



THE EFFECT OF COMMUNICATION EQUIPMENT ON AVALANCHE TRANSCEIVERS

ICAR CONVENTION 2018

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Chamonix, October 2018

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THE EFFECT OF COMMUNICATION EQUIPMENT ON AVALANCHE TRANSCEIVERS



INTRODUCTION

GOAL OF THIS PRESENTATION

**The interfering impact
of handheld radio transceivers
to avalanche transceivers**

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INTRODUCTION

AVALANCHE TRANSCEIVERS

Designed to search for buried subjects
Companion Rescue

International standardized frequency (457 kHz)
ETSI EN 700 318

Receiving transceiver follows the flux lines of the
magnetic field to the transmitting transceiver



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INTRODUCTION

COMMUNICATION EQUIPMENT

In recent years, users of avalanche
transceivers have started to replace their
current **analog communication equipment**
with **devices for digital radio networks.**



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INTRODUCTION

ELECTROMAGNETIC NOISE

Any type of electronic device
emits electromagnetic noise*



*even if the devices are tested to international EMC standards

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BACKGROUND

COMMUNICATION EQUIPMENT

Today, different generations of radio transceivers are in use,
simple analog and **complex digital devices**.

In this context: “**analog**” and “**digital**” are vague specifications,
since **every emitted signal is analog**.

The **channel access mode** makes the difference.

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BACKGROUND

CHANNEL ACCESS MODES

Frequency Division Multiple Access (FDMA)

- Frequency modulation (FM) of the analog microphone signal processing

Tetrapol, International Network Standard

Polycom, Swiss Network



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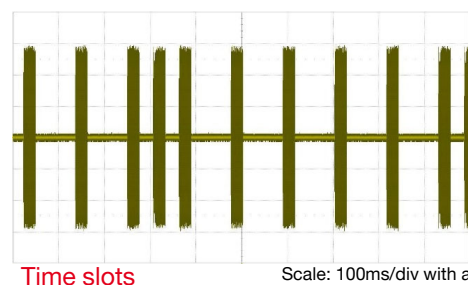
BACKGROUND

CHANNEL ACCESS MODES

Time Division Multiple Access (TDMA)

Phase modulation (PM) of the microphone signal processing in a digital data stream

Tetra, ETSI Network Standard
(ETSI Certified Standard)



Scale: 100ms/div with a
time slot length of 14 ms

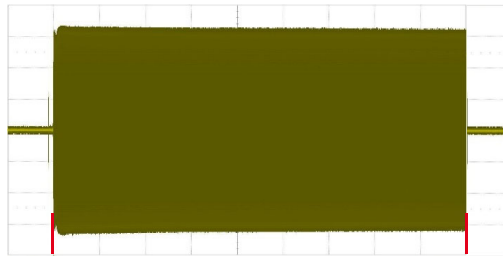
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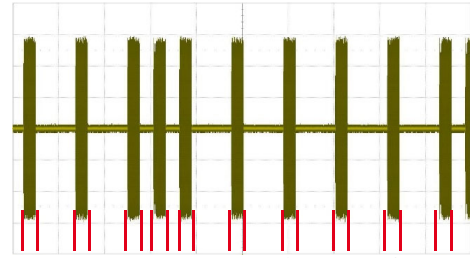


BACKGROUND

CHANNEL ACCESS MODES

**FDMA**

continuous carrier

**TDMA**

pulsed carrier

Scale: 100ms/div with a
time slot length of 14 ms

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METHODS

TEST ARRANGEMENTS

Radio transceivers placed in different positions and various antenna orientations to the avalanche transceiver

A loop antenna is used for generating an avalanche transceiver signal*



*equal to a distance of 45 m

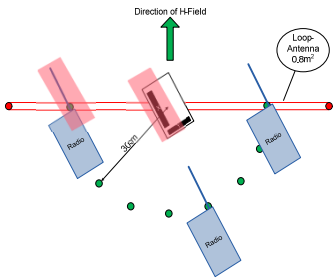
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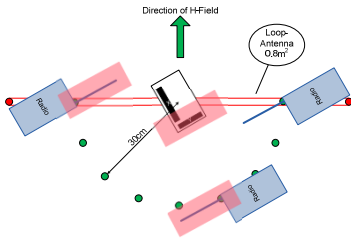


METHODS

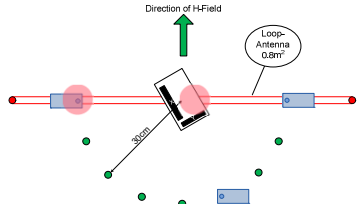
TEST ARRANGEMENTS



Parallel to
X-antenna



Parallel to
Y-antenna



Parallel to
Z-antenna

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METHODS

TESTED RADIO TRANSCEIVERS

Brand	Model	Modulation	Frequency [MHz]	Tx Power [W]
Motorola	GP380	FM	145	1
			173	5
Motorola	DP3441e	FM	155	5
Midland	M-99S	FM	446	0.5
TEAM	TeCom-X5	FM	476	4
Sepura	STP9038	Tetra	390	1.8
Motorola	MTP3550	Tetra	421	1.8

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METHODS

TESTED
AVALANCHE
TRANSCEIVERS

Brand / Model	SW Rev.
Mammut Barryvox S	3.0
Mammut PULSE Barryvox	4.0
Pieps Micro	2.5
Pieps DSP Pro	2.0
Arva AXIO	1.5
Arva Neo	2.0
Ortovox S1+	2.0
Ortovox 3+	2.1
Tracker 3	1.1

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RESULTS

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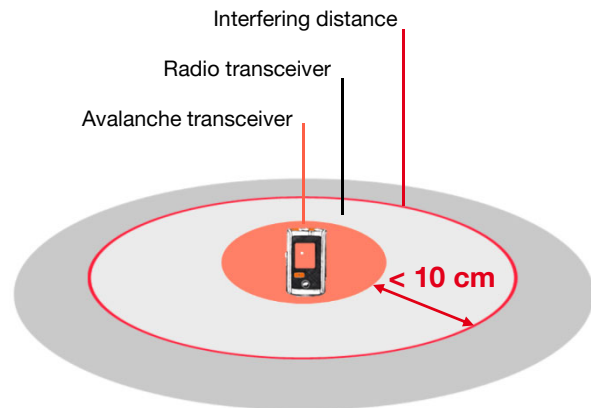


RESULTS - *SEND MODE*

INFLUENCE OF RADIO IN TRANSMIT MODE

Interference has been observed
For some of the tested avalanche
transceivers

- **At less than 10 cm between
both devices**



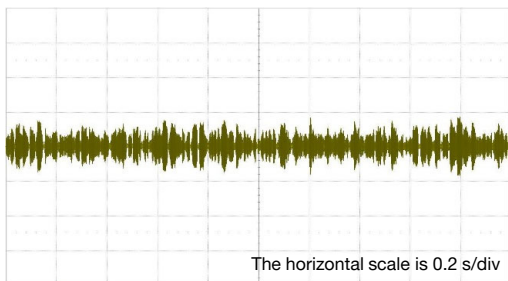
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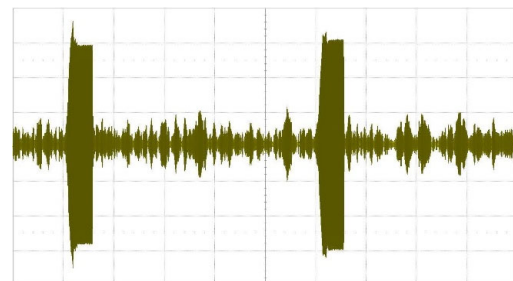


RESULTS - *SEARCH MODE*

BACKGROUND MEASUREMENT



White noise of a Pulse Barryvox
w/o any signal from a buried
avalanche transceiver



PULSE Barryvox signal when a
buried avalanche transceiver is
present

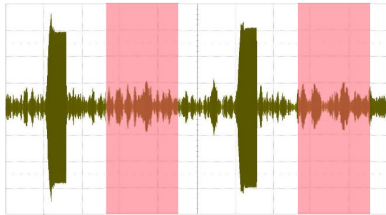
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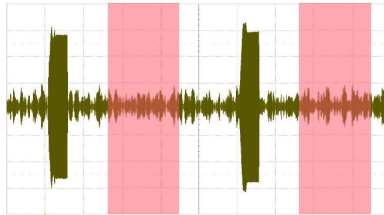


RESULTS - *SEARCH* MODE

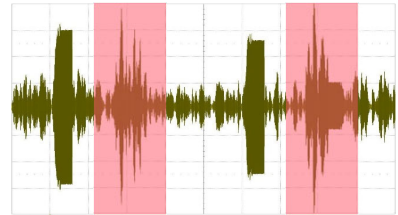
*INFLUENCE OF TETRA RADIO IN **STANDBY** MODE*



Signal when a buried subject is present



Tetra radio in **standby** mode at a distance of 30 cm



Tetra radio in **standby** mode at a distance of 15 cm

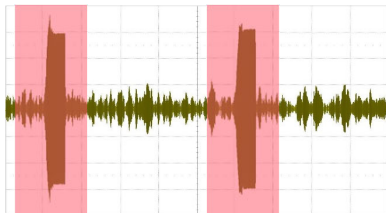
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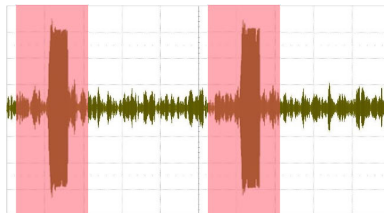


RESULTS - *SEARCH* MODE

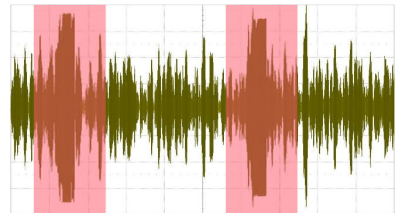
*INFLUENCE OF TETRA RADIO IN **TRANSMIT** MODE*



Signal when a buried subject is present



Tetra radio in **transmit** mode at a distance of 30 cm



Tetra radio in **transmit** mode at a distance of 15 cm

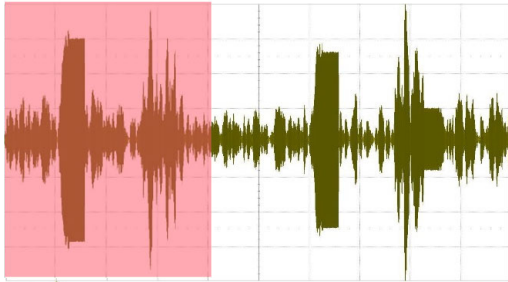
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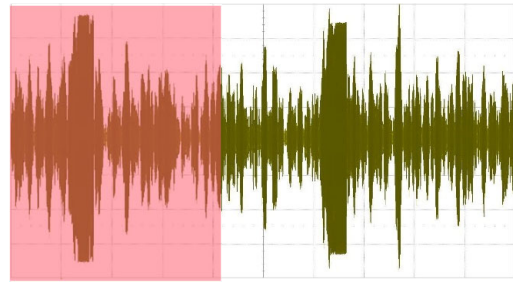


RESULTS - SEARCH MODE

INFLUENCE OF TETRA RADIO AT A DISTANCE 15 CM



Tetra radio in
standby mode at a
distance of 15 cm



Tetra radio in
transmit mode at a
distance of 15 cm

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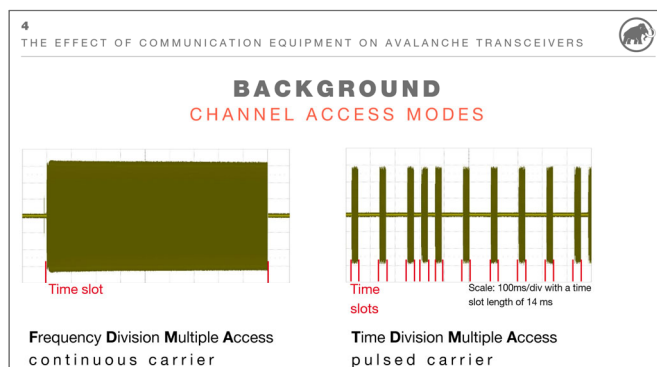


RESULTS - SEARCH MODE

INFLUENCE OF COMMUNICATION EQUIPMENT

The **interfering impact** of a radio transceiver **depends on the channel access mode** of the radio network:

- TETRAPOL, POLYCOM (FDMA)
- TETRA (TDMA)



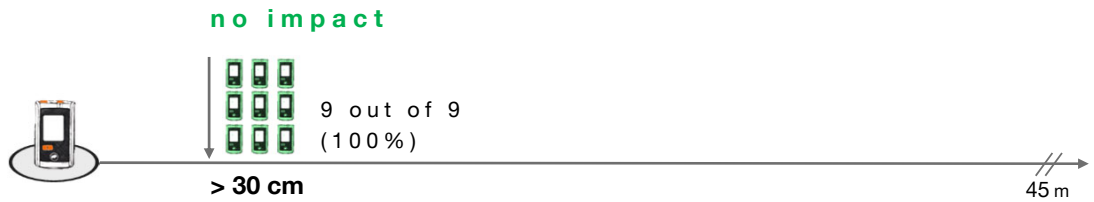
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RESULTS - SIGNAL SEARCH

INTERFERING IMPACT **FDMA** RADIO NETWORKS



**TETRAPOL
POLYCOM**

RADIO NETWORK, in transmit mode



without applied avalanche transceiver signal

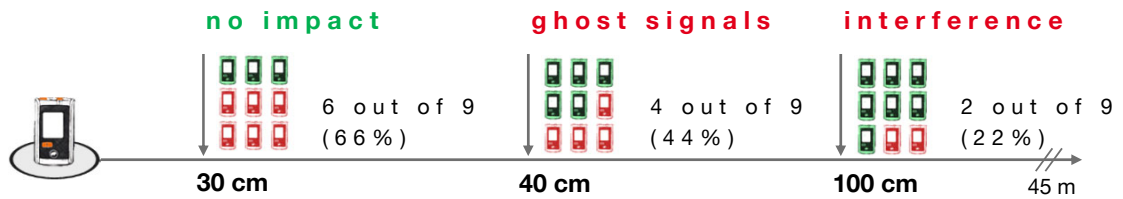
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RESULTS - SIGNAL SEARCH

INTERFERING IMPACT **TDMA** RADIO NETWORK



TETRA

RADIO NETWORK, in transmit mode



without applied avalanche transceiver signal

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VIDEO - SIGNAL SEARCH

INTERFERING IMPACT TDMA RADIO NETWORK



TETRA

RADIO NETWORK
in transmit mode



without applied
avalanche transceiver signal



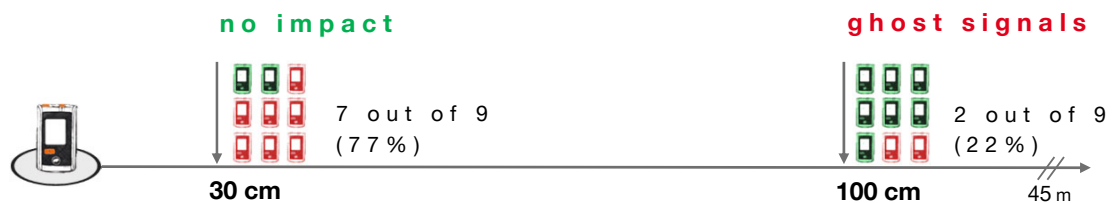
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RESULTS - COARSE SEARCH

INTERFERING IMPACT FDMA RADIO NETWORKS



**TETRAPOL
POLYCOM**

RADIO NETWORK, in transmit mode



with applied avalanche transceiver signal

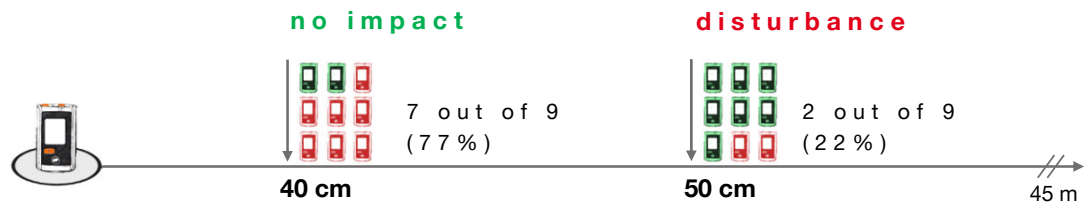
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RESULTS - COARSE SEARCH

INTERFERING IMPACT TDMA RADIO NETWORK

**TETRA**

RADIO NETWORK, in transmit mode



with applied avalanche transceiver signal

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VIDEO - COARSE SEARCH

INTERFERING IMPACT TDMA RADIO NETWORK

**TETRA**RADIO NETWORK
in transmit modewith applied
avalanche transceiver signal

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RESULTS - *SEARCH* MODE

INFLUENCE OF COMMUNICATION EQUIPMENT

Outcome: based on the results it became obvious that

the interfering impact of radio transceivers

to avalanche transceivers

is different between FDMA and TDMA radio networks.

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CONCLUSION

INFLUENCE OF COMMUNICATION EQUIPMENT

IN GENERAL

Follow the manufacturers recommendations for handling interfering objects

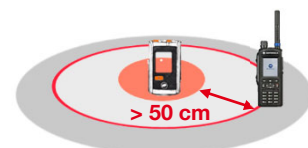


BARRYVOX RECOMMENDATION

SEND Mode
Keep a **minimum distance of 20 cm**



SEARCH Mode
Keep a **minimum distance of 50 cm**

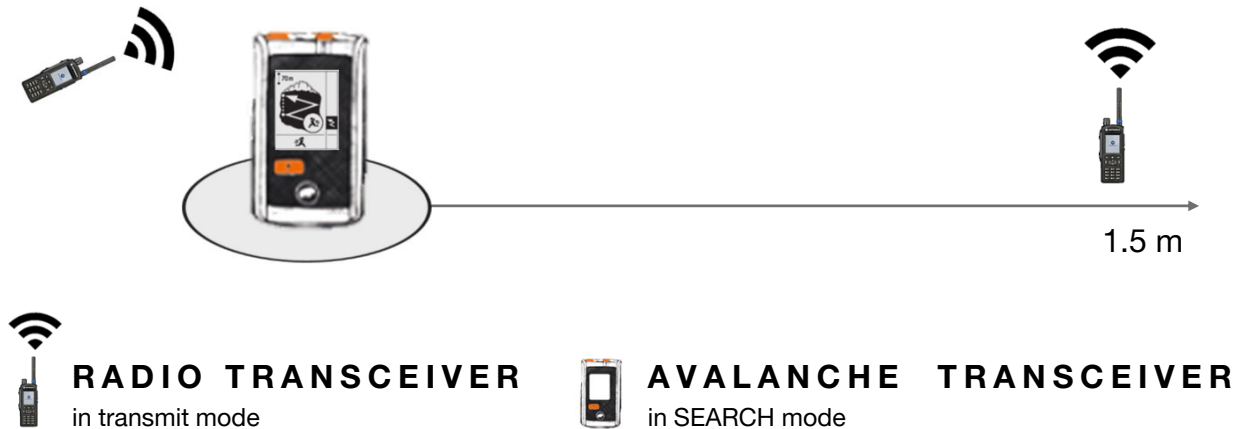


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BEST PRACTICE TO VERIFY INTERFERING OBJECTS



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FUTURE PERSPECTIVE COMMUNICATION EQUIPMENT

PRESENTATION WRAP UP

In the future the use of TDMA based radio transceivers will become even more commonplace for rescue organizations and professional operations.

Users of such communication equipment should be aware of the interfering impact of TDMA based radio transceivers on receiving avalanche transceivers during a search.

