Inside a WorldSpace satellite radio receiver

January 29, 2014
WoW is no longer operational. But I had a receiver lying around from when it was active. I opened it up and here is what I found in it:

Antenna Unit

Front Panel

Inside of the front
Mainboard with the various sections marked out

**STA001 – RF**

**Frontend for Digital Radio**

- Single chip receiver for
satellite digital transmission

- Superheterodyne receiver with IF output
- High input intercept point, low Mixer noise

- 54db IF VGA gain range
- Adjustable RF gain
- Adjustable IF gain
- Integrated RF VCO
- Integrated IF VCO
- Integrated synthesizer
- $i^2C$ bus compatible programming Interface
• Unregulated 2.7 volts to 3.3 volts voltage Supply
• Low cost external components

Block Diagram of STA001 – RF Frontend for Digital Radio

STA002 – Starman Channel Decoder

• Front end interface
  ○ IF input carrier frequency: f = 1.84 MHz
  ○ Single internal 6 bit
A/D converter

- QPSK demodulation
- Input symbol frequency: \( F_s = 1.84 \) Msymbols/s

- Digital Nyquist root filter:
  - Roll-off value of 0.4

- Digital carrier loop:
  - On-chip quadrature demodulator and tracking loop
- lock detector
- C/N indicator
- Digital timing recovery:
  - Internal timing error evaluation, filter and correction
- Digital AGC:
  - Internal signal power estimation and filter
  - Output control signal for AGC (1 bit)
• Forward error correction
  ○ Inner decoder
    ■ Viterbi soft decoder for convolutional codes, constraint length $M=7$, Rate 1/2
  ○ Deinterleave r block
  ○ Outer decoder
    ■ Reed-Solomon decoder for 32
parity bytes;
correction of up to 16 byte errors

- Block lengths:
  255

- Energy dispersal descrambler

- Back end Interface
  - Broadcast Channel selection
  - Audio Service Component selection to MPEG
decoder
   ○ Service
   Component
   selection
   • Control
     ○ I^2C serial Bus
     control
     interface
   • Decryption
     ○ WES Scheme

Block Diagram
of STA002 – Starman
Channel Decoder

---

STA003T – MPEG 2.5
Layer III Audio
Decoder

• Single chip
  MPEG2 layer 3
• Supporting
  o All features specified for Layer III in ISO/IEC 11172-3 (MPEG 1 Audio) except 44.1KHz Audio
  o All features specified for Layer III 2 channels in ISO/IEC 13818-3.2 (MPEG 2 Audio) except 22.05KHz Audio
  o Lower sampling
frequencies
syntax
extension,
(not specified
by ISO) called
MPEG 2.5
except
11.025KHz
Audio

- Decodes layer III
  stereo channels,
dual channel,
single channel
  (mono)
- Supporting the
  MPEG 1 & 2
  sampling
  frequencies and
  the extension to
  MPEG 2.5:
  48, 32, 24, 16, 12,
  8 kHz
- Accepts MPEG
  2.5 layer III
elementary compressed bitstream with data rate from 8 kbit/s up to 128 kbit/s

- Digital volume control

- Digital bass & treble control

- Serial bitstream input interface

- Ancillary data extraction via I^2C interface.

- Serial PCM output interface (I^2S and other formats)

- PLL for internal clock and for output PCM clock generation
- Low power data elaboration for power consumption optimisation
- CRC check and synchronisation error detection with software indicators
- I²C control bus
- Low power 3.3 volts CMOS technology
- 14.72 MHz external input clock or built-in crystal oscillator

Block Diagram of STA003T – MPEG 2.5 Layer
III Audio Decoder

PT6524 – LCD Driver IC

- CMOS Technology
- Up to 4 Common and 51 Segment Drivers
- Up to 204 LCD Segments
- Up to 12 General Purpose Output Ports
- 1/4 Duty – 1/2 Bias or 1/4 Duty – 1/3 Bias Drive Technique
- No Decoder Intervention Necessary to Display the Data
- Power Saving
Mode provided

- RC Oscillation

Circuit

Block Diagram

of PT6524 – LCD Driver IC

ST72F321 – Microcontroller

- Memories
  - 32K to 60K dual voltage
  - High Density Flash
  - (HDFlash) or ROM with read-out protection
capability. In-
Application
Programming
and In-
Circuit
Programming
for HDFlash
devices

- 1K to 2K
  RAM
- HDFlash
  endurance:
  100 cycles,
  data
  retention: 20
  years at 55°C

• Clock, Reset And
  Supply
  Management
  • Enhanced
    low voltage
    supervisor
    (LVD) for
main supply
and auxiliary voltage
detector
(AVD) with interrupt capability

- Clock sources:
  - crystal/ceramic resonator oscillators,
  - internal RC oscillator,
  - clock security system and bypass for external clock
- PLL for 2x frequency multiplication
- Four Power
Saving
Modes: Halt,
Active-Halt,
Wait and
Slow

• Interrupt
  Management
  • Nested
    interrupt
    controller
  • 14 interrupt
    vectors plus
    TRAP and
    RESET
  • Top Level
    Interrupt
    (TLI) pin on
    64-pin
    devices
  • 15 external
    interrupt
    lines (on 4
    vectors)
• Up to 48 I/O Ports
- 48/32 multifunctional bidirectional I/O lines
- 34/22 alternate function lines
- 16/12 high sink outputs

- 5 Timers
  - Main Clock Controller with: Real time base,
  - Beep and Clock-out capabilities
  - Configurable watchdog timer
  - Two 16-bit timers with: 2
input captures, 2 output compares, external clock input on one timer, PWM and pulse generator modes
  ○ 8-bit PWM Auto-reload timer with: 2 input captures, 4 PWM outputs, output compare and time base interrupt, external clock with
event detector

- 3 Communications Interfaces
  - SPI synchronous serial interface
  - SCI asynchronous serial interface
  - I²C master interface

- 1 Analog peripherals
  - 10-bit ADC with up to 16 input ports

- Instruction Set
  - 8-bit Data Manipulation
  - 63 Basic
Instructions
  ◦ 17 main

Addressing
Modes
  ◦ 8 x 8

Unsigned
Multiply
Instruction

● Development

Tools
  ◦ Full
      hardware/sof
tware
development
package
  ◦ In-Circuit
    Testing
capability
have you found a way to reprogram it? i've been trying to find anything related to it on the web but have failed. on the normal broadcast you get yazmi audio.....which is playing old maestro channel tunes.....any ideas?~?

Hi,
I broke my WorldSpace opening it :P. So of course it won't work any more.
Meanwhile try the Saregama Worlds app for Android:
https://play.google.com/store/apps/details?id=com.srgm.activities&hl=en it seems to have the Farishta Channel too!!

REPLY

Anonymous
· April 15, 2014 at 1:52 PM
dear Anurag
I also own a tongshi damb-r receiver, that i dismantle, i found inside a tuner labelled TDW-A (200509 05) Have you got information about this tuner, or could you tell me if yours device features a usb port for linking to a pc computer in order to receive data.
FYI Worldsap satellite still operational with a US company called omni-sat
Waiting for your reply.
thanks

REPLY

Anurag Chugh
Hi, I am not aware of the TDW part number. My device does not have a USB Port

REPLY

Unknown

· June 8, 2014 at 7:21 PM

Hai all ...i want used world space satellite radio and antenna (or antenna)

REPLY

To leave a comment, click the button below to sign in with Google.

About Me

Anurag Chugh
Pune, Maharashtra, India