Doc. ECC(24)XX

CEPT ECC
Electronic Communications Committee **Plenary**

65th ECC Plenary Meeting

Hybrid meeting; Vienna, Austria, and Virtual, 05 – 08 November 2024

Date issued: **30 October 2024**

Source: **DSA**

Subject: **Comparison on CBTC assumption between different ECC report and ETSI TR**

Group membership required to read? (Y/N)

N

Summary:

Several ECC reports and ETSI Technical Reports (including SRdocs) related to CBTC have been published. Some were descriptive only, whilst others assessed the impact of CBTC as a victim or as an interferer.

This paper summarizes the differences we found when comparing these reports, particularly when it comes to the CBTC signal level and the retransmission/ diversity / redundancy capabilities.

Proposal:

ECC is invited to :

- Consider the attached comparison table when discussing CBTC issues (Attachment 1)
- Consider the explanation on the effect of re-transmissions as a major mitigation technique that was missed in ECC Report 355 (Attachment 2)
- Consider the questions in FGVLP(24)009_LS from DSA or delegate those to the appropriate place (copied into Attachment 3)

Background:

ETSI TR103 111, ETSI TR 103 580, ETSI TR 103 442, ECC Report 290, ECC Report 355

Attachment 1

Source/Parameter	Retransmissions (Unicast)	Mode	CBTC Min Signal levels	Impact of -30 dbm/MHz	Deployed Region
ETSI TR 103 111 (SRdoc)	Yes	Normal, No degraded mode mentioned 2 frequencies at each end of the train	-		
ETSI TR 103 580	Yes	Normal, No degraded mode mentioned Frequency diversity not used	- 77 dBm[1]		Malaga (E), Paris (F)
ETSI TR 103 442		Normal, No degraded mode mentioned 2 frequencies at each end of the train,	-		
ECC Report 290	yes	Normal, No mention to degraded mode Frequency diversity not used	– 77 dBm (for wayside) - 76 dBm (for trains)[2]	Acceptable	
Stat. Study 2 and 3 of ECC Report 355	no	Degraded, and/or only 1 frequency at each end of the train	- 84 or -87 dBm	-37 dBm/MHz not OK in some studies	Paris (F)
Other parts of ECC Report 355	-		-77 dBm	-37 dBm/MHz OK in most studies	

[1] The minimum Urban Rail received signal considered was -77 dBm[1], corresponding to a deployment with system margin as described in ECC Report 290 // In order to guarantee a link between train and wayside in more than 99 % locations, a fade margin of 15 dB is used.
[2] typical levels of –77 dBm (for wayside) or -76 dBm (for trains) are taken into account which are considered as margins to allow higher level of interference into CBTC.

Attachment 2

CBTC Systems using 802.11 technology.

In general, systems relying on 802.11(a) systems have the following re-transmission functionality.

0. MAC Layer (Layer 2, mandatory in 802.11):

Any packet received needs an acknowledgement (ack) within 16 µS. If no ack received, then retransmission is initiated. The retransmission than takes place when the channel is not occupied. This might be somewhere between milliseconds and 10's of milliseconds depending on the channel congestion.
The retransmissions are subject to the same ack procedure as highlighted above. The actual number of attempts or maximum duration (packet lifetime) depends on the customized setup.

1. TCP Layer (Layer 4):

The CBTC system uses unicast, i.e. the TCP/IP protocol, this is also a system where each packet needs acknowledgement (ack), but is highly customizable. Within a certain time period (windowing) an ack is expected, e.g. 100 ms. If no ack, then retransmissions happen until the maximum allowable delay happens (2.5 seconds).

Only after all these retries fail, is the actual information packet lost.

The effect of retransmissions in modelling:

In general, retransmissions in a mobile environment are highly effective since there is a significant change in the channel even over short periods of time. In system design, this is considered by multiplying the error probabilities.

Retransmissions are a very effective mitigation technique. Demonstrated based on statistical study 3 in ECC Report 355:

0 Retransmissions: 4822 events over 60 days, (0.09%).
1 Retransmissions: 5 events over 60 days (0.00009%).
2 Retransmissions: 0 events over 60 days or equivalent to 1 event in 39 years (0.00000008%).

Attachment 3: Questions for clarifications from FGVLP(24)009

In addition to our answers above, we have the following questions related to the topic:

1. Given that this appears to be a known weakness on some existing rail implementations, what measures and timescales are in place so that future implementations of CBTC are more resilient to their neighbours?

2. Related to the above question, our members have noted that ECC PT SE21 has been studying receiver resilience across a range of radio products. Has this group studied and made any recommendations in relation to current CBTC receiver design and what improvements are to be expected?

3. Noting that the existing European regulatory framework already contains mitigation measures such as a guard band and a more stringent OOBE limit of -37 dBm/MHz (compared with ERC REC 74-01), is it the intention for these extra mitigation measures to be a temporary solution until such time as the legacy CBTC implementations are updated?

4. ETSI work on CBTC in TR 103 580 V1.1.1 has considered CBTC to be based on a unicast IEEE 802.11 system with inherent retransmission capabilities. It seems the system analysed in ECC Report 355 does not include this significant mitigation technique on CBTC side and may drastically overstate the interference impact. Is there a plan to evaluate that missed mitigation technique?

If FG-VLP is not in a position to answer the above questions, then we respectively request that this attachment is passed to ECC for their consideration.