

# ICOM IC-9100 Modification

Application Note

**WAVECOM**  
NACHRICHTENTECHNIK

## Introduction

With a few, simple modifications, the ICOM IC-9100 amateur radio transceiver is well suited for remote monitoring with W-CLOUD. The modifications will provide a new 36 kHz IF output and expand the receiving frequency range considerably. The receiver functions are controlled via ICOM's RS-BA1 remote

control client-server application, whereas the monitored signal at IF level is transferred using W-CLOUD in high-quality I/Q format. This solution ensures that all HF, VHF and UHF modes and all analysis functions are fully available.

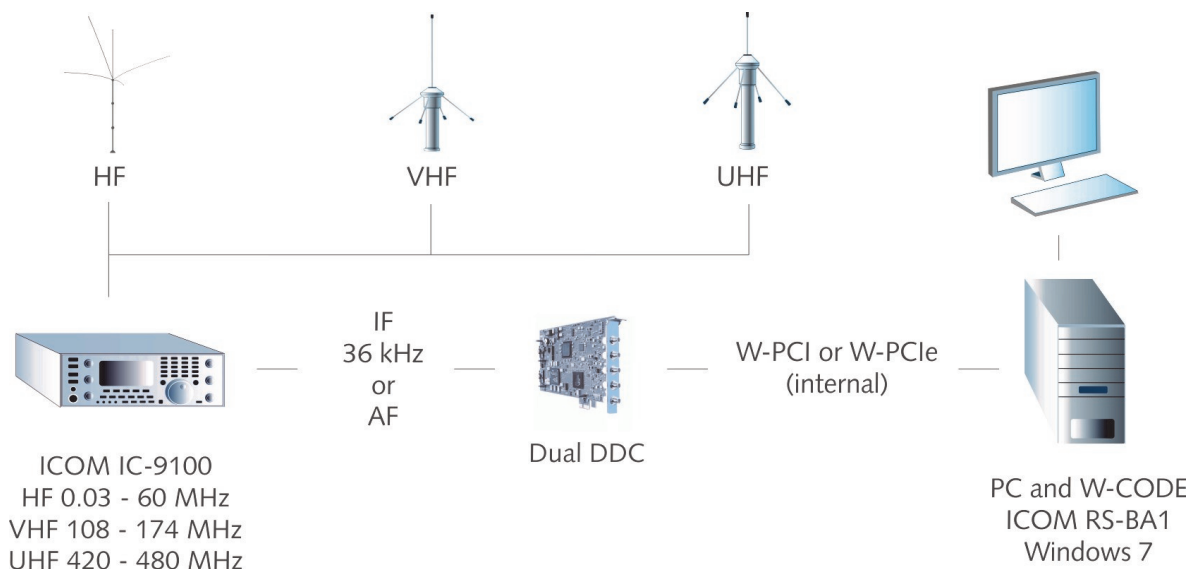
## Modification of IC-9100

RS-BA1 transfers the compressed AF signal of a remotely monitored emission. However, the transfer is compressed using a lossy algorithm, which means that the signal cannot be fully exploited for decoding and analysis.

In addition to HF monitoring, IC-9100 can also be used in the VHF and UHF ranges where many data

transmission modes. To optimally decode these signals the output of the receiver must be presented to the decoder in an IF sourced I/Q format.

For the IC-9100 this means that the 36 kHz IF output of the transceiver must be forwarded to the DDC (Digital Down Converter) of a W-PCI or W-PCIe decoder card for transformation into I/Q data.



*The illustration shows a possible receiver configuration after the modification. Data is transferred in high quality I/Q format from W-CLOUD to the final destination via the Internet or a wired or wireless LAN.*

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### Where To Make The Modification

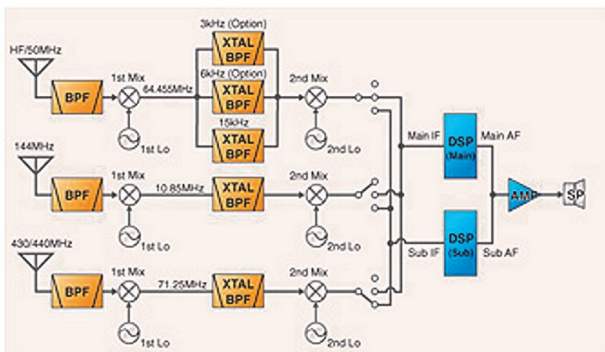
For the IF output modification, the "ICOM® SERVICE MANUAL HF/VHF/UHF Transceiver IC-9100" should be consulted and the modification should be undertaken by an experienced service engineer.

### How To Make The Modification

The IC-9100 36 kHz final IF is produced by the receiver DSP, but the signal paths differ depending on the reception frequency in question refer to the transceiver schematics below for the subsequent discussion.

For 2 m signals (145 MHz) the 1<sup>st</sup> IF is 10.850 MHz. The signal passes a 15 kHz quartz filter FI331 and is then down-mixed to 36 kHz (designation VRIF).

For 70 cm signals (435 MHz) the 1<sup>st</sup> IF is 71.250 MHz. The signal passes a 15 kHz quartz filter FI731 and is then down-mixed to 36 kHz designation URIF). VRIF and URIF are routed via the MAIN and SUB frequency band switches.



For the modification described in this application note, the MDRIF signal is the signal of interest (Main Band Path) whereas the Sub Band Path is unaffected. If required it is however possible to include the sub band given that the new W-PCI and W-PCI decoder cards offer two independent Digital Down Converter (DDC) inputs.

Referring to the schematic, IC4605 serves as an analog switch for the RX MUTE function, which acts as

Certain ICOM distributors may also be able to undertake this modification in which case the warranty of the receiver would not be void.

a calibration of the DC offset of the A/D converter. As the signal has a relatively high impedance, it should not be extracted from this point.

IC4602 and IC4603 shift the signal phase for the AINL+ and AINL- inputs of the A/D converter (ADC/CODEC). The circuit also serves as a buffer and a low-pass filter for the HF components of the signal.

The signal is available at IC4603 PIN 1 with zero phase shift and a very low impedance, which makes this PIN the best point for extracting the signal. The low-impedance op-amp output also prevents stray radiation from entering.

The 36 kHz IF signal is extracted through a 100 Ohm resistor and a non-polarized 1 uF capacitor in series. A shielded cable should be used for connecting the signal to the output connector.

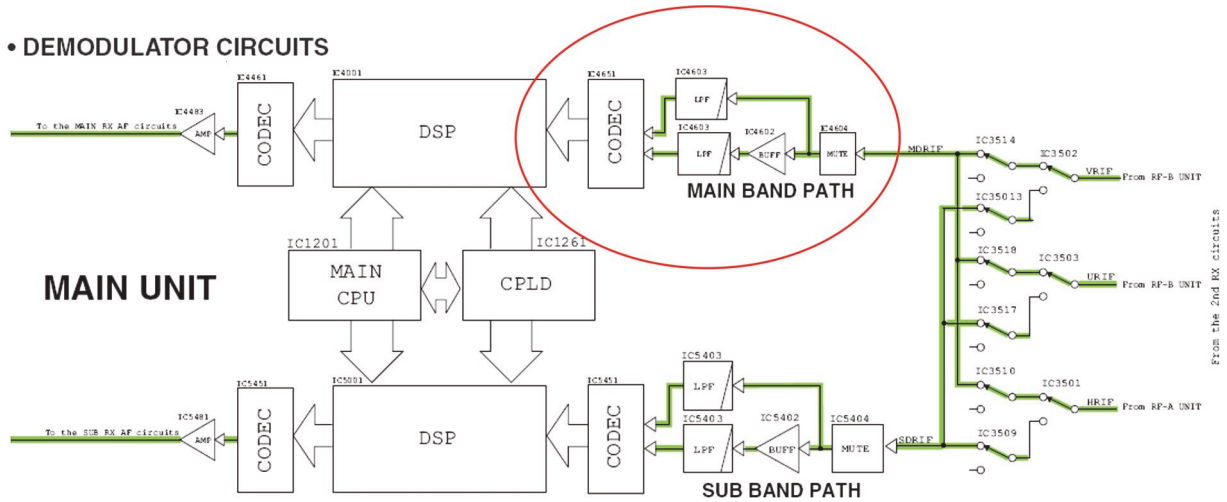
The IF filters limit the VHF and UHF bandwidth to 15 kHz. Due to the requirements of AM and SSB, the level of the 36 kHz IF signal is linearly proportional to the input signal and therefore this 36 kHz output cannot be compared to the 455 kHz limiter-amplifier IF outputs of earlier receivers. The special nature of the 36 kHz output makes the GAIN setting of the W-PCI card somewhat complicated.

Similar to the characteristics of the IC-9100 36 kHz output, the 10.7 MHz IF output of the ICOM IC-9500 is also linearly proportional to the input signal. And similarly the GAIN setting is also difficult. Attention should therefore be paid to the fact that the AUTO GAIN mode of W-PCI and W-PCIe only works partially with the IF outputs of IC-9100 and IC-9500 receivers. Wavecom is in the process of optimization of this GAIN setting.

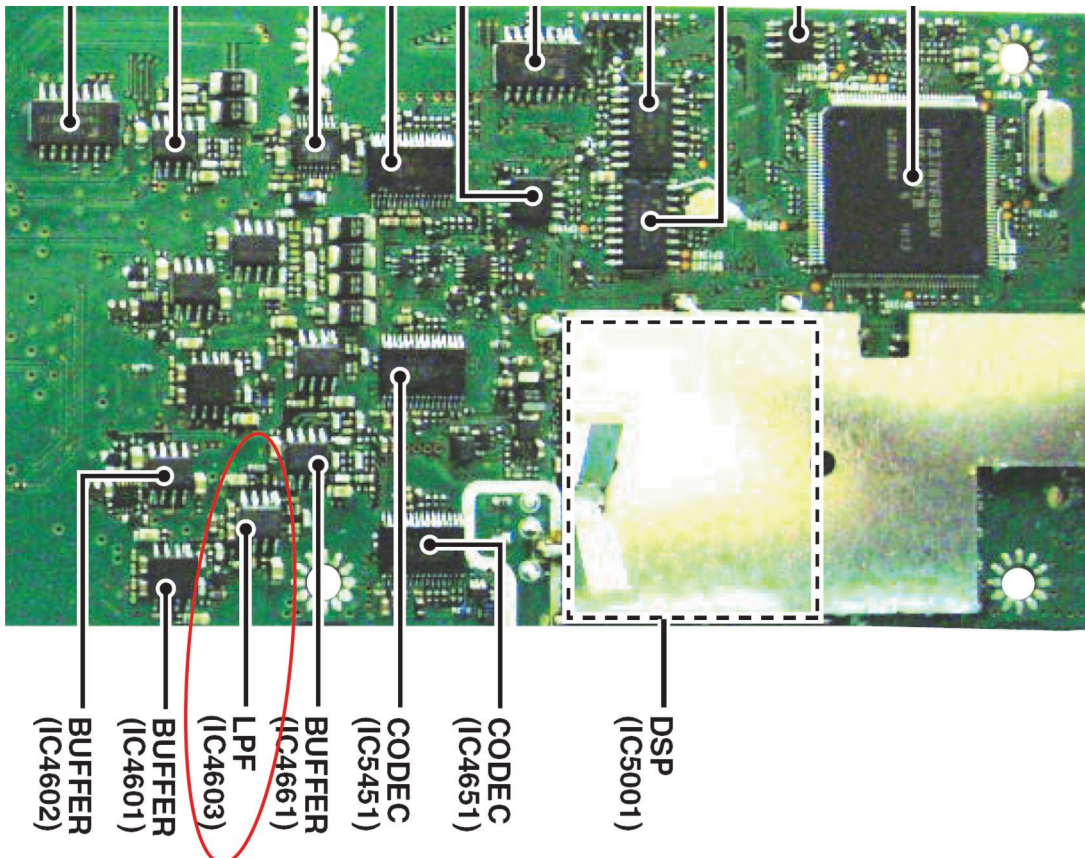
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## Functional Overview, Main Band Path (IF) (see service manual, p.3-4)



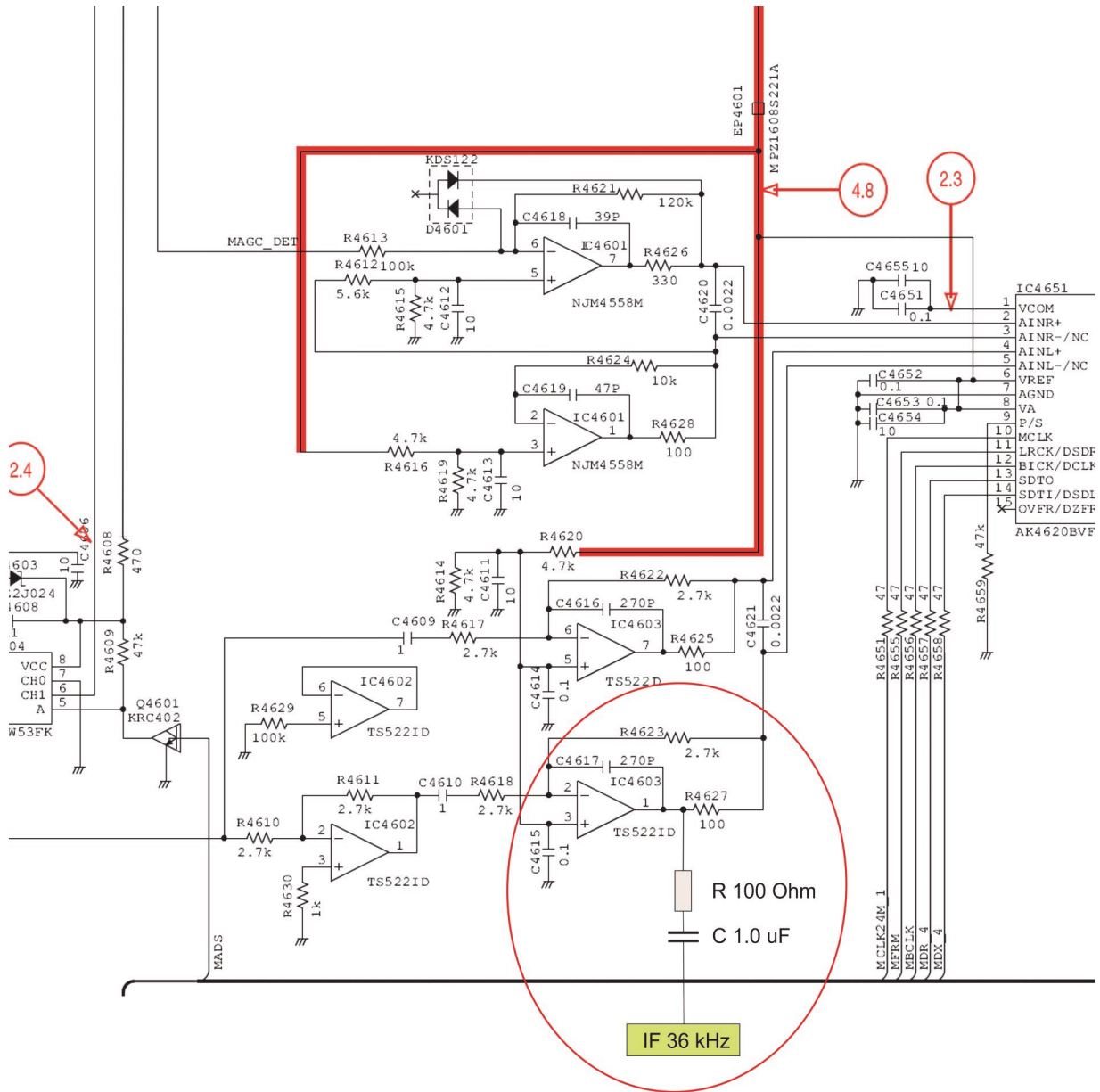
## PCB view IC4603 Low-Pass Filter (see service manual p.2-3)



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## Modification for 36 kHz IF output (see service manual p.10-7)



### Galvanically Separated Power Supply

The first modification experiments with the IC-9100 produced strong interference signals (birdies). The problem was solved by inserting a simple mains transformer i.e. 230 V-to-230 V AC) with galvanic isolation between the W-CLOUD host

power input plug and a power wall outlet or power distribution strip. This measure prevents unwanted ground loop feedback. Also it should be emphasized that antennas must be well grounded.



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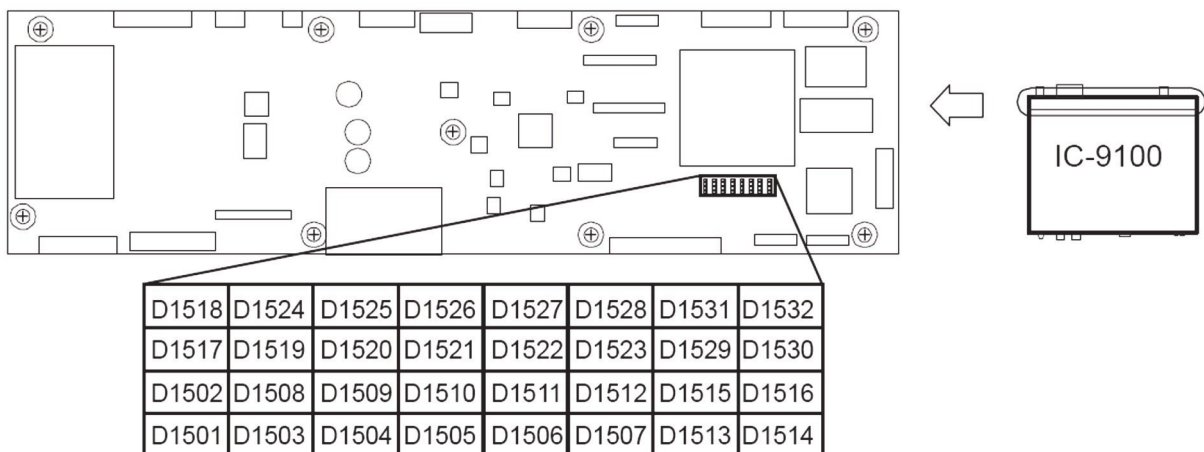
## IC-9100 Receiving Frequency Range Expansion

A simple removal of two diodes enables a considerable expansion of the receiving range of the IC-9100. After the modification the ranges will be:

- HF band: 0.03–60.0 MHz
- VHF band: 108.0–174.0 MHz
- UHF band: 420.0–480.0 MHz
- SHF band: 1240.0–1320.0 MHz (optional unit)

## Overview of the TX/RX modification diodes

MAIN unit (top side)



Remove D1504 and D1505 as shown below

D1518	D1524	D1525	D1526	D1527	D1528	D1531	D1532
D1517	D1519	D1520	D1521	D1522	D1523	D1529	D1530
D1502	D1508	D1509	D1510	D1511	D1512	D1515	D1516
D1501	D1503	<b>D1504</b>	<b>D1505</b>	D1506	D1507	D1513	D1514

Remove D1504 and D1505

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Since more than thirty years Wavecom Elektronik AG has developed, manufactured and distributed high quality devices and software for the decoding and retrieval of information from wireless data communication in all frequency bands. The nature

of the data communication may be arbitrary, but commonly contains text, images and voice. The company is internationally established within this industry and maintains a longstanding, world-wide network of distributors and business partners.

### Product Information

Products	<a href="http://www.wavecom.ch/product-summary.php">http://www.wavecom.ch/product-summary.php</a>
Datasheets	<a href="http://www.wavecom.ch/brochures.php">http://www.wavecom.ch/brochures.php</a>
Specifications	<a href="http://www.wavecom.ch/product-specifications.php">http://www.wavecom.ch/product-specifications.php</a>
Documentation	<a href="http://www.wavecom.ch/manuals.php">http://www.wavecom.ch/manuals.php</a>
Online help	<a href="http://www.wavecom.ch/content/ext/DecoderOnlineHelp/default.htm">http://www.wavecom.ch/content/ext/DecoderOnlineHelp/default.htm</a>
Software warranty	One year free releases and bug fixes, update by DVD
Hardware warranty	Two years hardware warranty
Prices	<a href="http://www.wavecom.ch/contact-us.php">http://www.wavecom.ch/contact-us.php</a>

### System Requirements

	<i>Minimum</i>	<i>Recommended</i>
CPU	P4 Dual-Core 2.4 GHz	Core i5 or Core i7 2.8 GHz
Memory	2 GB RAM	4 - 8 GB RAM
OS	Windows XP	Windows 7 32-bit or Windows 7 64-bit

### Distributors and Regional Contacts

You will find a list of distributors and regional contacts at <http://www.wavecom.ch/distributors.php>