ICOM

Vol.1

ICOM SHF Project

— Super High Frequency Band Challenge —

Dec 10, 2021

Icom Incorporated (Headquarters: Hirano-ku, Osaka, President: Hiroshi Nakaoka) has been doing technical research on a new project to create a product from scratch by utilizing our wireless communication technology knowhow cultivated over more than half a century.

Under the theme of "ICOM SHF Project – Super High Frequency Band Challenge –", we started to develop a new amateur radio available for use in the 2.4 GHz and 5.6 GHz bands.

Icom engineers are working hard to research and develop a number of never cleared challenges within the SHF band, such as large cable loss and higher frequency stability requirements. The ultimate goal is to bring it to the market as a new radio product.

Icom is striving to bring to you a new era in fun and possibilities of an SHF band amateur radio, which to date has had high technical and equipment hurdles to overcome, and we hope to make these bands more attractive and active so that anyone can easily operate on them. We are developing an epoch-making SHF band amateur radio that no one has never imagined before.

Please watch with intrigue as we continue with our new challenges, such as what kind of ideas and technologies will be implemented, and what kind of functions and designs will be used.

Icom Inc.

— SHF Project —

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Vol.2

ICOM SHF Project

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Feb 15, 2022

Two Technical Challenges to be Solved

When trying to operate in the SHF band, cable loss will be the biggest bottleneck.
For example, in the 5.6 GHz band, if a 30 meter long, 15 mm diameter high quality coaxial cable is used to connect between the antenna and transceiver, the cable loss will be 7.2 dB (at 5.6 GHz) and a 2 watt output from a transceiver will be reduced to 380 mW output from the antenna.

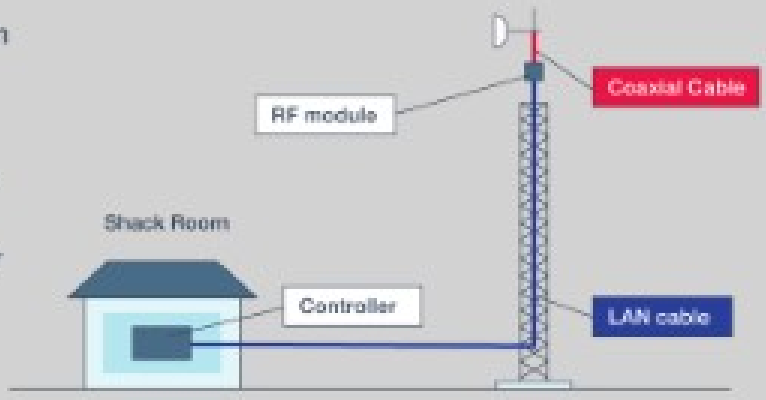
Another challenge in the SHF band is the ultimate frequency stability requirement.
For example, the IC-9700's frequency stability is about ±0.5 ppm, but ±0.5 ppm stability in the 5.6 GHz band means a 2800 Hz deviation. It is completely outside of the IF filter and cannot be demodulated in the SSB and CW modes. In other words, the practical frequency stability for SSB and CW mode in the 5.6 GHz band is about ±0.01 ppm or less. This is an extremely difficult level to achieve with an OCXO (Oven Controlled-crystal Oscillator).

Do Not Use a Long Coaxial Cable

The project team considered several ways to solve the cable loss issue. As a result, we decided to configure the RF module by directly placing it under the antenna and control it with a separate controller.

■System Configuration

Install the RF controller directly under the antenna and control it with a separate controller. A LAN cable is used to connect the controller to the RF module.



A LAN cable is used to connect the controller to the RF module. By using this kind of cabling set up, only a small length of a coaxial cable (about 30-40 cm) is required between the RF module and the antenna. Thus, only minimal loss occurs. For example, even if the controller and RF unit are separated by 30 meters, the loss from coaxial cable is still minimized, due to the short coaxial cable length.

Another Advantage of Using a LAN Cable

When installing the RF module directly under the antenna, the issue of how to supply DC power arises. Therefore, we decided to adopt PoE (Power over Ethernet) technology that supplies power over a LAN cable. Since Ethernet twisted pair wiring is limited to 100 meters, it is possible to install the RF module at a location 100 meters away from your shack (the controller).

By adopting PoE technology, the connection can be made with a single cable, and the RF module can be installed more freely. Moreover, the PoE technology makes it possible to supply power with low power loss. Normally, if the power cable is extended to 20 meters, the voltage drop will be too large for a 10 watt transceiver, and it will not operate properly. With PoE technology, DC power loss can be reduced by raising the voltage and reducing the current, so it is possible to supply stable power, even if the cable is long.

Ultimate Frequency Accuracy and Stability

Another challenge is frequency accuracy and stability. Even with a high-performance OCXO, frequency gradually changes due to temperature and aging. The annual deviation will be ±0.3 ppm and ±1.5 ppm in 10 years. At 5.6 GHz, the deviation will be as much as 8.4 kHz in 10 years. To solve this problem, we have adopted a method that uses a high-precision 1 Pulse-per-second (1PPS) clock signal from a GNSS (GPS) receiver to enable advanced frequency management. By synchronizing with this reference signal, the OCXO frequency can be compensated with high accuracy.

Have Fun with the SHF Band

The SHF band has many challenges, such as cable loss and frequency stability, so there are high hurdles for developing an SHF band transceiver. By clearing these issues, Icom will continue to develop further, so that more amateur radio operators can challenge SHF band operation and discover its enjoyment and potential.

ICOM

Vol.3

ICOM SHF Project

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April 15, 2022

Design Sketch for <SHF-P1> Concept Model

Releasing the <SHF-P1> Design concept for the Icom SHF Project. **This prototype model will be displayed at the Dayton Hamvention in Ohio, USA from 20th May 2022.**

Controller with Compact Size

The controller is designed based on the compact IC-705. The operation system is basically the same as the IC-705. The Real-time spectrum scope can be adjusted for various band spans.

■Controller

Front view

Front side (design sketch)

Back view

LAN cable connector

RF Module with 2.4 GHz/5.6 GHz and GPS Antenna Connectors

2.4 GHz and 5.6 GHz antenna connectors enable operation on two SHF bands. In addition to these connectors, there is also a GPS antenna connector. A high-precision 1 Pulse-per second (1PPS) clock signal from a built-in GPS receiver enables advanced frequency management.

■RF Module