



3GPP TSG RAN Meeting #77
Sapporo, Japan, September 11-14, 2017

RP-171816

Motivation for WI on Sidelink Enhancements in LTE for Wearable and IoT Use Cases

Agenda Item: 10.1.2

Source: Intel Corporation

Document for: Discussion

FeD2D Study Item Objectives

Further Enhancements LTE Device to Device, UE to Network Relays for IoT and Wearables SI ([RP-161839](#)) was approved at RAN#73 in September, 2016 with the following main objectives:

1. Study and evaluate a generic Layer 2 evolved UE-to-Network Relay architecture, including methods for the network to identify, address, and reach a evolved Remote UE via an evolved ProSe UE-to-Network Relay UE [RAN2]:
 - a) Study the possibility of a common solution supporting the following use cases [RAN2]:
 - UE to network relaying over non-3GPP access (Bluetooth/WiFi); UE to network relaying over LTE sidelink; Unidirectional and bidirectional UE to network relay.
 - b) Investigate potential impacts to protocol stack, procedure and signalling mechanisms, such as authorization, connection setup, UE mobility, parameter configuration and security, allowing multiple evolved Remote UEs via an evolved ProSe UE-to-Network Relay UE [RAN2].
 - c) Study path selection/switch between the cellular link (Uu air interface) and relay link and provide service continuity and QoS [RAN2, RAN3].
2. Study necessary LTE sidelink enhancements:
 - a) Introduce additional evaluation assumptions to the sidelink evaluation methodology defined in TR 36.843 focussing on analysis of wearable use cases [RAN1,RAN2].
 - b) Identify mechanisms to enable QoS, reliable, and/or low complexity/cost & low energy sidelink [RAN1, RAN2, RAN4].
 - c) Study additional co-existence issues with adjacent carrier frequencies that may arise due to the new mechanisms identified [RAN4].

Study Item Conclusions

RAN2 and RAN4

RAN2 completed SI work in June'17 with the following conclusions

- Bi-directional Layer 2 evolved ProSe UE-to-Network Relay UE is feasible from RAN2 perspective
 - The impact of unidirectional relay was not fully analyzed from RAN2 perspective
- DRX enhancements over PC5 are feasible from RAN2 perspective
- RAN2 discussed group handover options and agreed not to pursue group handover response option (section 5.1.2.4.2)
- Three path switch/mobility scenarios were identified with solutions provided for each scenario (including RAN3 impacts)

RAN4 completed SI work in June'17 with the following conclusions

- No additional co-existence issues with adjacent carrier frequencies comparing to the R12/13 D2D

Study Item Conclusions

RAN1

RAN1 completed work in September'17 and concluded on feasibility of the following sidelink enhancements:

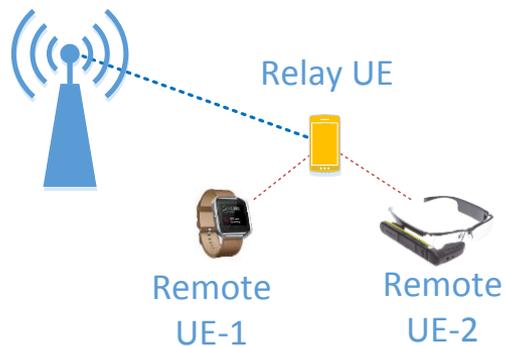
- Sidelink support of UEs with single RX chain, RF BW limitation (1/6 PRBs), w/ or w/o SL RX capabilities
- Enhancements of sidelink sync procedure to enable Relay UE to serve as a sync source for in-coverage Remote UEs
- Enhancements of discovery procedure / signalling to improve discovery performance and communication establishment for BW limited Remote UEs
- Enhancements targeting sidelink unicast communication, including
 - eNB-controlled and Relay UE assisted resource allocation modes
 - Semi-persistent scheduling
 - Sidelink power control
 - Sidelink measurements and reporting / feedback for sidelink link adaptation

Study Item Scenarios

RAN1 Use Cases & Scenarios

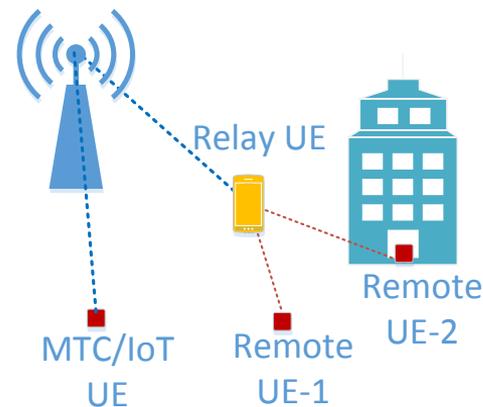
Scenario 1: D2D-aided wearable

- Direct communication with or relaying traffic of “companion devices” (Remote UEs)
- Remote UEs are in close proximity to Relay UE



Scenario 2: D2D-aided MTC/IoT

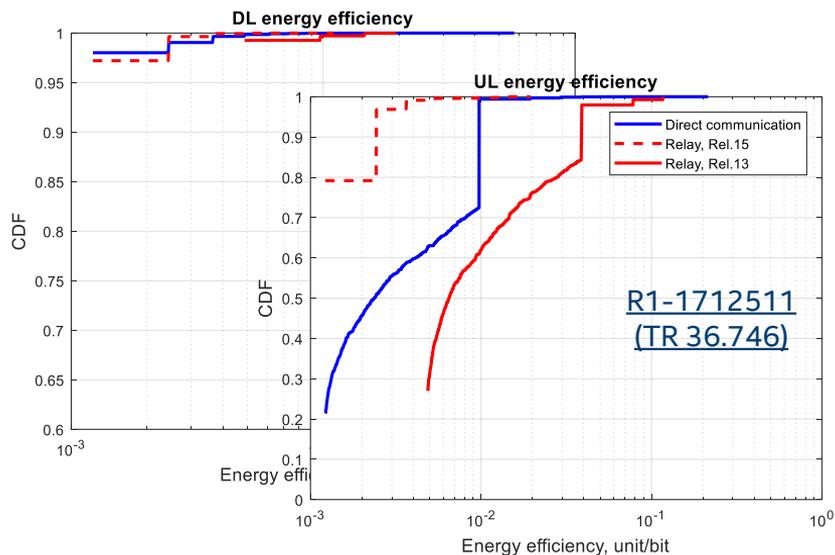
- Relaying of traffic of IoT/MTC devices for energy efficient coverage extension
- Remote UEs are in normal or enhanced coverage modes of operation



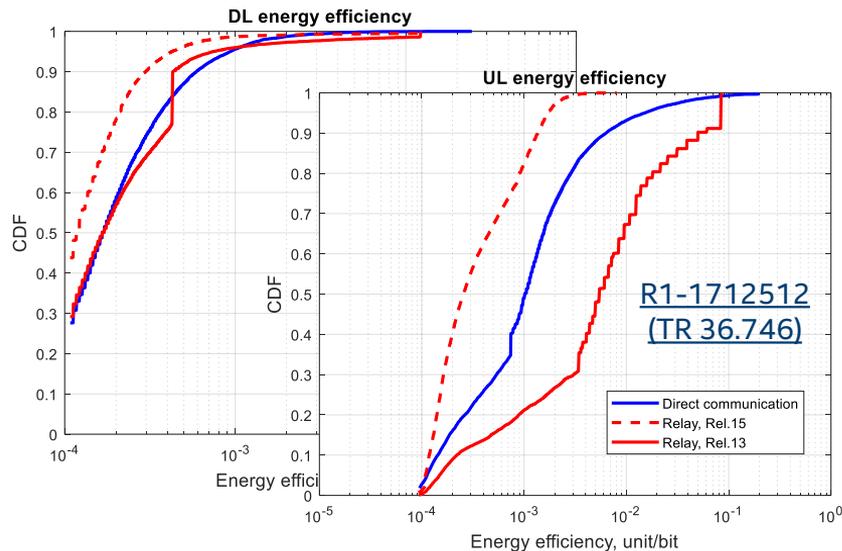
Study Item Evaluations

Communication (UE-to-NW Relaying) Framework

Scenario 1: D2D-aided wearables



Scenario 2: D2D-aided MTC/loT

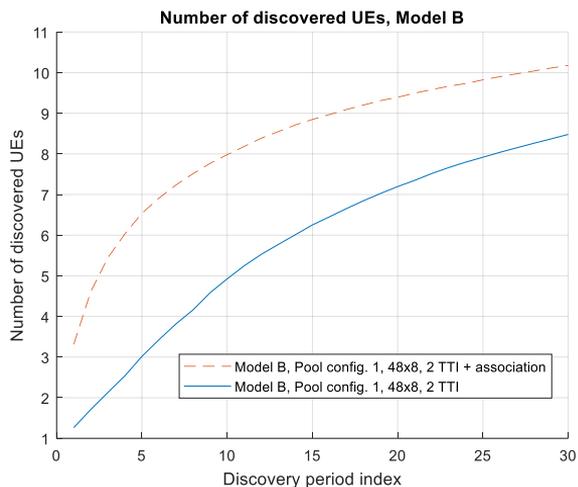


Sidelink enhancements can provide significant improvement in terms of DL/UL energy efficiency over direct link or R12/13 sidelink solutions

Study Item Conclusions

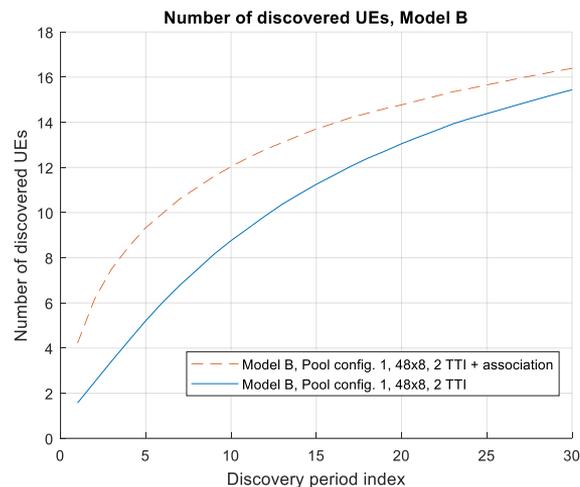
Discovery Evaluations

Scenario 1: D2D-aided wearables



R1-1712513
TR 36.746

Scenario 2: D2D-aided MTC/loT



	Baseline	Enhanced
Mean time to discover target Relay, ms	2120.73	327.2 (548%)
Mean energy spent to discover target Relay, unit	21.18	3.257 (550%)

	Baseline	Enhanced
Mean time to discover target Relay, ms	2115.72	335.88 (530%)
Mean energy spent to discover target Relay, unit	21.14	3.342 (533%)

Sidelink enhancements can significantly benefit discovery performance for BW limited remote UEs

FeD2D Work Item Objectives

RAN1-led WI scope (including Remote UEs with 1 and 6 PRB BW constraints)

- Specify enhancements to synchronization [RAN1, RAN2]
 - Enable in-coverage Relay UE to serve as a sync source for in-coverage Remote UE
 - Enhanced SLSS/PSBCH format for UEs with 1 PRB BW
- Specify enhancements to sidelink discovery [RAN1, RAN2]
- Specify enhancements for sidelink unicast communication [RAN1, RAN2]
 - Measurements and reports to facilitate link adaption on sidelink
 - Enhanced power control mechanisms on sidelink
 - Necessary enhancements to eNB-controlled resource allocation
 - Relay UE-assisted resource allocation
 - Semi-Persistent Scheduling in sidelink
 - Necessary enhancement to PSCCH/PSSCH resource pools

