How to optimize radio links in harsh M2M environments ?

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Summary

Context - Jamming environment

Number of unlicensed transmitter
Quantity of data by transmitter
Normative requirements

Solutions - Classical Approaches

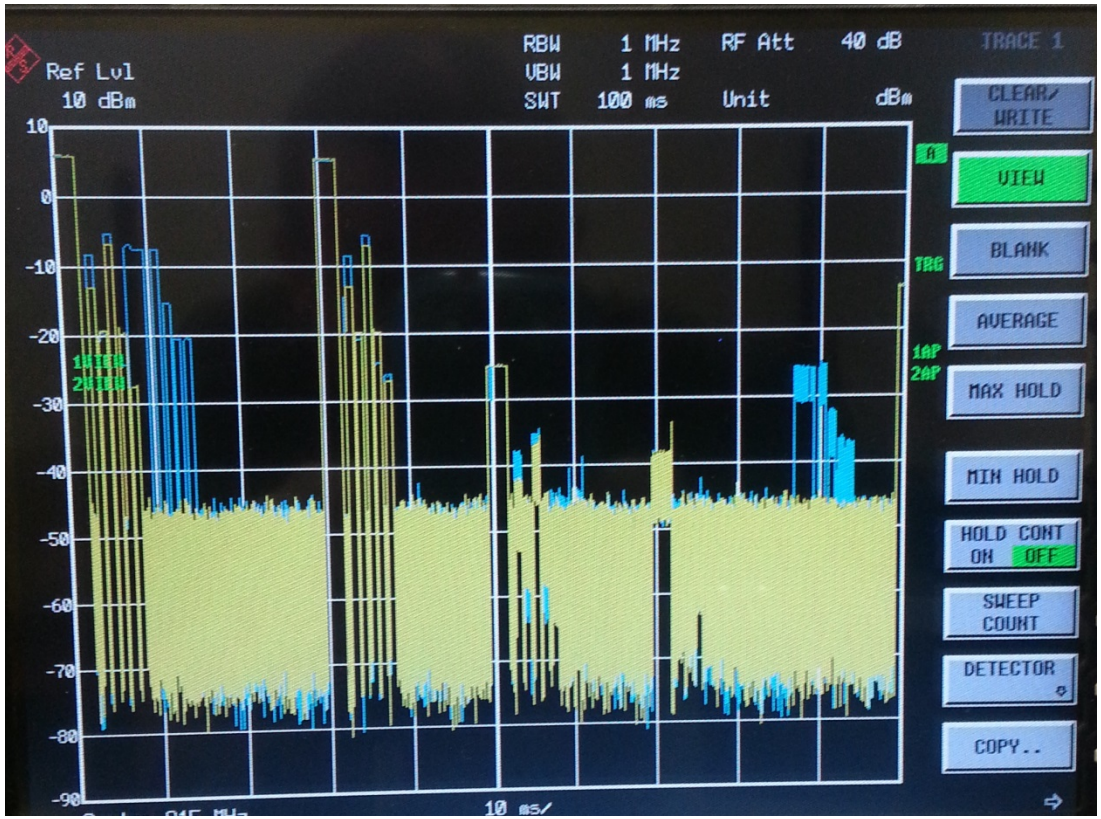
Repetition
FHSS
Increase of the data rate

Adeunis RF Solution

Goals
Technical Description
Tables
RF Characteristics
Offer & Services

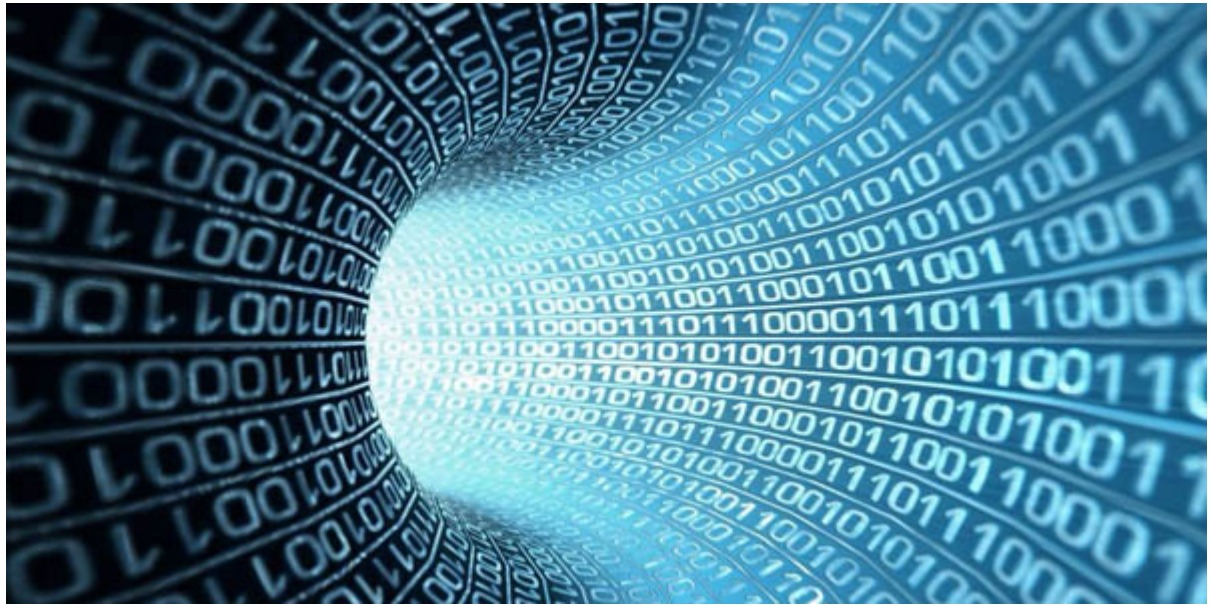
Context - jamming environment : Number of unlicensed transmitter

- ✓ More and more devices in the ISM bands and mainly in the 863-870MHz
  - M2M market
  - Telemetering
  - IoT market
  - Etc…
- ✓ Own systems more and more complex : Point to point communication are replaced by networked systems
- ✓ 2 kinds of interferences :
  - Others or competitors systems.
  - Your own system (density of communication).



Context - jamming environment : **Quantity of data by transmitter**

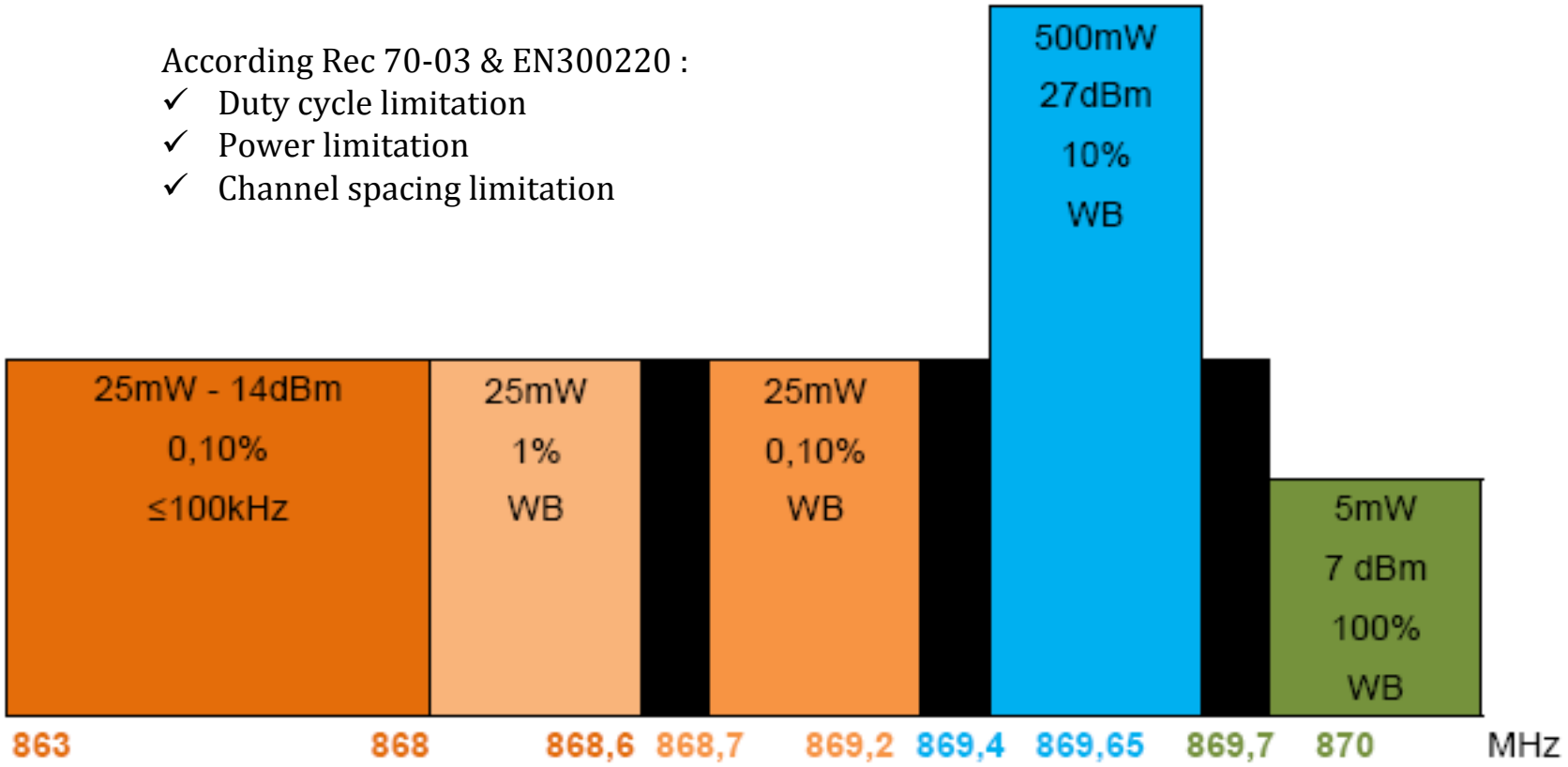
- ✓ Increase of the amount of data to transmit →Increase of the risk of collisions
- ✓ Application diversification : Data / Audio / Video
- ✓ Higher Data Encapsulation : Protocol (Network Adress, Frame length…)



Context - jamming environment : **Normative requirements**

According Rec 70-03 & EN300220 :

- ✓ Duty cycle limitation
- ✓ Power limitation
- ✓ Channel spacing limitation



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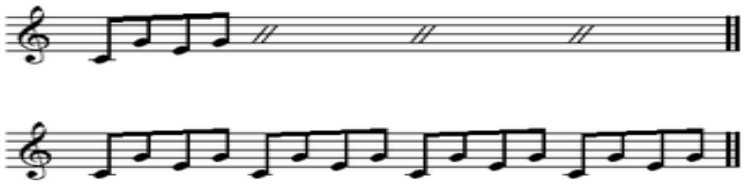
Solutions - Classical Approaches : **Repetition**



✓ No. this would increase the number of transmission and the risk of collisions

✓ Not really possible do to the Duty Cycle limitation.

Solutions - Classical Approaches : **FHSS** (Frequency Hopping Spread Spectrum.)

Why Not? Problem → European normative requirements :

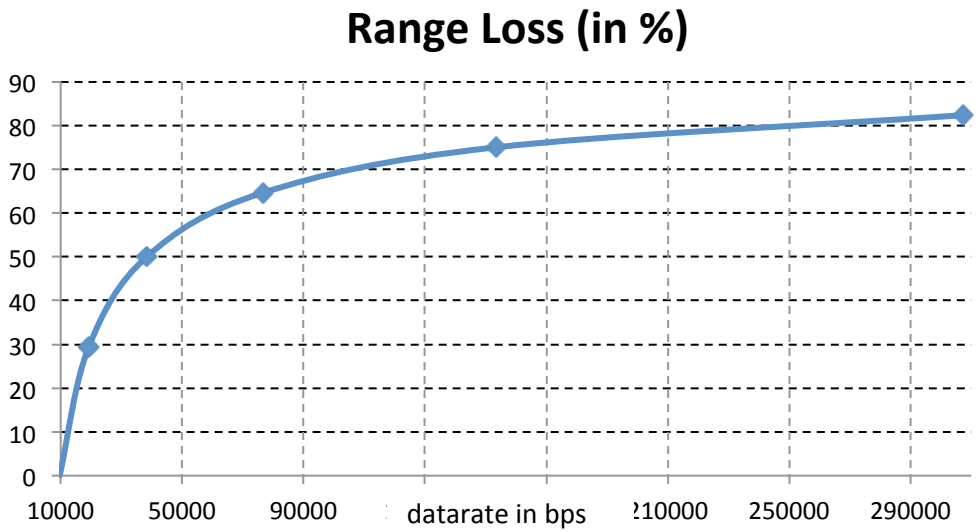
- ✓ Min of 47 hopping → latency
- ✓ Very low duty cycle : 0,1% duty cycle limit applies to the entire transmission (not at each hopping channel) → duty cycle per channel : 0,002% eg 76ms max /hour/channel

863-870 MHz (notes 3 and 4)	25 mW e.r.p.	≤ 0.1% duty cycle or LBT (notes 1 and 5)	≤ 100 kHz for 47 or more channels (note 2)

Solutions - Classical Approaches : **Increase of the data rate**

- ✓ Problem : Tx channel spacing normative requirement. Channel spacing <100kHz in more than 70% of the 83-870MHz band.

- ✓ Reduction of the range of communication.



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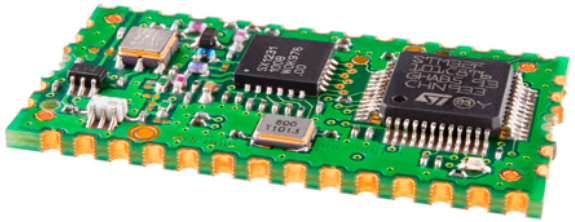
Adeunis RF Solution : **Goals**

- ✓ Increase the duty cycle
- ✓ Improve the reliability of the communications
- ✓ Limit the collision risk
- ✓ Keep an effective use of the spectrum
- ✓ Fulfill all normative requirements.

→Development of a dedicated MODULE ready to use in your own product :



Adeunis RF Solution : Technical Description

- ✓ The module is a ready to choose solution which use the best channel to transmit :
  - In case of no RF traffic, the transmiter will periodically (on each message) change is frequency in a table of 6 channels.
  - In case of RF interferences, the module will choose automatically another channel to allow the communication.
- ✓ Receiver is permanently synchronized on the transmitter whatever the used channel.
- ✓ Normative parameter LBT+AFA (Listen Before Talk with Adaptative Frequency Agility) fullfilled.
- ✓ Dutycyle up to 15% instead of the most common 0,1 & 1%
- ✓ 12 tables available of 6 channels available
- ✓ No collision between your systems even on the same table
- ✓ R&TTE certification included radio standard EN300220

Adeunis RF Solution : Technical Description

✓ Each table uses its own 1MHz frequency bandwidth. This approach gives a second level of protection and limits the risk of interferences between tables.

✓ In each table, the last channel is chosen in the 100% duty cycle sub band. The channel can be used as a back up channel.

Table	F1 (in MHz)	F2 (in MHz)	F3 (in MHz)	F4 (in MHz)	F5 (in MHz)	F6 (in MHz)
T01	863,1	863,3	863,5	863,7	863,9	869,1
T02	863,15	863,35	863,55	863,75	863,95	868,2
T03	864,1	864,3	864,5	864,7	864,9	869,425
T04	864,15	864,35	864,55	864,75	864,95	869,475
T05	865,1	865,3	865,5	865,7	865,9	869,525
T06	865,15	865,35	865,55	865,75	865,95	869,575
T07	866,1	866,3	866,5	866,7	866,9	869,625
T08	866,15	866,35	866,55	866,75	866,95	869,85
T09	867,1	867,3	867,5	867,7	867,9	869,75
T10	867,15	867,35	867,55	867,75	867,95	869,8
T11	868,1	868,3	868,5	868,75	868,95	869,9
T12	868,15	868,35	868,55	868,8	869	869,95

Adeunis RF Solution : RF Characteristics

Parameter	Typ. Value	Comments
Frequency Band	863-870MHz	
Number of tables	12	
Power	14dBm (25 mW)	
Sensitivity	-115dBm	At Ber 1^{e}-3
RF Datarate	20kbps	
Power Supply	3,3Vdc	From 2,2 to 3,6Vdc
Configuration	By AT registers	
Communication Modes	Adressed Sub Networks Broadcast	

Adeunis RF Solution : **Offer & Services**

- ✓ Reference of the module : ARF7912.
- ✓ Samples available.
- ✓ Already some industrial & application success stories
- ✓ Possible customization depending on your application :
  - Form factor
  - Software
  - Specific functionnalities
  - Etc…

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Q & A