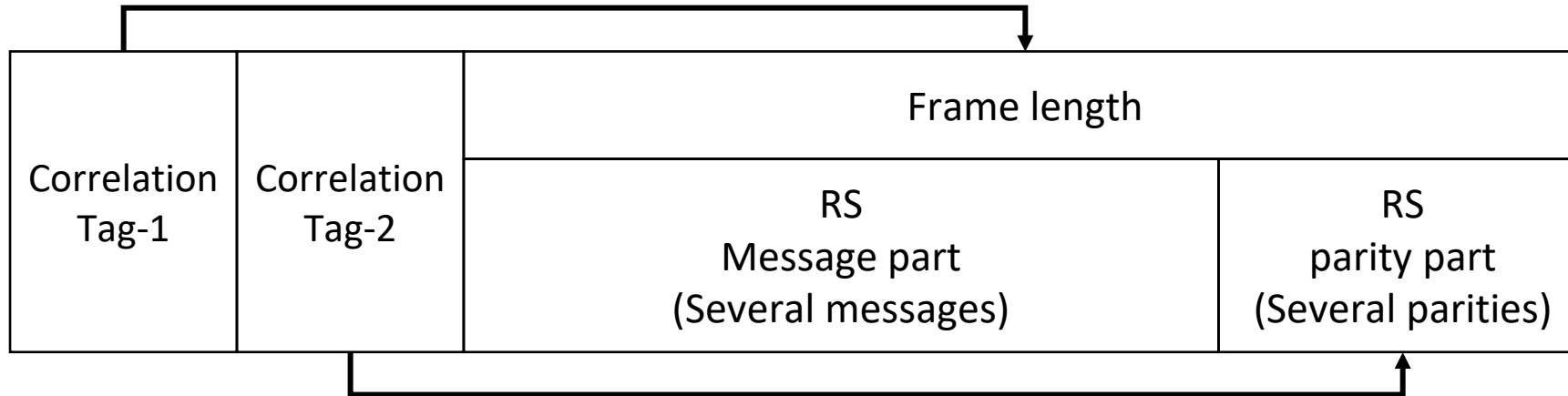
We propose a format that combines two types of Correlation Tags for frame with multiple blocks to reduce the number of Tags consumed in the future.

FX.25 Correlation Tag Code (part1)

Tag	Correlation Tag Value	Encoding Type	Tag type
00	0x566ED2717946107E	Reserved	
01	0xB74DB7DF8A532F3E	RS(255,239)	Tag-1
02	0x26FF60A600CC8FDE	RS(144,128)	Tag-1
03	0xC7DC0508F3D9B09E	RS(80,64)	Tag-1
04	0x8F056EB4369660EE	RS(48,32)	Tag-1
05	0x6E260B1AC5835FAE	RS(255,223)	Tag-1
06	0xFF94DC634F1CFF4E	RS(160,128)	Tag-1
07	0x1EB7B9CDBC09C00E	RS(96,64)	Tag-1
08	0xDBF869BD2DBB1776	RS(64,32)	Tag-1
09	0x3ADB0C13DEAE2836	RS(255,191)	Tag-1
0A	0xAB69DB6A543188D6	RS(192,128)	Tag-1
0B	0x4A4ABEC4A724B796	RS(128,64)	Tag-1
0C	0x0293D578626B67E6	2 x RS(255,239)	Tag-1
0D	0x41C246CB5DE62A7E	2 x RS(255,223)	Tag-1
0E	0x720267AF1BE1F846	2 x RS(255,191)	Tag-1
0F	0x93210201E8F4C706	3 x RS(255,191)	Tag-1
continued			

Frame length expansion format with 2nd Tag

The first tag specifies the length of the frame.



The second tag specifies the FEC coding algorithm.

FX.25 Correlation Tag Code (part2)

Tag	Correlation Tag Value	Encoding Type	Tag type
10	0x10A58F97533893FA	Reserved	
11	0xF186EA39A02DACBA	Reserved	
12	0x60343D402AB20C5A	2 x Specified by PN2	Tag-2 (with Tag-3)
13	0x811758EED9A7331A	3 x Specified by PN2	Tag-2 (with Tag-3)
14	0xC9CE33521CE8E36A	4 x Specified by PN2	Tag-2 (with Tag-3)
15	0x28ED56FCEFFDDC2A	5 x Specified by PN2	Tag-2 (with Tag-3)
16	0xB95F818565627CCA	6 x Specified by PN2	Tag-2 (with Tag-3)
17	0x587CE42B9677438A	7 x Specified by PN2	Tag-2 (with Tag-3)
18	0x9D33345B07C594F2	8 x Specified by PN2	Tag-2 (with Tag-3)
19	0x7C1051F5F4D0ABB2	9 x Specified by PN2	Tag-2 (with Tag-3)
1A	0xEDA2868C7E4F0B52	10 x Specified by PN2	Tag-2 (with Tag-3)
1B	0x0C81E3228D5A3412	11 x Specified by PN2	Tag-2 (with Tag-3)
1C	0x4458889E4815E462	12 x Specified by PN2	Tag-2 (with Tag-3)
1D	0xA57BED30BB00DB22	13 x Specified by PN2	Tag-2 (with Tag-3)
1E	0x34C93A49319F7BC2	14 x Specified by PN2	Tag-2 (with Tag-3)
1F	0xD5EA5FE7C28A4482	15 x Specified by PN2	Tag-2 (with Tag-3)
continued			

Table.2

FX.25 Correlation Tag Code (part3)

Tag	Correlation Tag Value	Encoding Type	Tag type
20	0x9428192C9F6C6EFC	Use PN2 (Extended tag)	Tag-3 (show table A)
21	0x750B7C826C7951BC	Undefined	
22	0xE4B9ABFBE6E6F15C	Undefined	
23	0x059ACE5515F3CE1C	Undefined	
24	0x4D43A5E9D0BC1E6C	Undefined	
25	0xAC60C04723A9212C	Undefined	
26	0x3DD2173EA93681CC	Undefined	
27	0xDCf172905A23BE8C	Undefined	
28	0x19BEA2E0CB9169F4	Undefined	
29	0xF89DC74E388456B4	Undefined	
2A	0x692F1037B21BF654	Undefined	
2B	0x880C7599410EC914	Undefined	
2C	0xC0D51E2584411964	Undefined	
2D	0x21F67B8B77542624	Undefined	
2E	0xB044ACF2FDCB86C4	Undefined	
2F	0x5167C95C0EDEB984	Undefined	
continued			

Table.3

FX.25 Extended Correlation Tag Code

Tag	Correlation Tag Value	Encoding Type	Tag type
20-0	0x9428192C9F6C6EFC	Reserved	Tag-3
20-1 (1bit rotated)	0x4A140C964FB6377E	RS(255, 239)	Tag-3
20-2 (2bit rotated)	0xA50A064B27DB1BBE	RS(255, 223)	Tag-3
20-3 (3bit)	0xD285032593ED8DDE	RS(255, 191)	Tag-3
20-4	0xE9428192C9F6C6EE	Reserved	Tag-3
20-5	0xF4A140C964FB6376	Reserved	Tag-3
20-6	0xFA50A064B27DB1BA	Reserved	Tag-3
20-7	0xFD285032593ED8DC	Reserved	Tag-3
20-8	0x7E9428192C9F6C6E	Reserved	Tag-3
20-9	0xBF4A140C964FB636	Etc.	Tag-3
20-10	0xDFA50A064B27DB1A	Etc.	Tag-3
20-11	0xEFD285032593ED8C	Etc.	Tag-3
20-12	0x77E9428192C9F6C6	Etc.	Tag-3
20-13	0xBBF4A140C964FB62	Etc.	Tag-3
20-14	0xDDFA50A064B27DB0	Etc.	Tag-3
20-15 to 20-62			Tag-3

Table.A

FX.25 Correlation Tag Code (part4)

Tag	Correlation Tag Value	Encoding Type	Tag type
30	0xD2E344CAB512ED78	Undefined	
31	0x33C021644607D238	Undefined	
32	0xA272F61DCC9872D8	Undefined	
33	0x435193B33F8D4D98	Undefined	
34	0x0B88F80FFAC29DE8	Undefined	
35	0xEAAB9DA109D7A2A8	Undefined	
36	0x7B194AD883480248	Undefined	
37	0x9A3A2F76705D3D08	Undefined	
38	0x5F75FF06E1EFEA70	Undefined	
39	0xBE569AA812FAD530	Undefined	
3A	0x2FE44DD1986575D0	Undefined	
3B	0xCEC7287F6B704A90	Undefined	
3C	0x861E43C3AE3F9AE0	Undefined	
3D	0x673D266D5D2AA5A0	Undefined	
3E	0xF68FF114D7B50540	Undefined	
3F	0x17AC94BA24A03A00	Undefined	
40	0x41C246CB5DE62A7E	Reserved	

Table.4

Please visit PRUG website for further information.

<http://www.prug.com/>