DDS FM STEREO TUNER
T-1200

This new "DDS FM Stereo tuner T-1200" is the succession model of T-1100 launched back in 2010.

Using a blend of Accuphase traditional RF circuit design with sophisticated digital signal processing, "Variable bandwidth IF filter", "Multipath reduction", "Digital FM detector", "DS-DC stereo demodulator" have been moved to software on the DSP chip.

With further refinement of whole unit, the noise performance or the stereo separation is impressively improved than former model.

Discover supreme listening pleasure with this ultimate tool of FM stereo broadcasts, which Accuphase has been developing since the day of establishment.

Front View

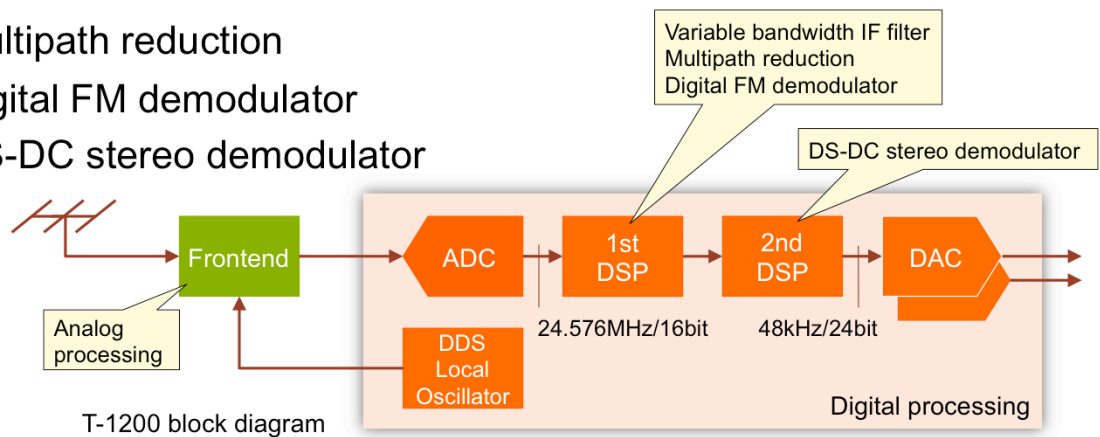- New front panel design brings gorgeous looking

T-1200

130mm

T-1100

120mm

Accuphase tidies up the gorgeous design which is worth the sound quality and performance with new 10mm taller front panel.

Technical features

- Full digital processing after Front End Circuit
  - Variable bandwidth IF filter
  - Multipath reduction
  - Digital FM demodulator
  - DS-DC stereo demodulator

Variable bandwidth IF filter
Multipath reduction
Digital FM demodulator

DS-DC stereo demodulator

Frontend

ADC

1st DSP

2nd DSP

DAC

Analog processing

DDS Local Oscillator

24.576MHz/16bit

48kHz/24bit

Digital processing

T-1200 block diagram

Only the front end which selects and amplifies the weak radio signals is analog circuit. After the front end, all circuits including local Oscillator are digital signal processing.

Digital signal processing section consists of 2 pcs of DSP. 40bit floating- point processor ADSP-21369(Analog Devices) is used as 1st DSP, and it performs "Variable bandwidth IF filter", "Multipath reduction", "Digital FM demodulator".
2nd DSP is TMS320F2810(TI), and it is used as a "DS-DC stereo demodulator".

Front end circuit

- RF attenuator
- Two-stage Double-tuned turning circuit
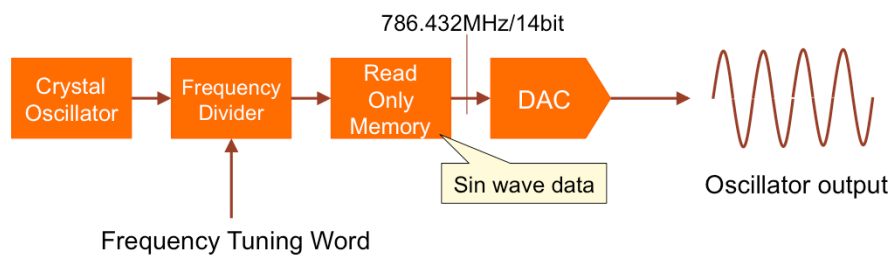- Automatic Gain Control
- Double Superheterodyne
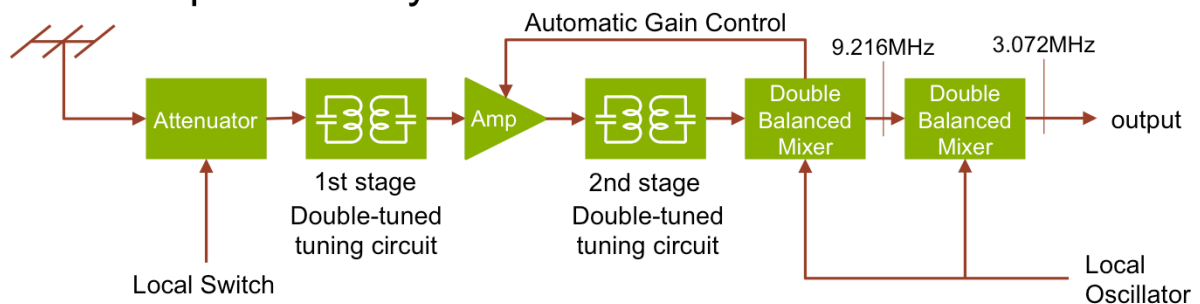
The front end in FM tuner just picks out and amplifies the desired station signal from many others coming from the antenna, and converts it to the intermediate frequency.

It is very important section to decide the characteristics like receiving sensitivity or selectivity.

・RF attenuator
  It works to handle the broadcast stations with strong electric intensity while suppressing interference or cross-modulation.

・Two-stage double-tuned turning circuit
  It achieves both excellent selectivity and low cross-modulation distortion.

・Automatic Gain Control
  It optimizes the RF Amplifier gain according to antenna input level.

・Double Super heterodyne
  With 2 step frequencies conversion, it blocks the interference signal and optimally converts the frequencies for the A/D converter at next stage.

DDS(Direct Digital Synthesis) local oscillator

- The high purity signal is provided than PLL
  - DDS oscillator has no feedback loop, therefore, highly pure oscillator output can be obtained.

786.432MHz/14bit

| Crystal Oscillator | Frequency Divider | Read Only Memory | DAC |

Sin wave data

Oscillator output

Frequency Tuning Word

Generally, PLL(Phase Locked Loop) circuit is used for a local oscillator. In a conventional PLL circuit, feedback is used to stabilize the frequency, but this produces frequency modulation components that tend to degrade tuner's noise characteristics.
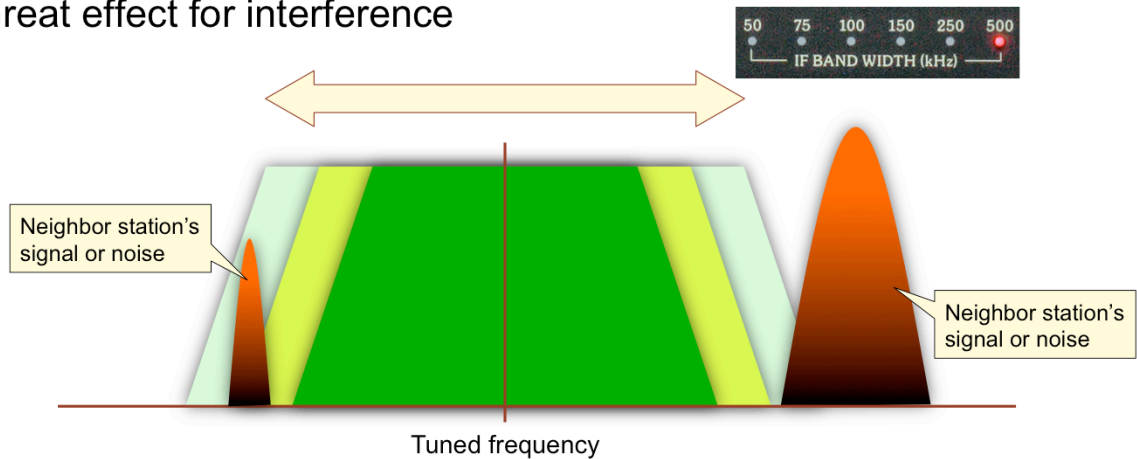
The local oscillator in the T-1200 is a DDS(Direct Digital Synthesis) circuit.

With DDS, the output of a quartz oscillator is divided to adjust the timing that governs the readout of data, and create the sine wave. There is no feedback loop, the frequency purity of the quartz oscillator is maintained as it is until the output.

T-1200's outstanding low noise characteristic is created by this revolutionary circuit.

Variable bandwidth IF filter

- 6 selectable bandwidth IF filter
  - Great effect for interference

Neighbor station's signal or noise

Neighbor station's signal or noise

Tuned frequency

50 75 100 150 250 500
IF BAND WIDTH (kHz)

Variable bandwidth IF filter reduces the influence of noise or neighbor station's signal.
It allows the user to obtain a good quality signal from a station affected by interference from a strong adjacent station.

The variable bandwidth IF filter is implemented using a FIR(Finite Impulse Response) type digital filter with complete linear phase characteristics, thereby eliminating the phase shift that can occur with conventional IF filter.

MPR: Multipath Reduction

- MPR reduces the distortion and noise by reflection waves
  - Great effect for interference
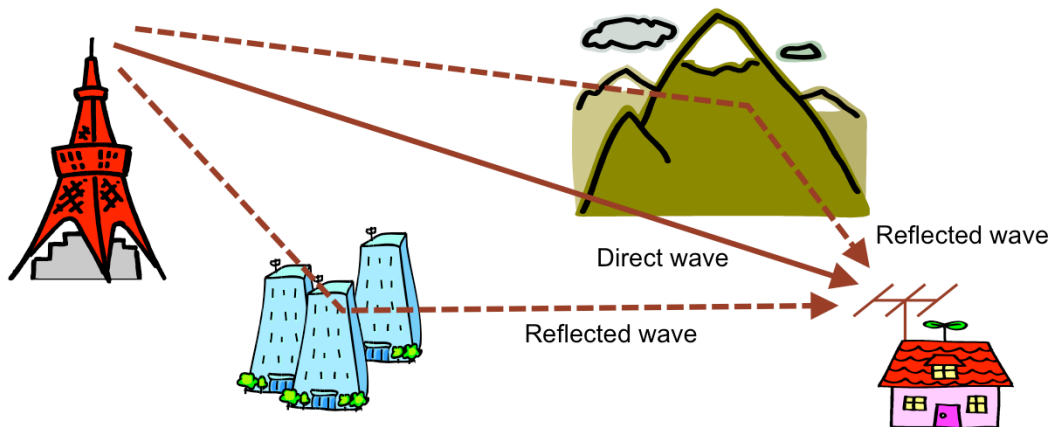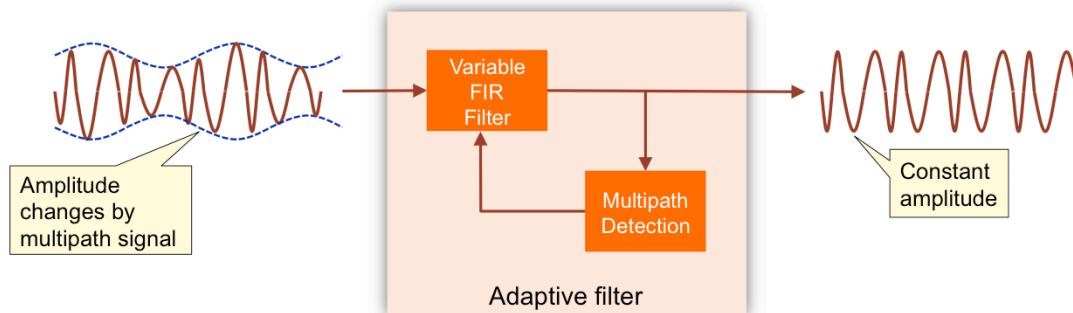

Direct wave

Reflected wave

Reflected wave

Multipath reception refers to a condition where the same broadcast signal reaches the antenna via several different propagation routes.

When the direct wave and reflected waves are received together, distortion and noise occur.

MPR(Multipath Reduction) is an innovative technology that effectively suppresses the harmful reflected waves, resulting in high-quality audio output without multipath.

Block diagram of MPR

• MPR applies Adaptive Filter technology

Amplitude changes by multipath signal

Variable FIR Filter

Multipath Detection
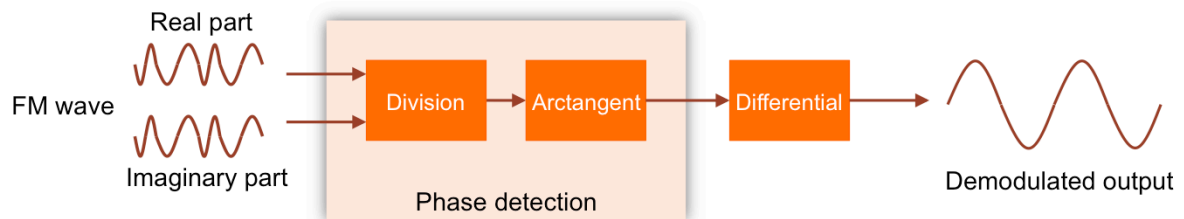
Adaptive filter

Constant amplitude

MPR applies the adaptive filter technology that transforms the filter shape to minimize multipath.

MPR function is based on high-speed, high-precision signal processing by 40bit floating point DSP chip.

Digital FM demodulation

- FM demodulation by numerical processing
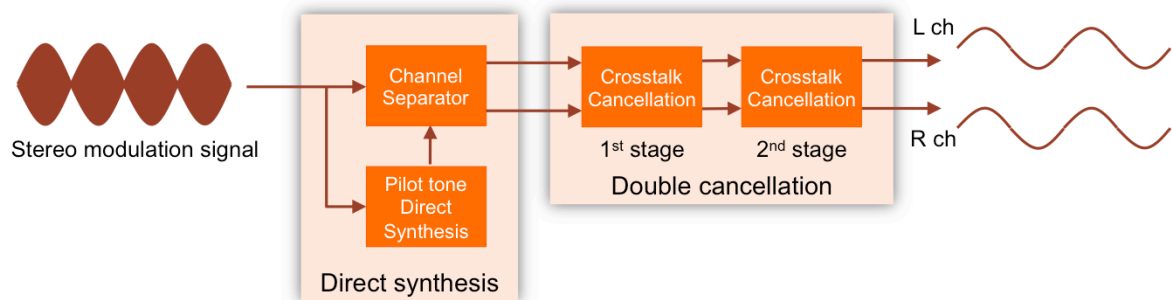 - Keeps distortion and noise to a minimum

FM demodulator circuit is also based on 40bit floating point DSP chip precisely calculating the theoretical formula to demodulate the FM signal.

Therefore, it enables the ideal FM demodulation with no distortion and noise.

DS-DC stereo demodulator

- DS-DC: Direct Synthesis – Double Cancellation
  - amazing stereo separation

DS-DC is an Accuphase original stereo demodulation technology which achieves amazing stereo separation.

DS-DC comprises the two technologies described below.

・Pilot Tone Direct Synthesis
With DS-DC, the pilot tone in the input signal is identified as is and generated directly by the DSP arithmetic.
Therefore the pilot tone can be extracted reliably even when a high level of noise is present.
Impressive stereo separation can be achieved even when the pilot tone level is low.

・Crosstalk Double Cancellation
After the input signal has been separated into the left and right components, the circuit eliminates crosstalk using a dual approach that also takes phase shift into consideration.
The result is extremely thorough left/right separation.

D/A converter

- Paralleled D/A converters per channel
  - Featured AK4490EQ(AKM Corporation)
  - MDS(Multiple Delta Sigma) architecture
  - Direct Balanced Filter circuitry

Direct Balanced Filter circuitry

DAC part with MDS architecture
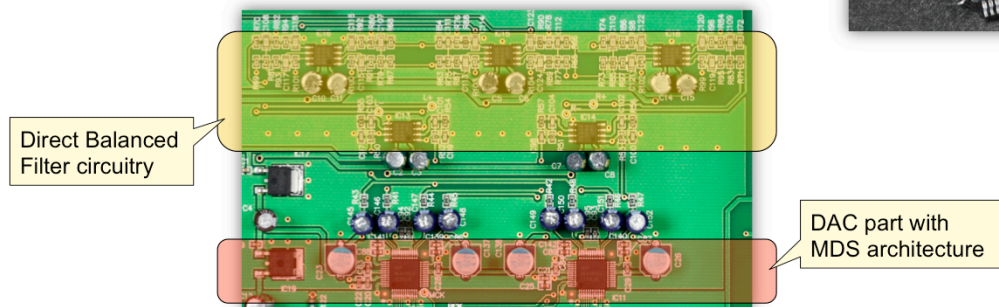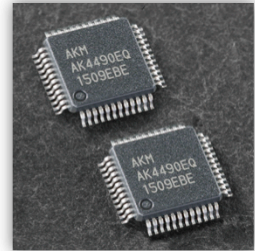
For D/A converter section, Accuphase updates the DAC chip to Asahi Kasei Micro Electronics' Premium DAC AK4490EQ for T-1200.
The former model T-1100 is equipped with AD1955(Analog Devices).

AK4490EQ has 2 DACs inside, and T-1200 contains 2 DACs connected in parallel per channel with Accuphase's unique technology, MDS (Multiple Delta Sigma) conversion system.

And also fully-balanced structure "Direct Balanced Filter" is employed after D/A converter in T-1200.

Ultra low noise performance

- 20% lower than the former model
  - S/N ratio: 92dB guarantee

T-1100   31.6 µV

T-1200   25.1 µV

-20%
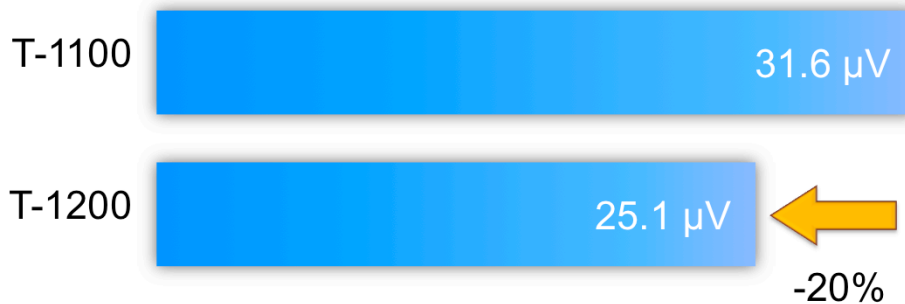
Output noise graph

Ultra Low Noise is one of the main technical features of T-1200.
The former model, T-1100 has the excellent noise performance, however, T-1200 achieves 20% lower output noise voltage than T-1100.
T-1200 guarantees 92dB Signal to Noise ratio which means 25.1µV of output noise voltage.

Stereo separation

- Amazing stereo separation with a DS-DC stereo demodulator
  - Guaranteed Spec. : 65dB @1kHz
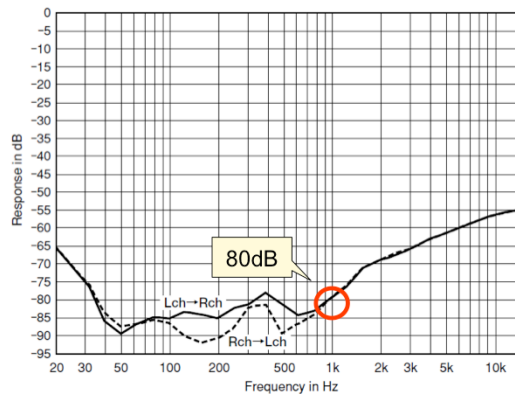
T-1200 proudly shows the great stereo separation characteristics which are quite important for the quality of music playback.
Though the guaranteed stereo separation is 65dB @1kHz, actual value reaches to 80dB.

Further more …

- Pulse tuning system
  - Traditional manual tuning feel
- High-quality digital output
  - Coaxial: 48kHz / 24bit
- High-quality remote commander

Accuphase original pulse tuning system provides traditional manual tuning feel.

T-1200 is equipped with a digital output connector to output the high-quality broadcasts before D/A conversion.