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44TH ASECAP STUDY & INFORMATION DAYS 2016

ASFA project “Coexistence 5.8/5.9”
G. Frémont – G. Toulminet

Intercontinental Hotel
23-25 May 2016

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CONTEXT

- Coexistence issue between ITS-G5 5.9 GHz and DSRC 5.8 GHz identified in 2007
- ASFA participated to the ETSI workshop and tests at the ISPRA JRC (4th – 8th July 2011)
- For configurations with high number of influent ITS stations
 - Risk of noticeable increased duration of electronic toll transactions, or
 - Failure of these transactions
- A proposal (TOCCATA project) has been prepared and submitted to the EC in the H2020 framework in August 2014
 - To investigate solutions for DSRC / C-ITS coexistence
 - To carry out and test on real sites of mitigation techniques
 - The proposal has not been selected by the EC for funding

OBJECTIVES OF THE ASFA PROJECT COEXISTENCE 5.8/5.9

ASFA decided to carry out a project on a limited scope

- Identification of conditions for which disturbance are observed for ETS in the TIS (*Télépéage Inter-Sociétés*) context, in channelised lane
- Tests of the coexistence mode for ITS stations, defined by ETSI

1. Tests on the site of “Les Eprunes”
2. Tests on the Sanef toll station of Senlis Bonsecours (A1)

TEST SITE OF “LES EPRUNES” (A5)

- Representative and used as reference for the TIS context
- Used for certification/conformity to specifications of CEN DSRC toll equipments and their operational interoperability



TESTED DSRC SCENARIOS – 07-08/03/2016

➤ CEN DSRC equipments

➤ Beacon : Kapsch TRX-1320 in axial position

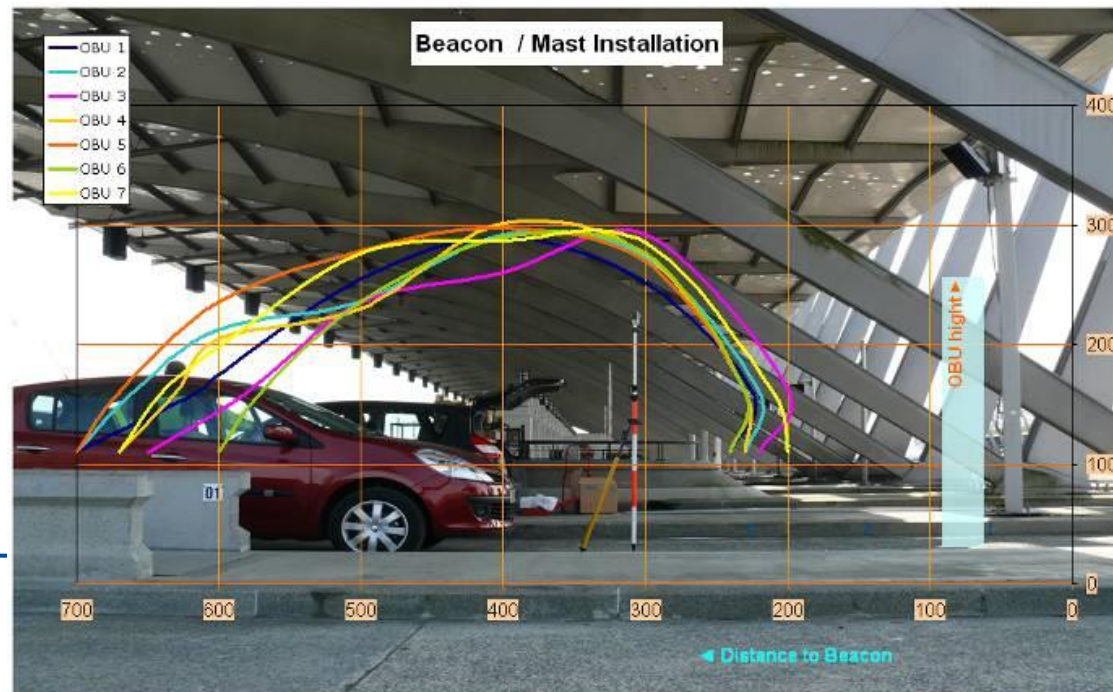
➤ Tag : Kapsch TS3203-10D

➤ 4 DSRC channels

➤ Position of the CEN DSRC tag with respect to the DSRC beacon

➤ optimal position

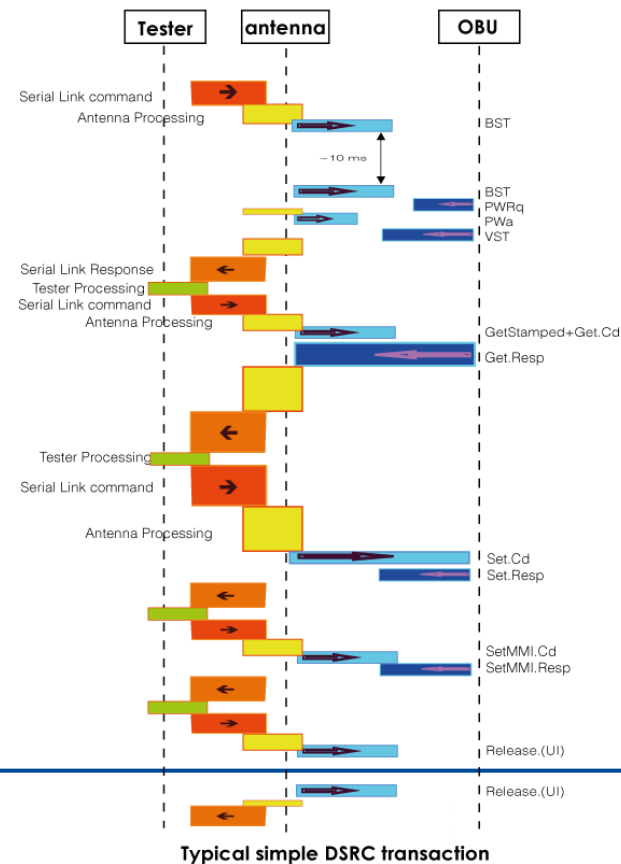
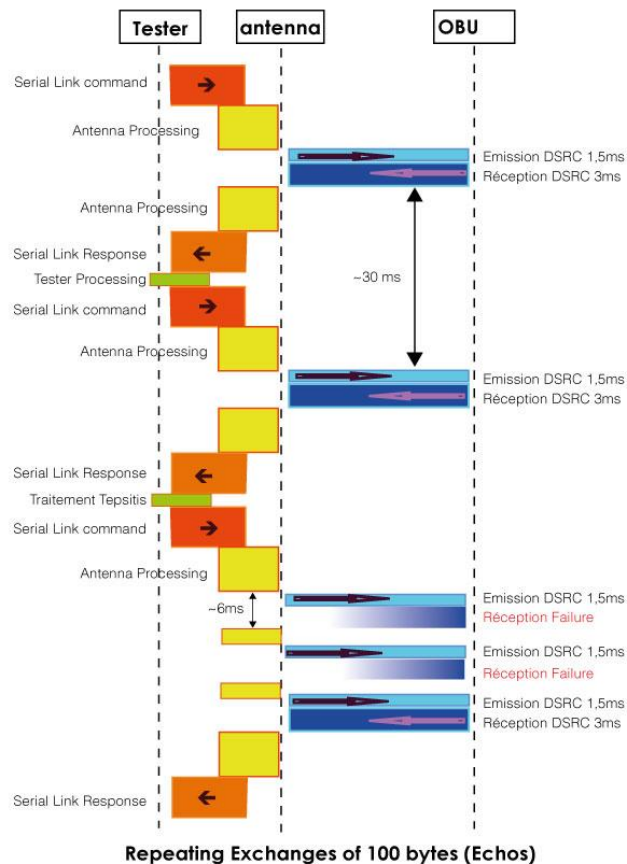
➤ border limit position



TESTED DSRC SCENARIOS – 07-08/03/2016

➤ CEN DSRC Scenarios :

- Repeating exchanges of 100 bytes messages between the beacon and the tag to occupy DSRC radio communication at a maximum;
- Repeating exchanges of typical TIS CARDME transactions

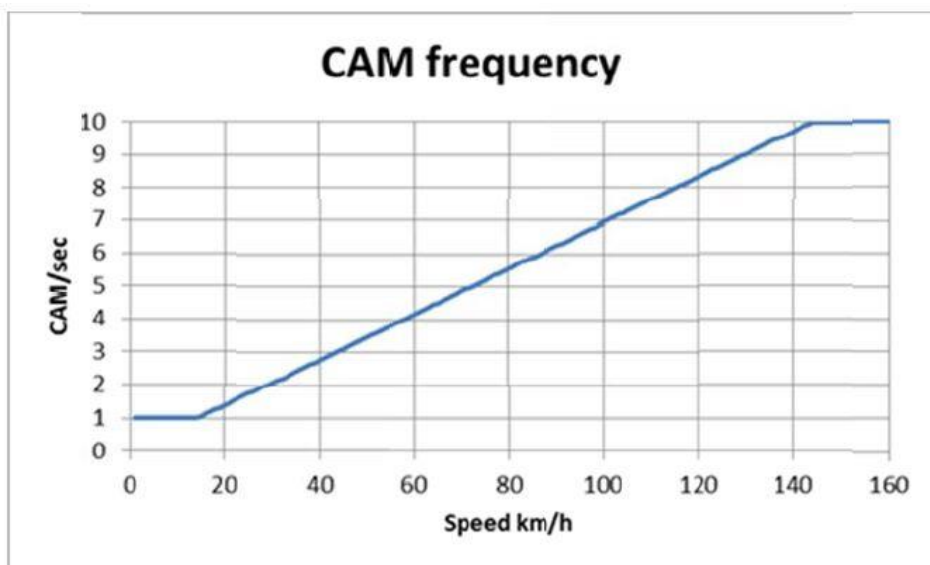


ITS PERTURBATION – 07-08/03/2016

➤ 1 to 3 ITS transmitters : NEAVIA ITS stations used in emission mode of CAM messages (message length < 1ms) with max. transmit power =28 dBm

➤ CAM emission duty cycle modified to simulate the presence of high number of influent ITS stations :

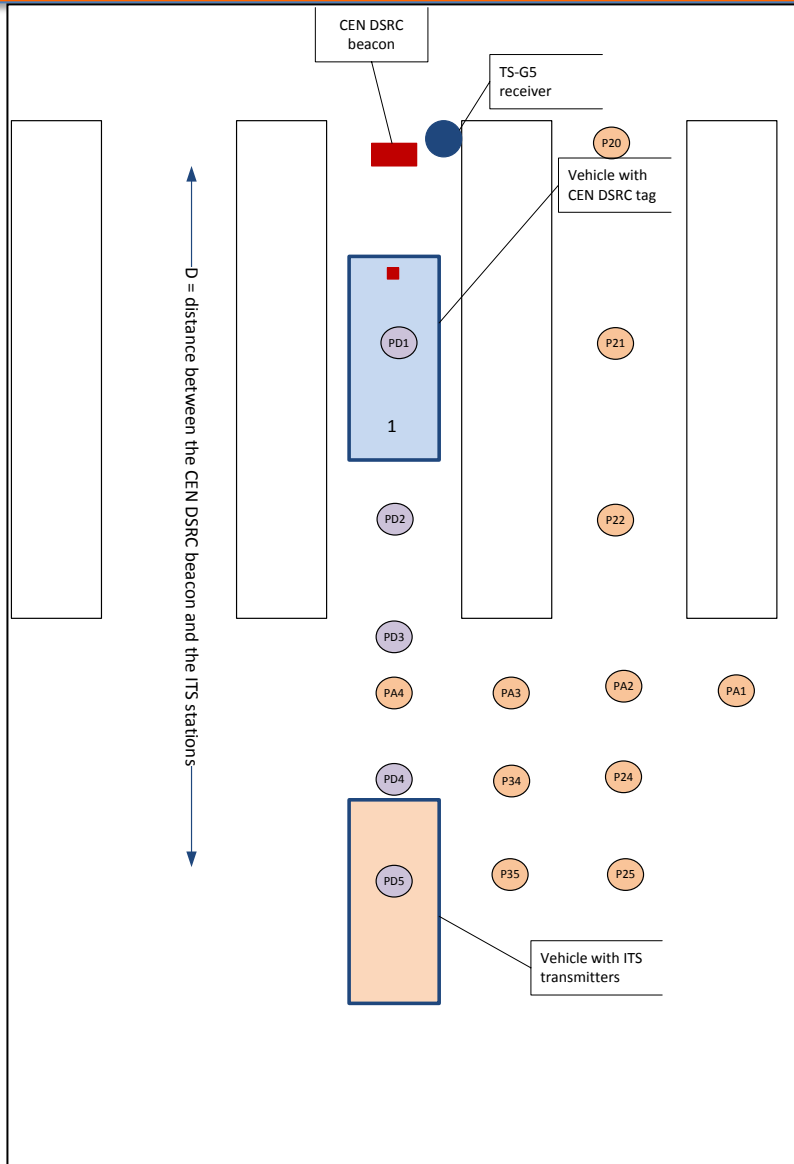
- 1 to 150 messages per second at a max. (about 1 message every 6ms) for 1 transmitter
- Limits in processing capacity of ITS stations
- Limits in transmission by radio module
- Anti collision mechanism that prevents C-ITS emission when the channel is occupied



➤ 1 ITS receiver : NEAVIA ITS station used in reception mode only

➤ Reception of a maximum of about 150 messages per second

TESTS SCENARIOS



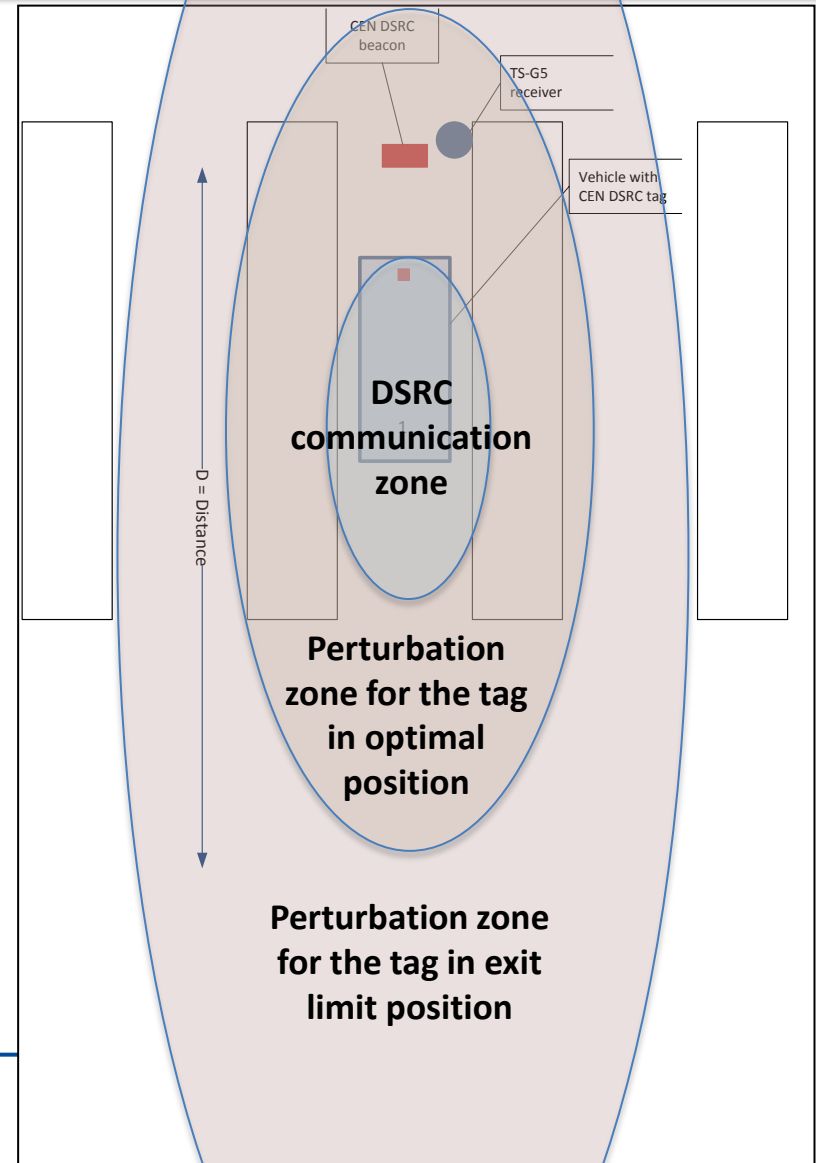
FIRST RESULTS

Perturbations observed

- For repeating exchanges of 100 bytes messages between the CEN DSRC beacon and the tag
- Kind of perturbations : Commands re-sent by the beacon, due to non reception of the answer by the tag
- More perturbations observed for 5,8025 and 5,8125 channels

Limited perturbations observed

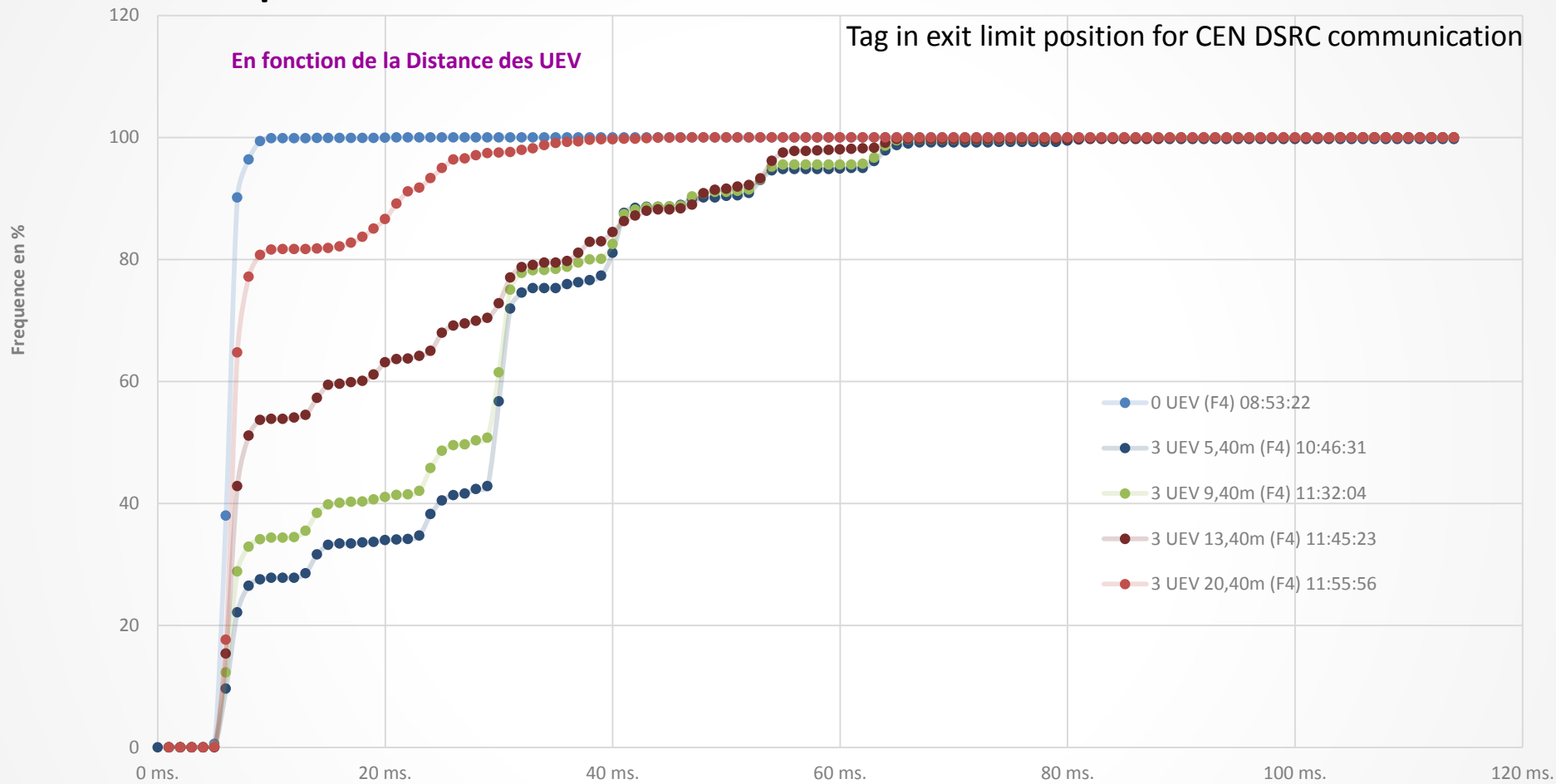
- for DSRC scenario corresponding to repetition of exchanges of typical TIS CARDME transactions



PRELIMINARY TESTS RESULTS

% OF TRANSACTIONS PERFORMED / DURATION OF TRANSACTION

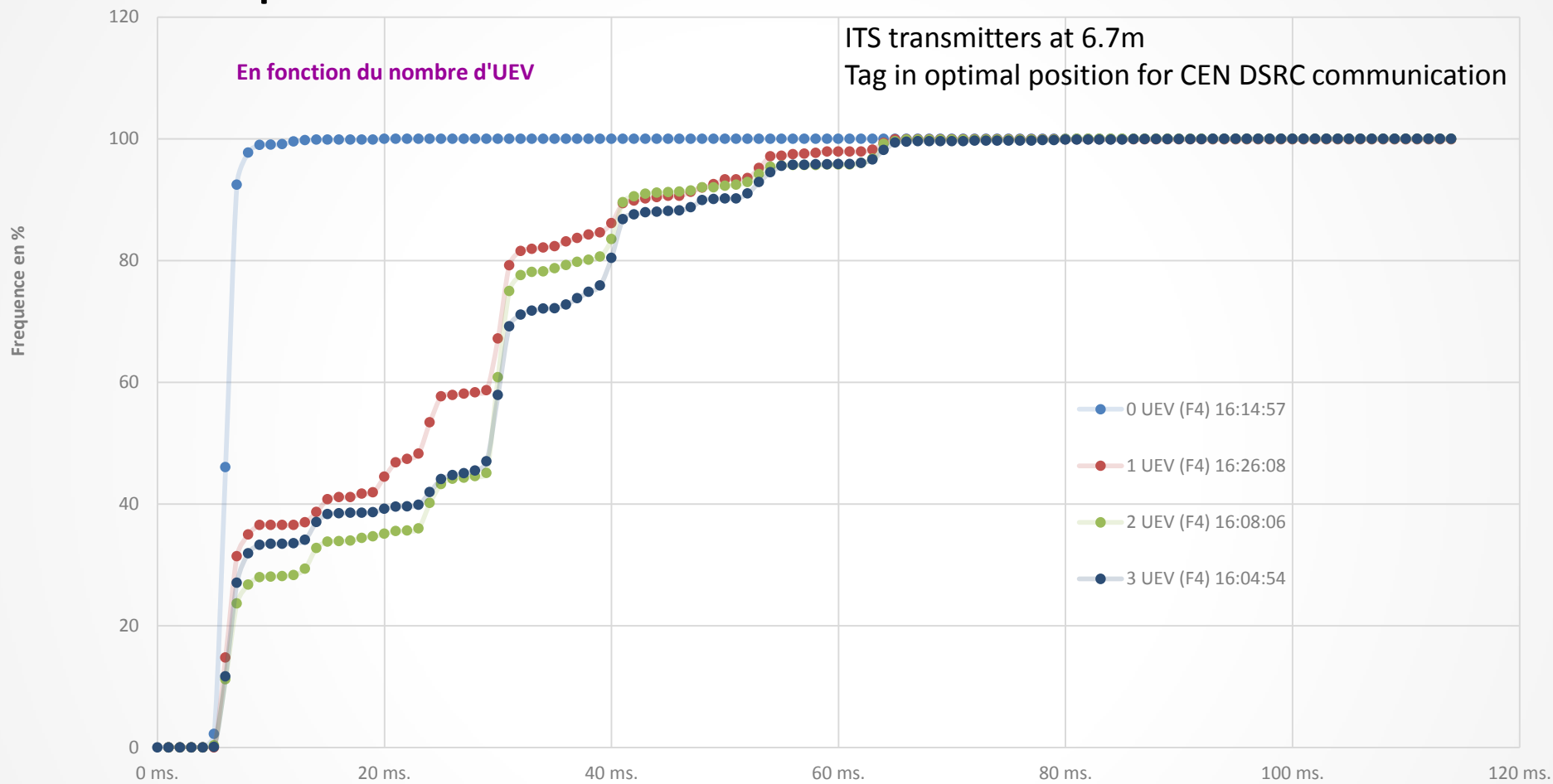
Variable parameter : Distance to the CEN DSRC Beacon



PRELIMINARY TESTS RESULTS

% OF TRANSACTIONS PERFORMED / DURATION OF TRANSACTION

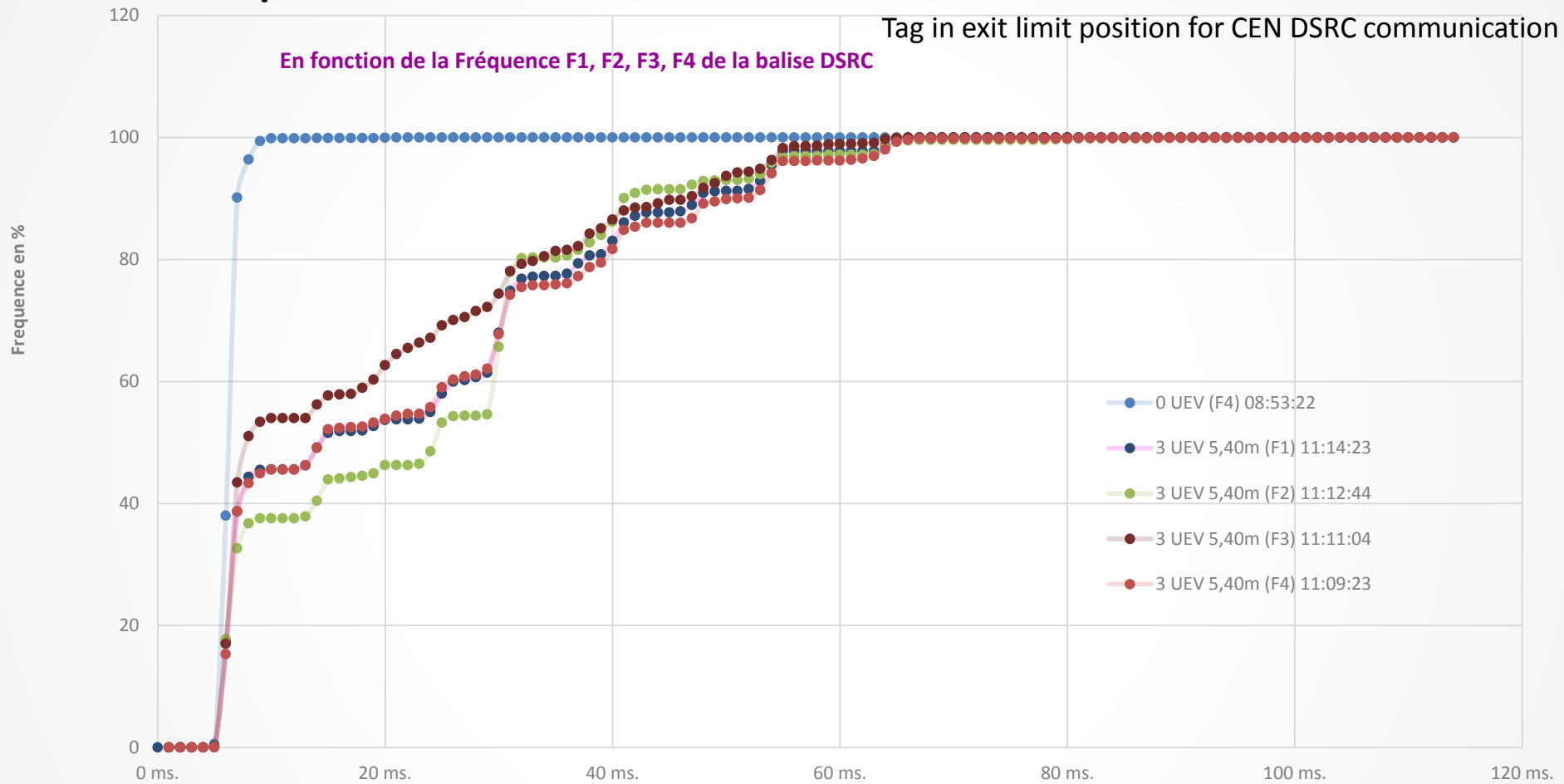
Variable parameter : Number of ITS transmitters



PRELIMINARY TESTS RESULTS

% OF TRANSACTIONS PERFORMED / DURATION OF TRANSACTION

Variable parameter : DSRC channel



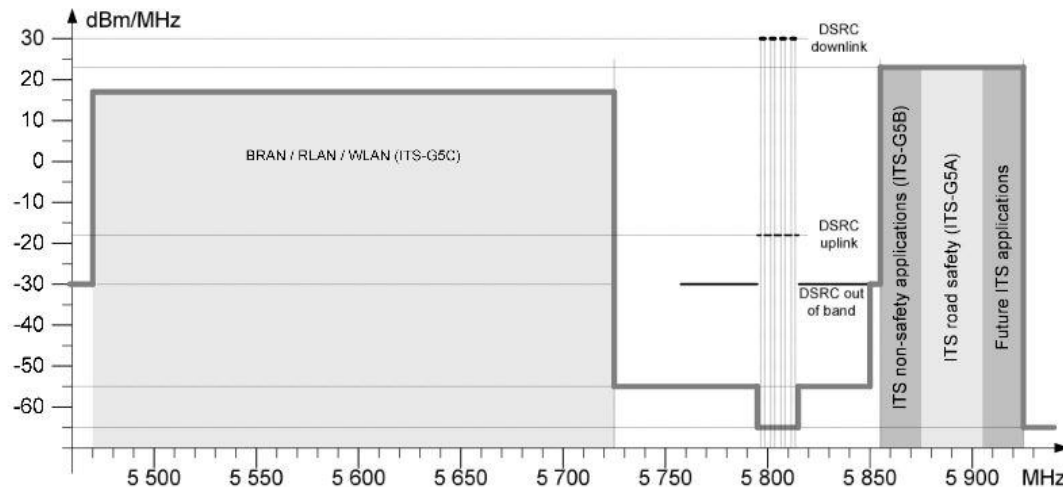
Durée pour obtenir réponse à la commande echos 100 octets

PRELIMINARY CONCLUSION

- Analysis and interpretation of first results still on-going
- In the ASFA test conditions, ITS transmitters (CAM messages, in Safety channel) seem to generate limited disturbances, due to
 - Limits in processing capacity of ITS stations
 - Limits in transmission by radio module
 - Anti collision mechanism that prevents C-ITS emission when the channel is occupied
- Complementary tests have to be performed
 - In different scenarios
 - Processing capacity of radio chip (NEAVIA) increased from 150 to 780 messages / s
 - With DSRC & C-ITS equipment from other manufacturers

PRELIMINARY CONCLUSION

➤ Non-safety ITS messages could generate more disturbance



ETSI ES 202 663 - Figure 2: Maximum limit of mean spectral power density (EIRP)

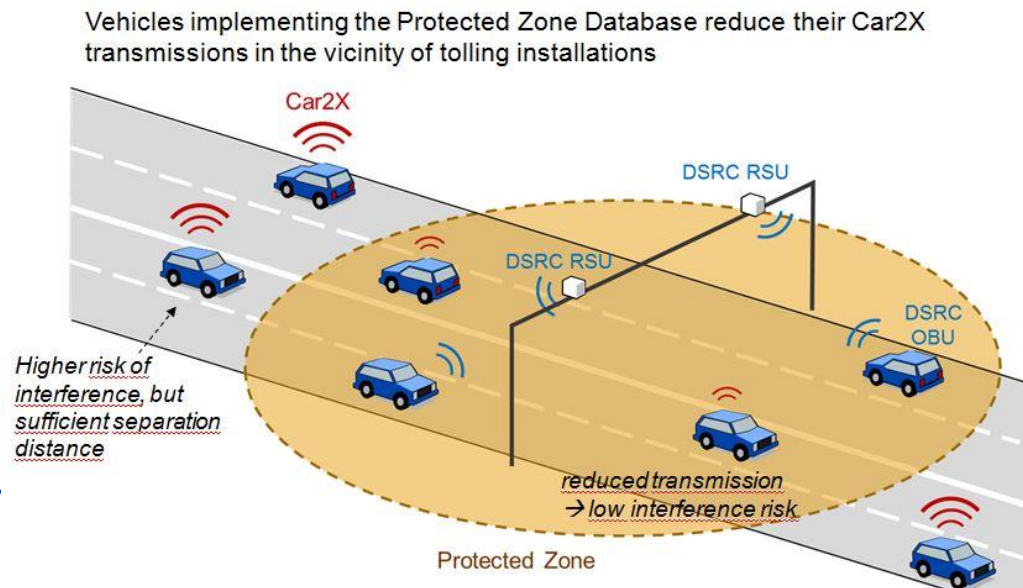
➤ Mitigation techniques have to be implemented anyway in in-vehicle C-ITS stations, with respect to European standard ETSI TS 102 792

- Reduction of power transmitted
- Reduction of duty cycle

PROTECTED ZONES

- Detection of protected zones by in-vehicle C-ITS stations
 - Detection of CEN DSRC frames in the frequency band 5,795 – 5,815 GHz, by the in-vehicle C-ITS stations, with respect to EN 12253 et EN 12795
 - Reception of ITS messages indicating the presence of CEN DSRC installation, sent by ITS-G5 RSE (upstream of the CEN DSRC installation)
 - Protected zone database integrated into in-vehicle ITS-G5 stations

- ASECAP is currently working on the elaboration of this database in collaboration with automobile industry
- The automobile industry will integrate the database into their in-vehicle C-ITS stations



Thank you for your attention

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