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Notes on FT-991 schematic transceiver by SP5GNI

FT-991 ALL-BAND, MULTIMODE PORTABLE TRANSCIEVER

„The FT-991 is the next generation in all mode, all band MF/HF/VHF/UHF transceiver with C4FM (System Fusion) Digital capability. The FT-991 includes multi-mode operation on CW, AM, FM, SSB, and Digital Modes (Packet, PSK31, RTTY and C4FM), with 100 Watts of HF/50mhz Capability (50 Watts VHF/UHF).

The New FT-991 now includes a high-resolution full color 3.5" TFT Touch panel for superior operability and visibility, incorporating a High Speed Spectrum scope with ASC (Automatic Spectrum-scope control) built right in.

The FT-991 is designed for the most competitive operating situations, with a suite of new features to enhance the experience. Whether you primarily operate at home, mobile or in the field, the FT-991 will provide outstanding fundamental performance plus give you easy access to the full rangeof exciting modes available on the ham bands today".

HF receiver is a triple conversion radio with the first IF frequency 69.45 MHz. Almost all the signal path is realized with discrete components, mostly bipolar transistors, rarely FETs or dual gate MOS-FETs. Preamplifiers AMP1 and AMP2 works on microwave low noise transistors 2SC3356, and the first mixer 4x 2SK294 dual gate MOS-FETs. Double balanced mixer NJM2594V is utilized as well. The second IF is 9 MHz, and the third IF is 24 kHz.

RF input amplifier 145 MHz band uses dual MOS-FET type BF2030W, and for 430 MHz band the high-electron-mobility transistor (HEMT) NE3509M04. VHF/UHF receiver uses the same first, second and third IF frequency as HF part, except FM, where the second IF is 450 kHz. The FM demodulator is NJM2591.

Complexity of the circuitry is high, it is visible that the designers put a lot of work and have the good experience in RF design.

Heterodyne is done on ***Analog Device integrated circuits – DDS AD9834, PLL ADF4116***.

Typical and simple operation amplifiers LM2902/4 and analog switches HCT4052/3 are used in the schematic in high quantities.

As power audio amplifier works 5W AB class chip LA4425A form ON-Semi.

Dual-port USB 2.0 hub type USB2512 is connected from the one side to the USB connector. On the other side the first channel goes through USB-serial bridge to the main processor, and the second channel is connected to the ***audio codec PCM2903 (Texas Instruments)***. So for digital modes (RTTY, PSK etc.) using one USB cable connection for external computer should be fine.

The heart of the transceiver is high speed, floating point ***Digital Signal Processor TMS320C6746 form Texas Instruments*** (3000 MIPS, 2250 MFLOPS, 361 pins). The signal from the last 24 kHz IF is digitized by 24-bit analog-to-digital converter inside the ***audio codec CS4270 (Cirrus Logic)***. DSP is performing

signal processing in digital domain (interference rejection, filtering etc.). After the processing, the signal is converted back to analog via the same CS4270 codec.

The second DSP from ***Texas Instruments TMS320VC5509*** is dedicated only for the transmitter audio correction. It is not the newest chip, but still very powerful for audio equalizing and compression. It is connected to SSM2602 codec.

All the system is controlled via ***Renesans microcontroller R5F61665*** (32 bit core H8SX CISC, 50 MHz, 145 pin). It is equipped with a lot of peripherals, including AC and CA converters.

HF/50 MHz power amplifier is push-pull configuration with two ***MOS-FETs - RD100HHF1, and UHF with 2x RD07MUS2B, both from Mitsubishi***.

Automatic antenna tuner is based on relays. In my opinion it is the weakest part of FT-991, I would recommend to use an external tuner.

Basic summary and features of FT-991 you can find on follow link to the FT-991 Yaesu web site
lhttp://www.yaesu.com/indexVS.cfm?cmd=DisplayProducts&ProdCatID=102&encProdID=D24F60F33816ED8BE5568D7E2B5E2131&DivisionID=65&isArchived=0

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