

# Interfacing 2-way Radios with a 4-wire Communication System

Duncan Lang

BSc (Hons) Live Sound Technology

## INTRODUCTION

With live events becoming ever more popular, whether that be theatre, concerts or broadcasted live events, it becomes more important to have a reliable communication system. If the communications fail, it can be a major issue. Many large-scale productions may have a significant number of people they wish to have on one communications (comms) system, potentially leading to a large expense of hiring of equipment.

Interfacing 2-way radios may be essential to a production keeping to budget, especially when a lot of the crew may require a radio as well as a comms pack. One channel of the radio can be utilised for comms and the remainder can be used as they normally would for the various departments. This can make the radios have two uses, making them a more useful asset to a production or venue than wireless comms packs.

## METHODOLOGY

The design of the device was based on a schematic which showed the basic electronics, and allowed a decision to be made as to whether or not to use a circuit board. The device was also set to have only one set of radios work with it, so no changeable functions were required. The circuit diagram can be seen in Figure 1.

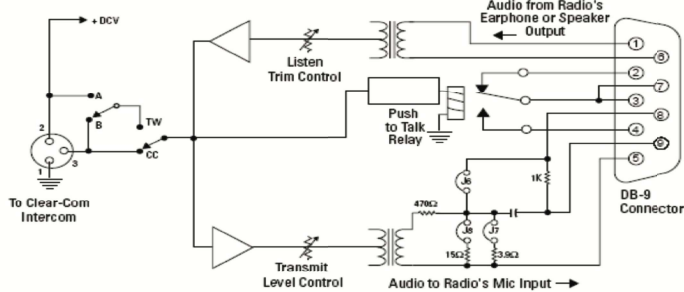


Figure 1 - TW-47 Circuit Diagram (Clear-Com 2007)

The actual device would have been encased in a varnished wooden box, which would have dove-tail joints to provide a secure and safe place to store the device.

Utilising the pin-out to the radio headset from the same document that the device schematic was found in, made things easier, not having to work out the method that the Retevis RT24 uses to key its transmitter.

These radios were chosen for reasons such as price, and ease of connectivity to their accessories.

The communication unit chosen was the Clear-Com FreeSpeak II system, for ease of access (as the university has one available), unlike a Riedel or RTS system which would require hiring. It was also chosen for usability (as it is 'programmed' through an internet page, as well as prior knowledge of the system).

## STANDARDS

Standard	Does it apply?	Reference
EN55103 Part 1 - Emissions	No, states that "This does not apply to: Consumer apparatus designed for security systems, and Apparatus designed for radio communications purposes".	(BSI Standards Limited 2009)
EN55103 Part 2 - Immunity	No, states that "This does not apply to: Consumer apparatus designed for security systems, and Apparatus designed for radio communications purposes".	(BSI Standards Limited 2009)
2004/108/EC	Yes, but the equipment to test the Electromagnetic Capability of a device is not easily accessible	(European Parliament, Council of the European Union 2004)
2006/95/EC	No, as it only applies to equipment operating between "50 - 1000 V AC and between 75 and 1500 V DC".	(European Parliament, Council of the European Union 2006)

## SYSTEM INTEGRATION

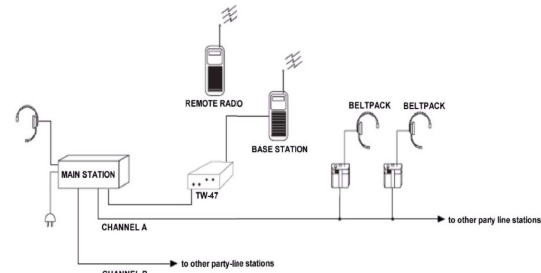


Figure 2 - Potential Circuit Integration (Clear-Com 2007)

You can see in Figure 2 one possible integration for a device similar to the one that was going to be made. While this image shows a 2-wire system, the connections could be into a matrix unit, allowing for many more connections than just a simple 2-wire system shown above. It could also be connected by a 4-wire connection using a 2-wire to 4-wire converter.

## TESTING

There were various tests planned, including Input and Output Frequency Response, Signal to Noise Ratio, Input and Output Distortion and Input and Output Impedance. It was also planned to test speech intelligibility, both for the electronics and the radios.

There was a lack of results for the virtual testing, which was due to utilising circuitlab.com. This turned out to be a less suitable option when compared to MATLAB.

## CONCLUSION

This project has provided some discussion points, such as future developments for the project, and how to improve the design and build process of the device. It has led to thoughts about improvements to the project, which includes the ability to add another channel to the device if required..

## Acknowledgements

I would like to thank Paul Bourne for his efforts and guidance in completing this project.

## References

- BSI STANDARDS LIMITED, 2009a. BS EN 55103-1:2009+A1:2012. London: BSI STANDARDS LIMITED, 2009b. BS EN 55103-2:2009. London: CLEAR-COM, 2007. Clear-Com TW-47 Two-Way Radio Interface Instruction Manual. Alameda: Vitec Group Communications Ltd
- EUROPEAN PARLIAMENT, COUNCIL OF THE EUROPEAN UNION, 2004. DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC. Brussels: European Union
- EUROPEAN PARLIAMENT, COUNCIL OF THE EUROPEAN UNION, 2006. DIRECTIVE 2006/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits. Brussels: European Union