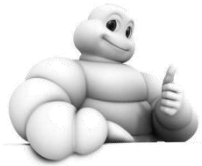
HFIA HIGH FREQUENCY INDUSTRY ASSOCIATION

THALES PRESENTATION

San Diego

25 January 2012

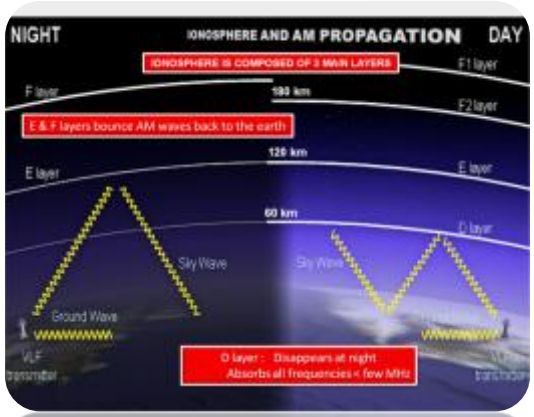


Presented by Eric Bader
HF & VHF MKTG Segment Manager

THALES

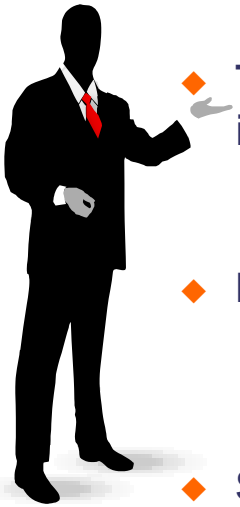
CONSTRAINTS OF HF TRANSMISSION

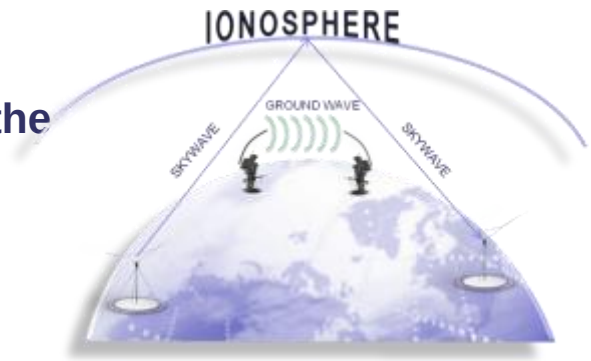
- **The HF propagation depends on the sun activity**
  - Modification of the ionosphere features
- **The sun activity depends on the place and the date of transmission .**
  - Usable HF frequencies depend on the LUF and MUF given for a spot at a period of time
- **The D layer of ionosphere disappears during the night**
  - LUF and MUF are different during the day and night



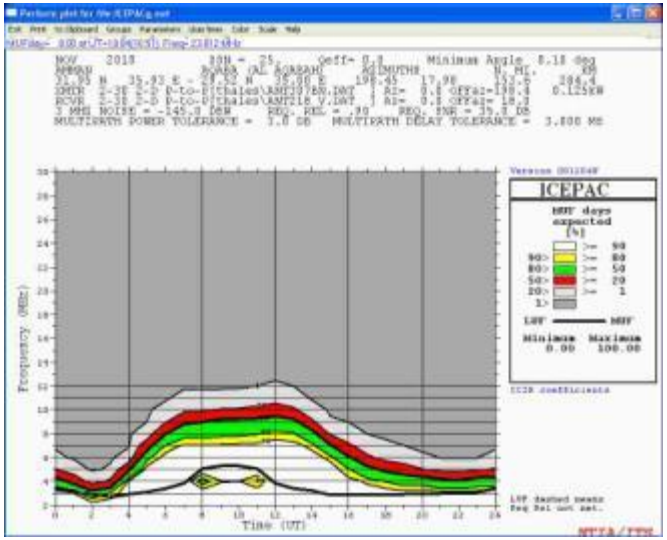
THALES

HF TRANSMISSION PROCEDURE





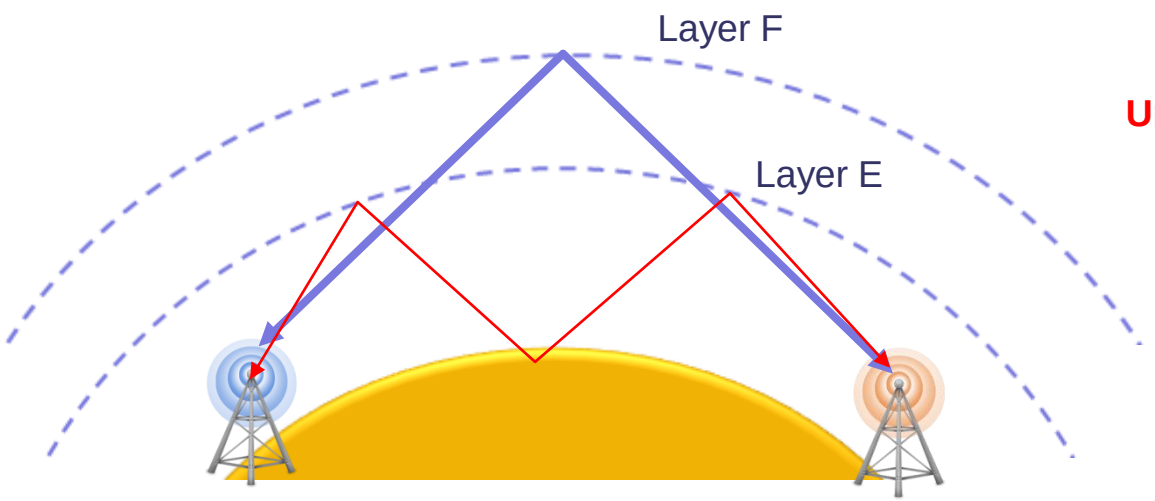
- **To perform long distance transmission, HF uses the ionosphere properties**
  - HF Performances linked to the quality of ionosphere
- **First step : identify the usable frequencies.**
  - Use existing free prediction software as VOACAP to set up of frequency list
- **Second Step : Start the procedure of link establishment**
  - Based on the frequency list , the transceiver :
    - chooses one frequency among the list
    - Tries to set up a link with one or several transceivers
    - Exchanges ARQ information reflecting the link quality
- **Third Step : If ARQ positive answer then a communication can start**

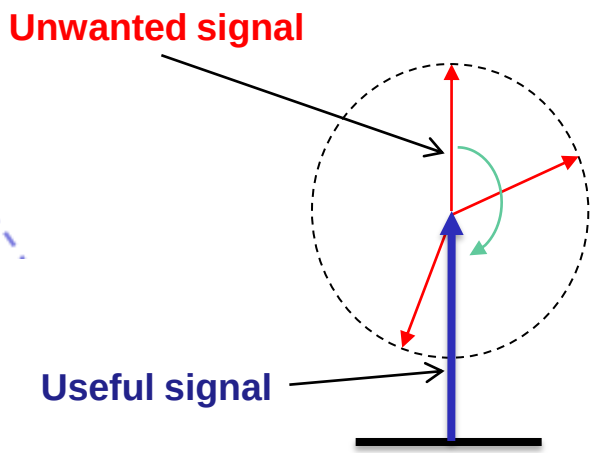


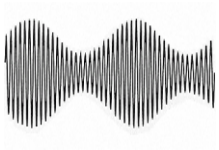
Fading effects

Unpredictable fading

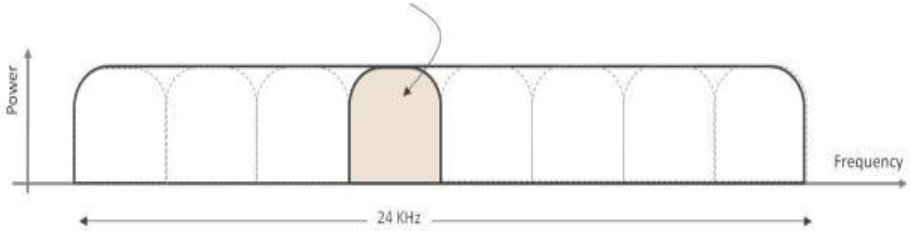
Fading effect can destroy the useful signal or a part of the useful signal

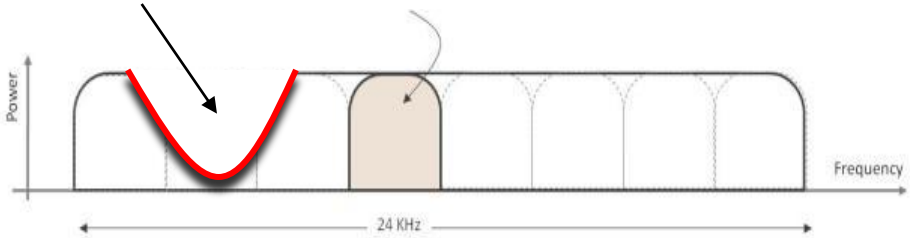






Inaudible Channel



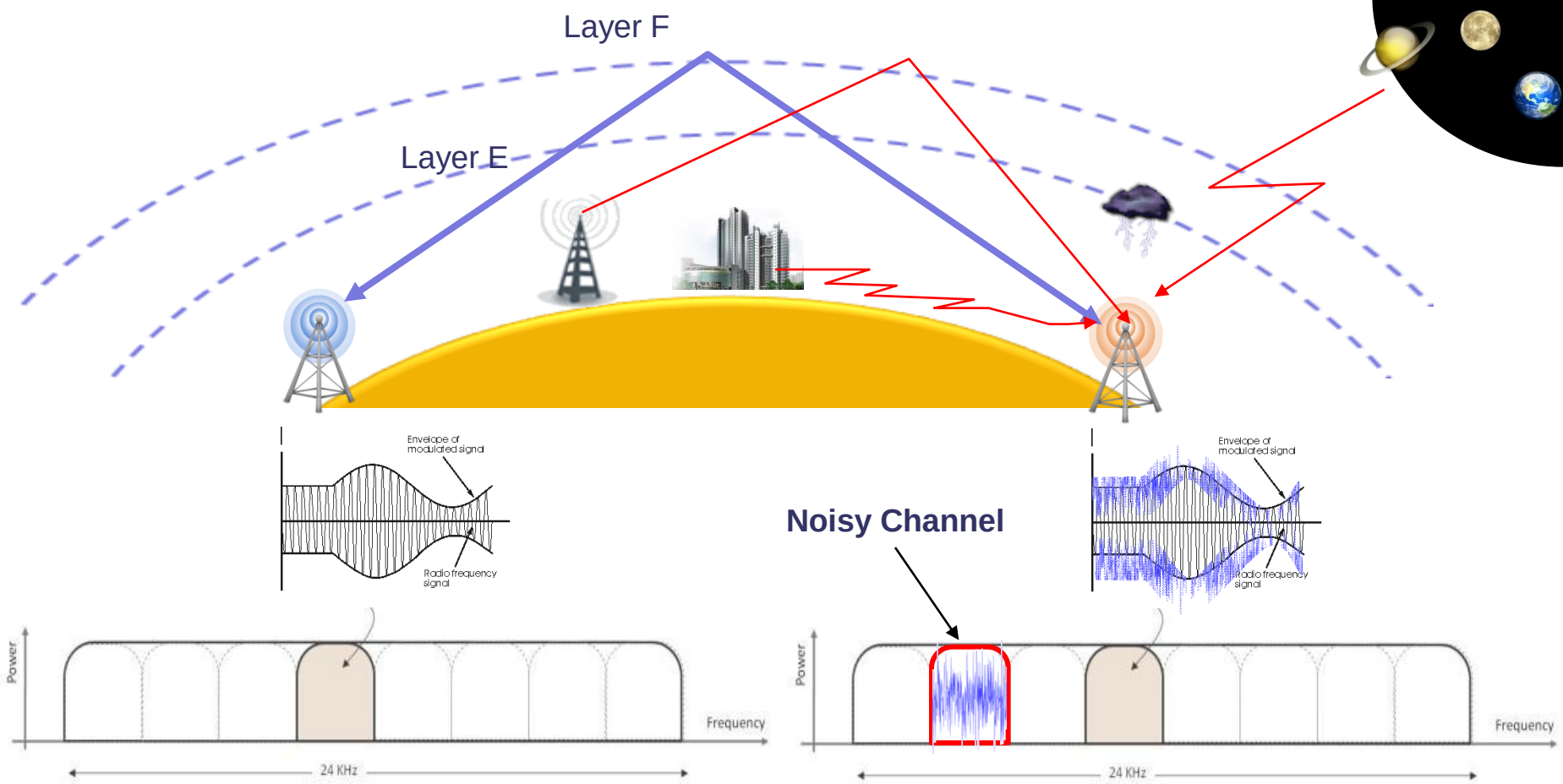


THE RESULT IS AN INAUDIBLE SIGNAL IN THE WORSE CASE

Noise effects

Noise

Noise in HF can occur from the space, the storm or from industrial activities

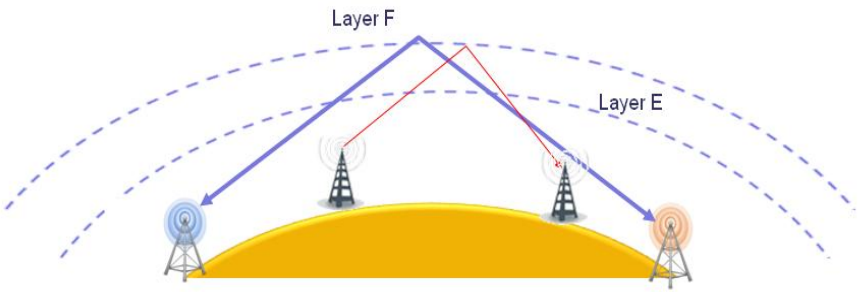


THE RESULT IS AN INAUDIBLE SIGNAL IN THE WORSE CASE

Occupied channel

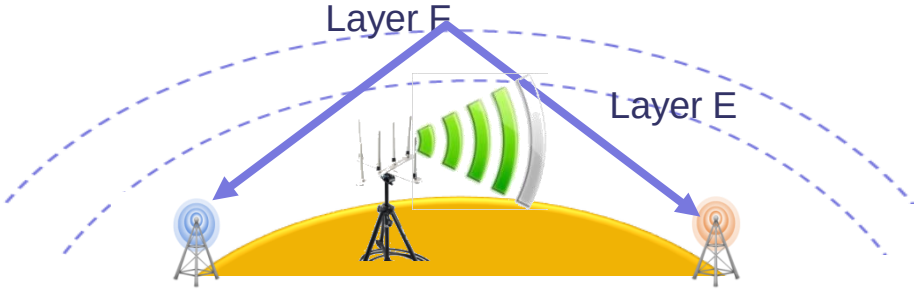
Occupied channel

Any HF channel can be used by an other user

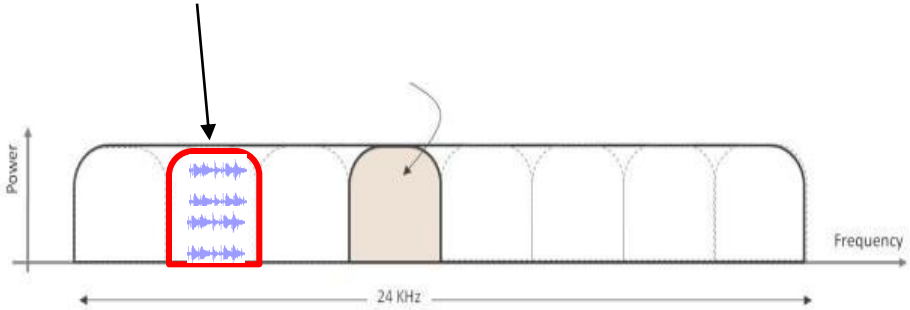


Jammed channel

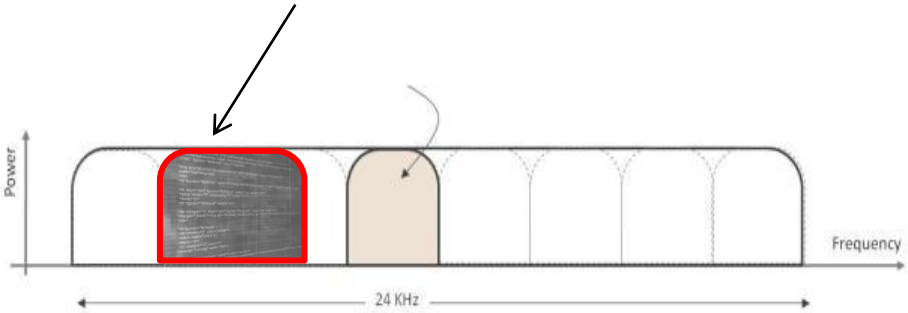
Presence of jammers



Occupied Channel



Jammed Channels

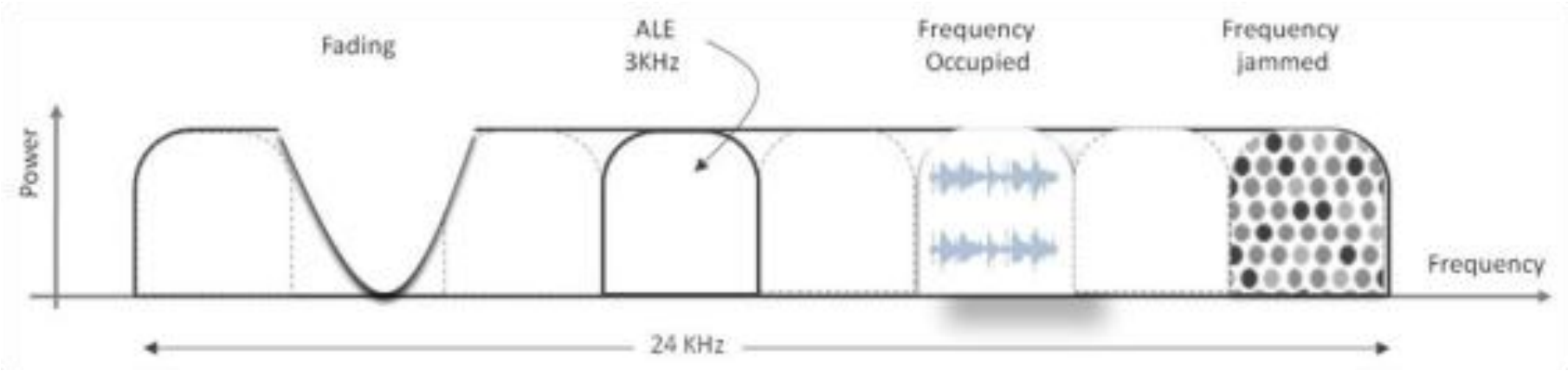


THE RESULT IS AN INAUDIBLE SIGNAL IN THE WORSE CASE

Wide band HF transmissions have to face some constraints linked to :

the HF propagation

and its use

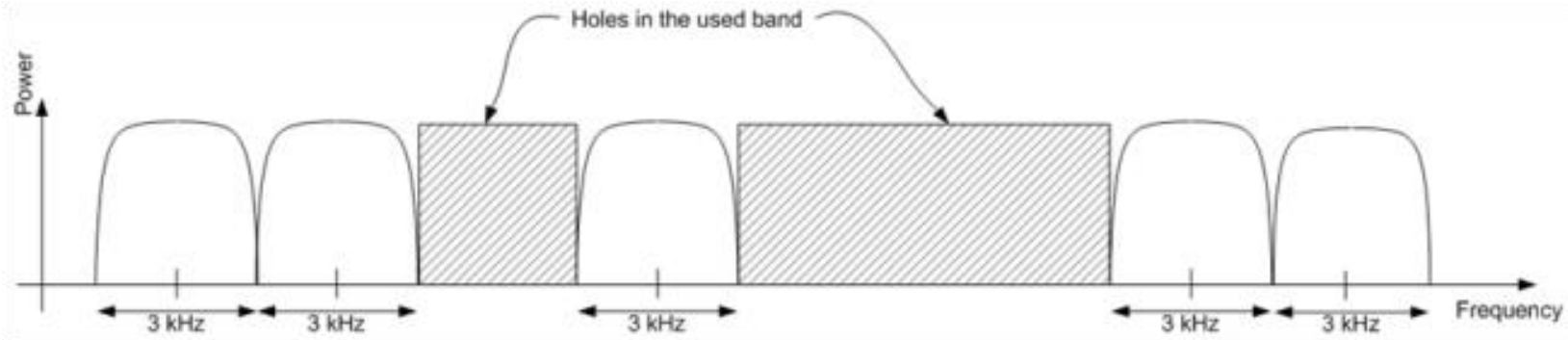


One way to avoid / minimize the HF constraints is to scan continuously the HF spectrum to identify the useable frequencies

Thales 4G solution called HF XL

Our proposal consists in :

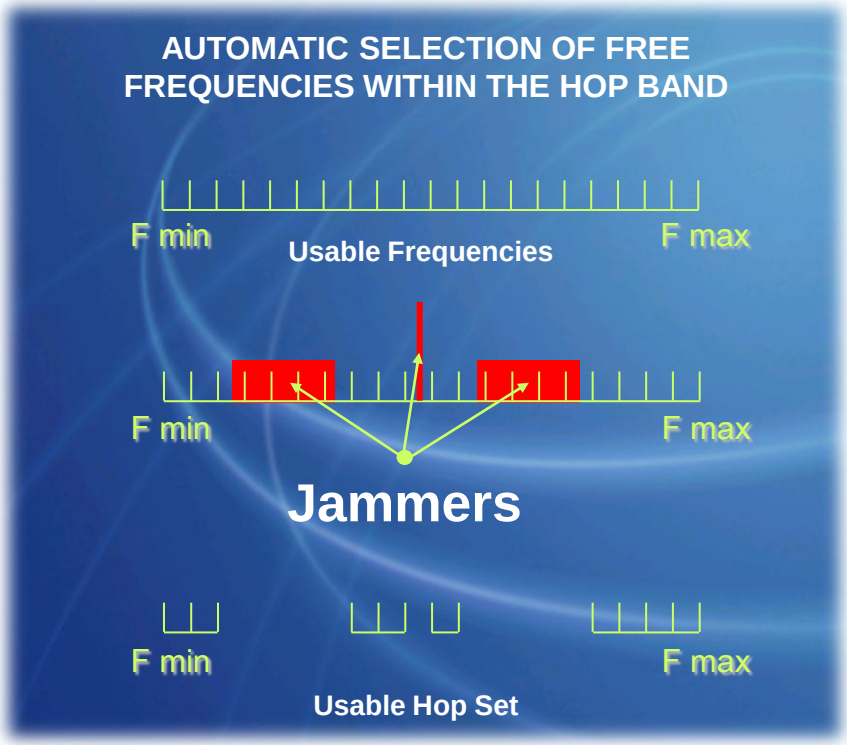
- **Cleaning the HF spectrum continuously**
- **Determining the available Frequencies**
- **Distributing the content over non contiguous channels (…or contiguous if it's possible)**

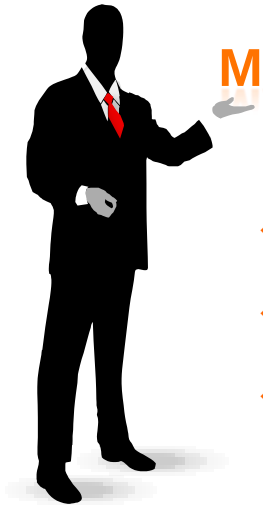


CLEANING SPECTRUM

HOW IT WORKS

- Generation of a hop set
- Analysis of the spectrum
- Cleaning of the hop set
- Broadcast the new free hop set





MAIN ADVANTAGES

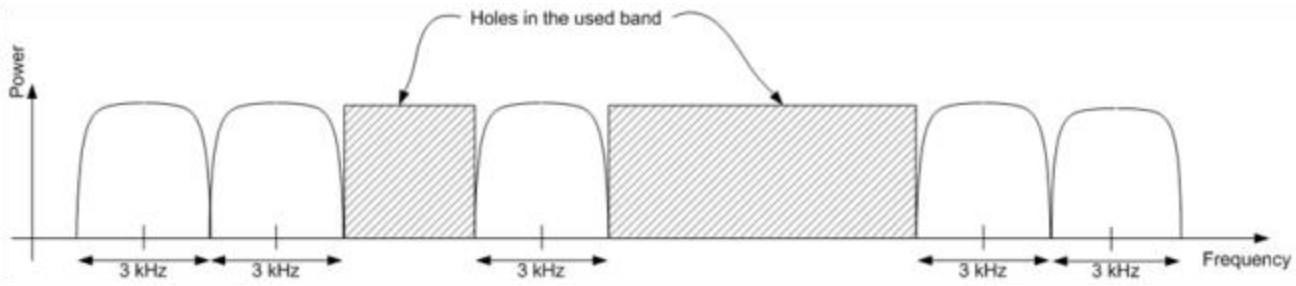
- **Speed up the ALE process**
- **Ensure a reliability of communication close to 100%**
- **Avoid the narrowband jammers or occupied frequencies**

With ALE → 100 % successful

4G SOLUTION HF XL

THALES PROPOSAL :

- Scan the HF spectrum and check on each the quality
- Perform independent channel modulation respecting the Stanag 4539
- Withdraw any channel with a low SNR
- Perform a dynamic process of channel selection



HF XL : an alternative solution for Wideband transmission

4G SOLUTION HF XL

ADVANTAGES :

- NO Issues of jammers or unwanted HF frequency occupation
- Automatic process that guaranties High level of QoS
- Re-Use of Current ST 4539
- Full Interoperability with legacy HF radio (if transmission on 1 channel or BLI)
- Offer potential high bit rate roughly 100 kbps with 24 KHz canalization

DRAWBACKS :

- Need higher power (6 dB back off)
- Need wideband antenna and antenna tuning box
- Digital processing is a little more complex than current (n x ST 4539) modem

4G SOLUTION HF XL

TO BE PERFORMED:

- Standardization of this process ..request will be sent to the NATO group
  - Light modification of the Stanag 4539 Autobaud for calling the HF XL

HF XL : FIRST RESULTS

One prototype is under tests today

- We have just started our measurement campaign and tested our solution
  - Over 300 km (from Thales headquarter to our production Site)
  - with no limitation of channel number

- We have used our broadband tactical antenna
- We have reused our tactical amplifier 400W with certain modifications

HF XL : FIRST RESULTS

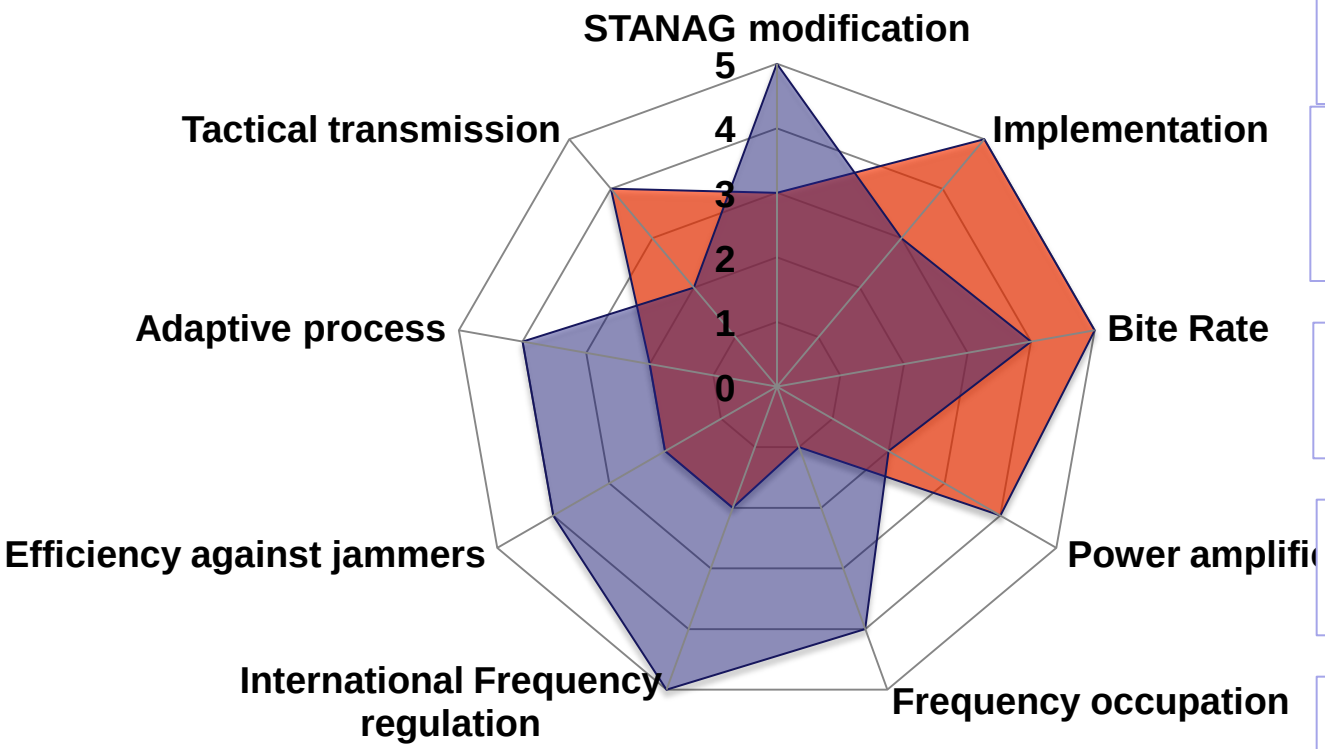
- **Results obtained:**
  - **max birate during certain periods of the day : 138 kb/s (TEB <10^{-5})**
    - **15 channels used**
  - **64 kb/s bitrate (TEB <10^{-5}) obtained regularly during the day**
    - **8 to 15 channels used**

NEXT STEP

- **Confirm our results over 1000 km**

COMPARAISON MIL 110C VERSUS THALES PROPOSAL

MIL STD 110C versus HF XL



Stanag modification
Mil 110C :Medium
HF XL: light

Tactical transmission
Mil 110C : well adapted to tactical
HF XL: better adapted to high power transmission (back off)

Bite Rate
Mil 110C : < 100 Kbps
HF XL : could be higher if nb channel > 8 …138Kbps 15 Channels

Implementation
Mil 110C : easier modification
HF XL : more sophisticated

Adpative process
Mil 110C : No
HF XL: Yes continuously

Efficiency against Jammers
Mil 110C : No
HF XL: High/ Adaptive allocation

International regulation
Mil 110C :mandatory for eight channels
HF XL: no need

Power amplification
Mil 110C :mandatory mono carrier
HF XL: need 6 db back-off ..multicarrier

THALES POSITION FOR THE FUTURE 4G HF NETWORK

- Thales is developing both Solutions
- All solutions have advantages and issues to be fixed
- Thales proposal will be fully checked within 2012

Next “rendez vous” in 2012 for a test over 1000 km with the maximum channels available over H24

THANK YOU

FOR YOUR ATTENTION

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