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DISH v. Entropic
IPR2023-00391

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(12) **United States Patent**
Gurantz et al.

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(45) **Date of Patent: Oct. 31, 2006**

(54) **SIGNAL SELECTOR AND COMBINER FOR BROADBAND CONTENT DISTRIBUTION**

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(73) Assignee: **Entropic Communications, Inc.**, San Diego, CA (US)

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(22) Filed: **Nov. 6, 2002**

Related U.S. Application Data

(60) Provisional application No. 60/345,965, filed on Nov. 7, 2001, provisional application No. 60/333,722, filed on Nov. 27, 2001, provisional application No. 60/358,817, filed on Feb. 22, 2002.

(51) **Int. Cl.**
H04H 1/00 (2006.01)

(52) **U.S. Cl.** **455/3.02**; 455/3.01; 455/3.04; 455/427; 725/71; 725/78

(58) **Field of Classification Search** 455/3.01–3.05, 455/103, 137, 12.1, 20, 427; 725/64, 71, 725/78, 98, 118
See application file for complete search history.

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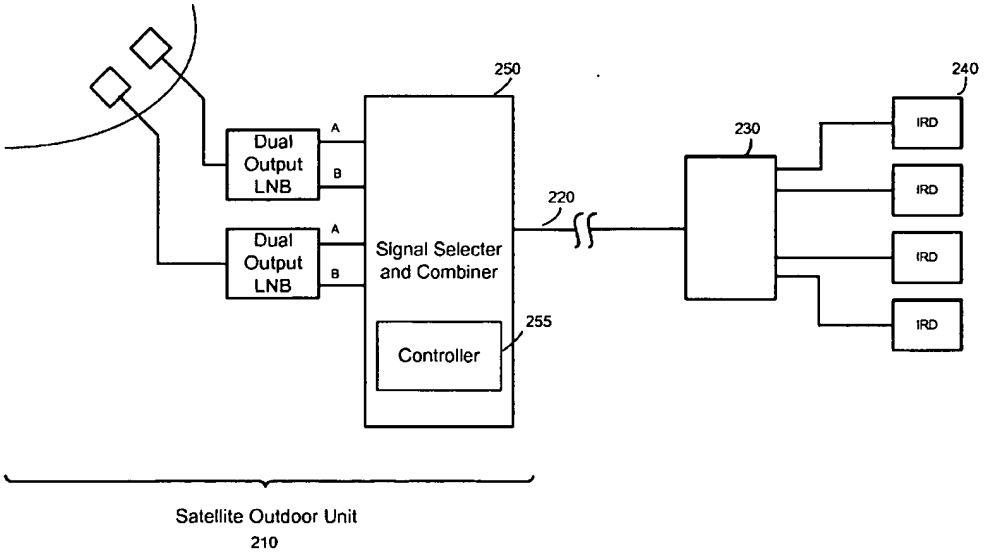
* cited by examiner

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(57) **ABSTRACT**

In a satellite receiving system, program channels are selected from one or more broadband signals and combined with other selected channels and transmitted from a first unit, for example an outdoor unit, to a second unit, for example a gateway, server, or set-top box, using a single cable. Channels can be selected by digitizing the broadband signal then digitally filtering to isolate the desired channels. The outputs of several LNBs can be selected and combined into one signal. Multiple set-top boxes can receive independent signals over a single cable from the outdoor unit.

23 Claims, 17 Drawing Sheets



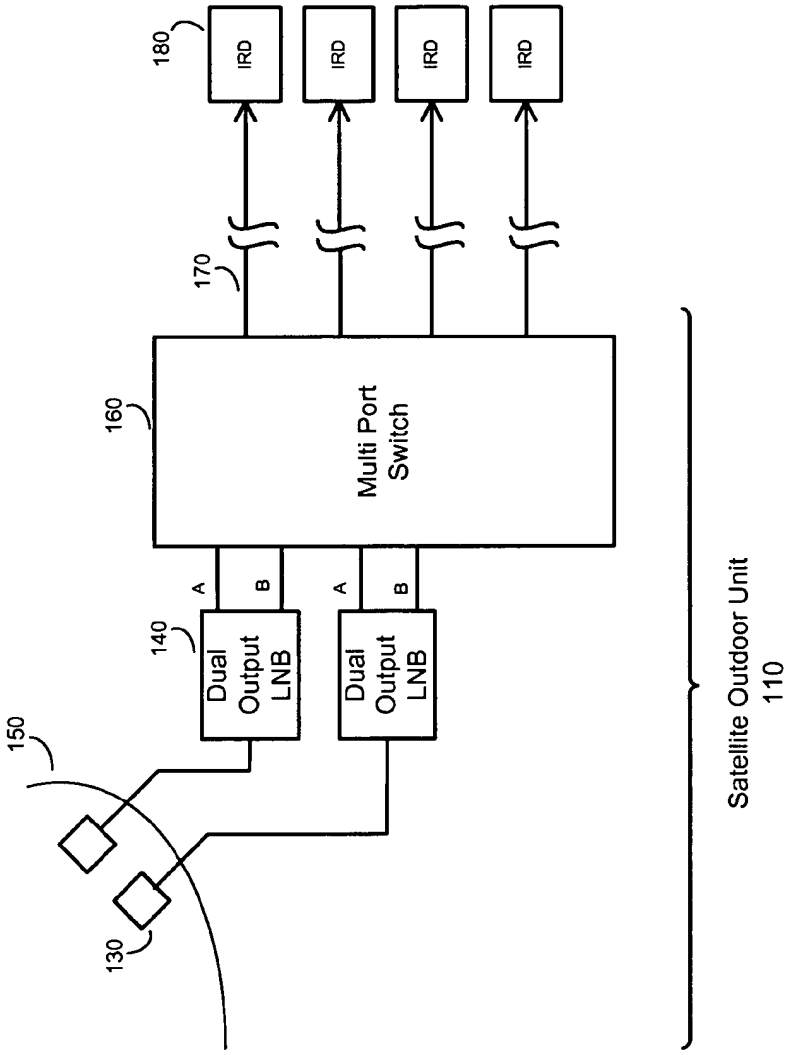


FIG. 1
Prior Art

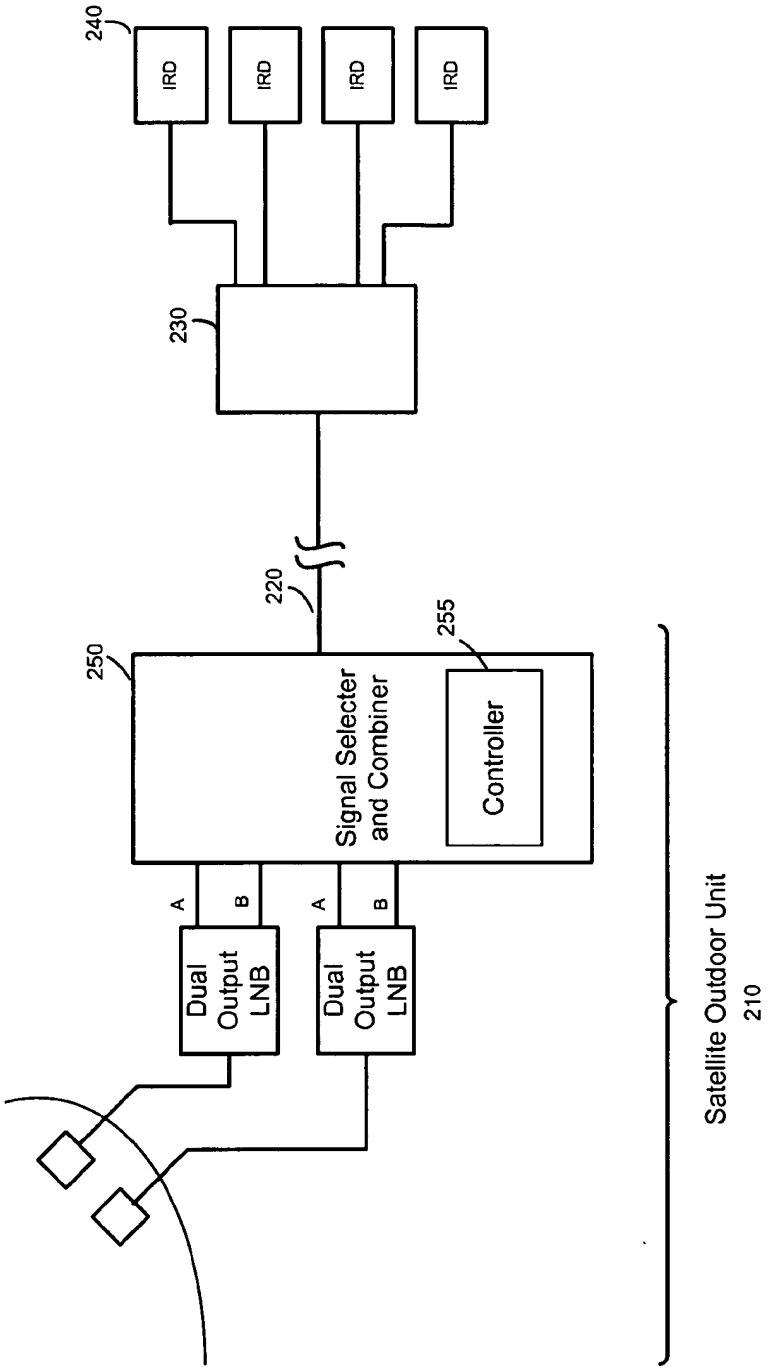

240
IRD
IRD
IRD
IRD
230
220
255
250
Signal Selecter and Combiner
Controller
A
B
A
B
Dual Output LNB
Dual Output LNB
Satellite Outdoor Unit
210

FIG. 2

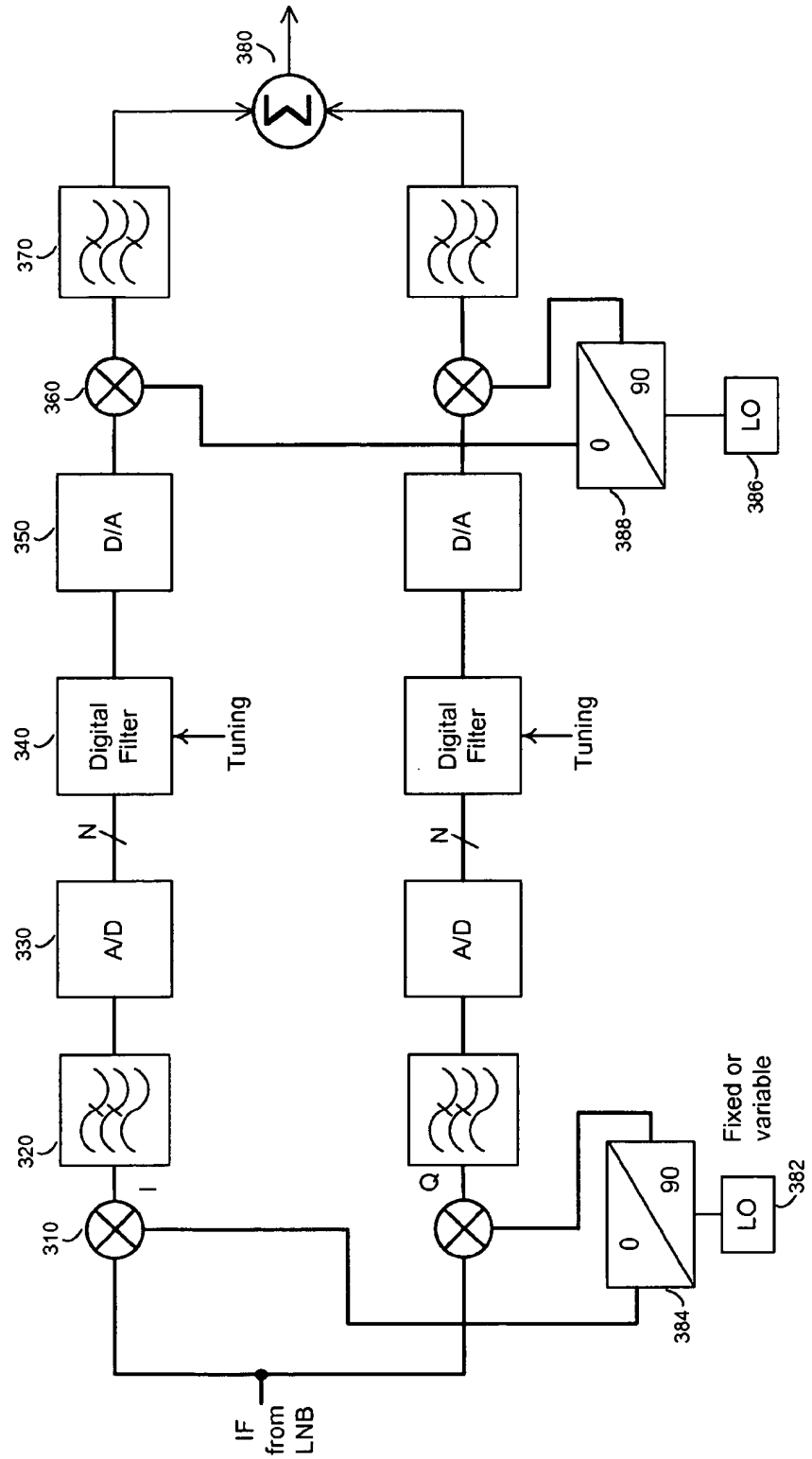

380
370
360
350
D/A
340
Digital Filter
Tuning
N
330
A/D
320
310
I
Q
IF from LNB
90
0
LO
386
388
384
382
Fixed or variable

FIG. 3

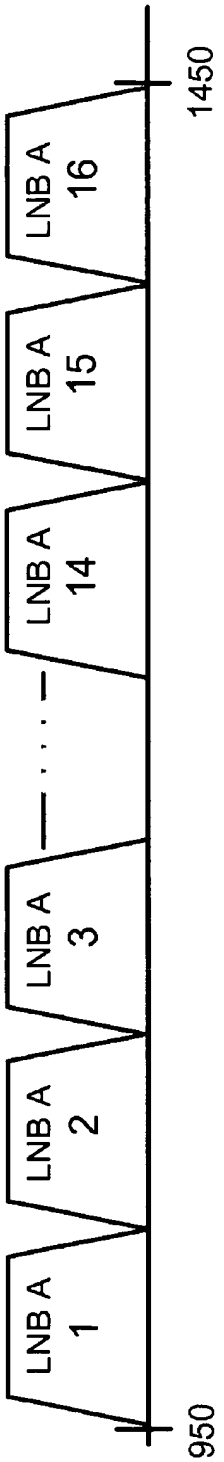


FIG. 4

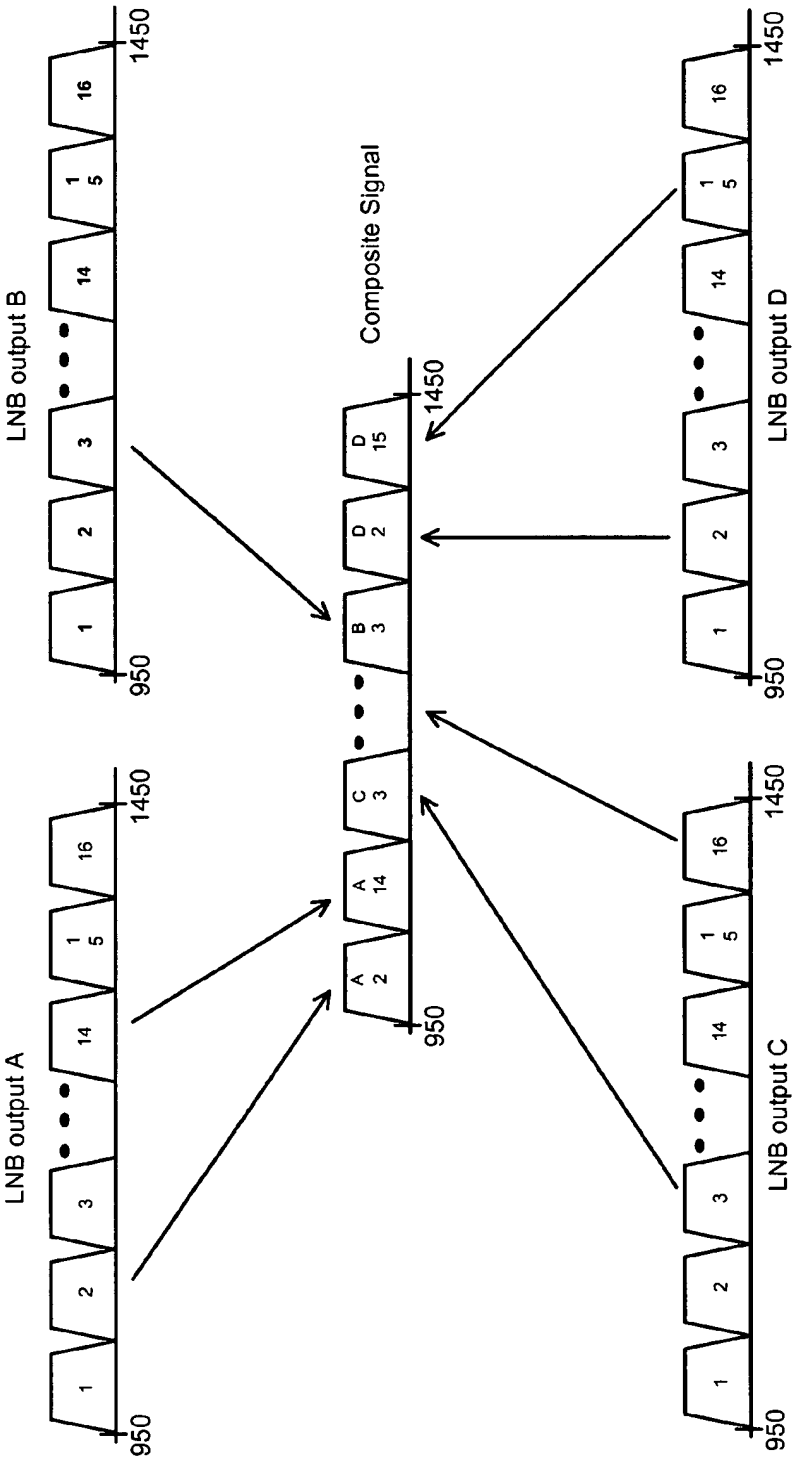
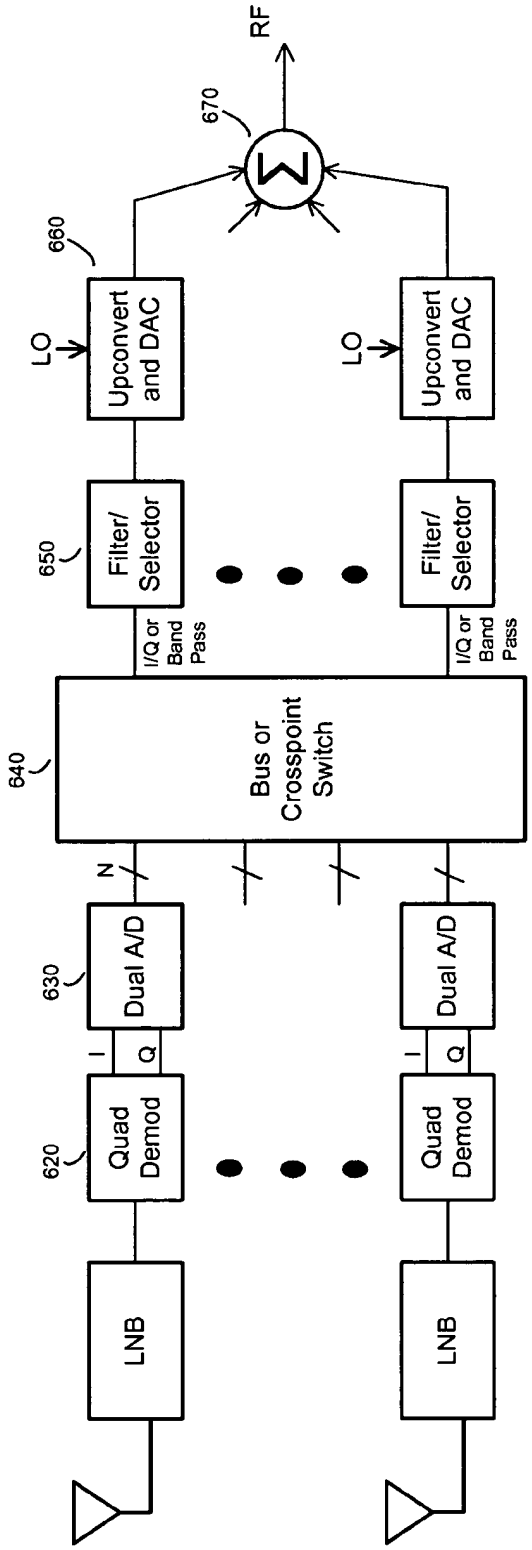
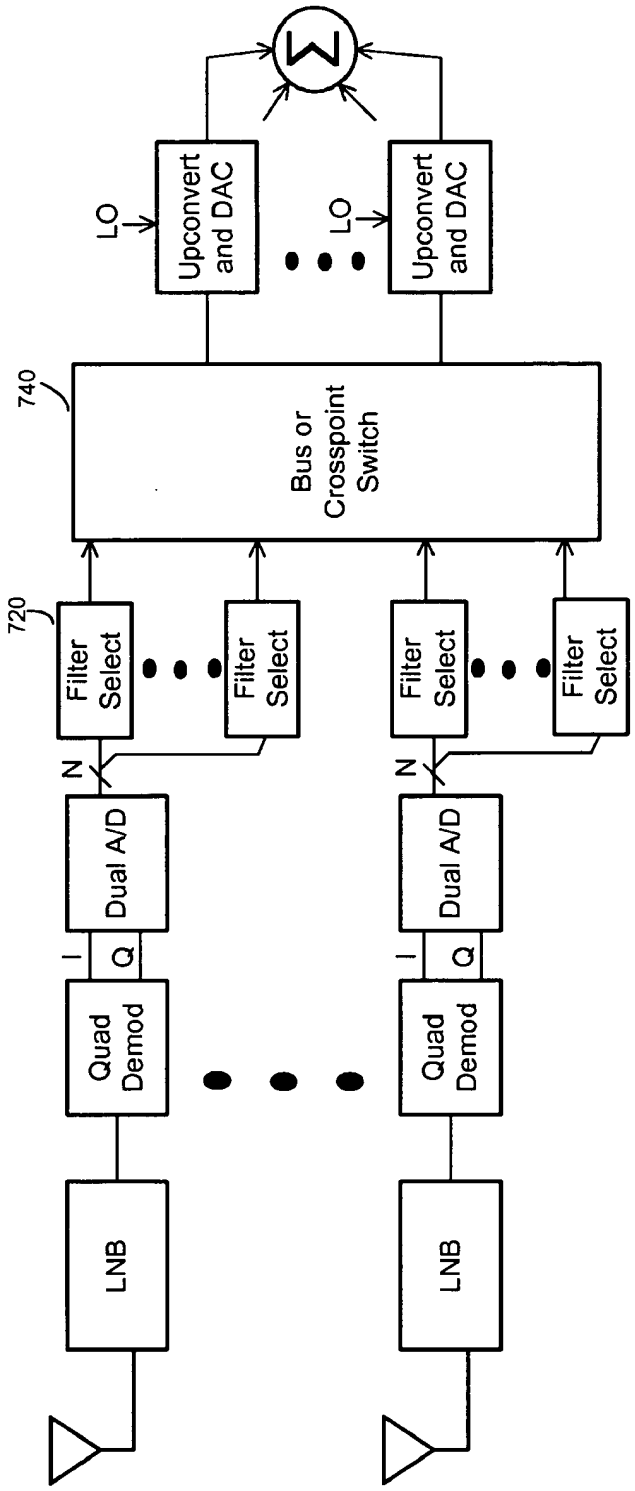

LNB output A
LNB output B
LNB output C
LNB output D
Composite Signal
950
1450
1
2
3
14
15
16
A 2
A 14
B 3
C 3
D 15
D 2

FIG. 5



Digital Routing of Digitized Signals

FIG. 6



Digital Routing of Digitized Signals

FIG. 7

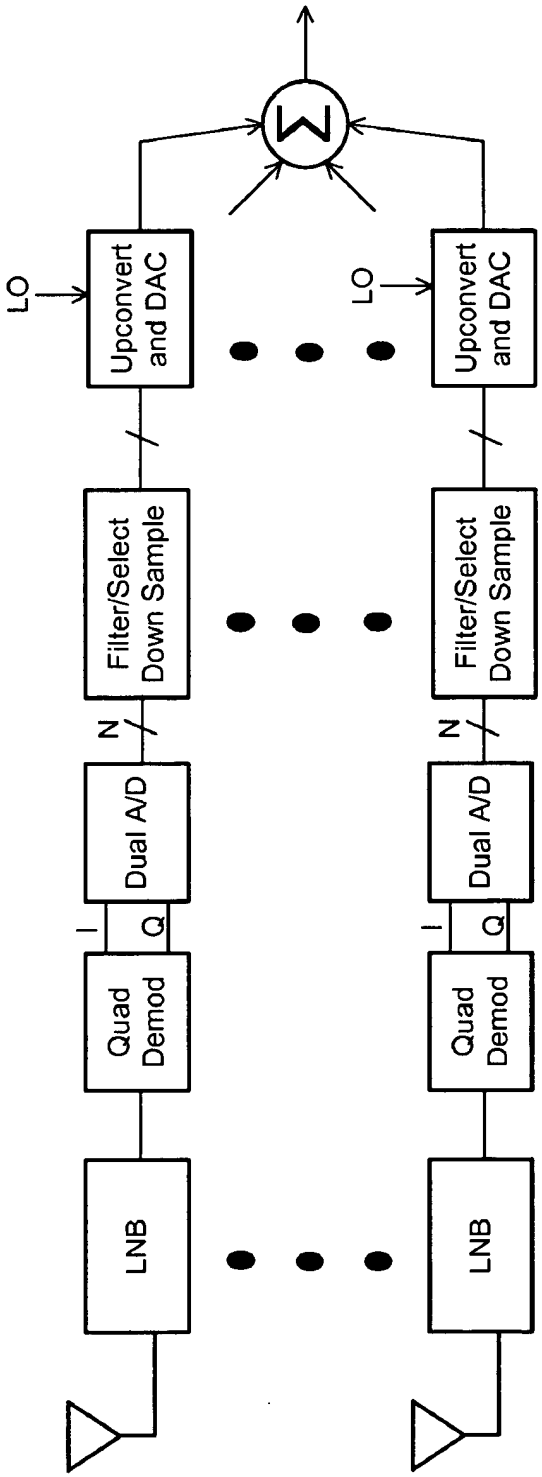

LO
Upconvert and DAC
LO
Upconvert and DAC
Filter/Select Down Sample
Filter/Select Down Sample
N
N
Dual A/D
Dual A/D
I
Q
I
Q
Quad Demod
Quad Demod
LNB
LNB

FIG. 8

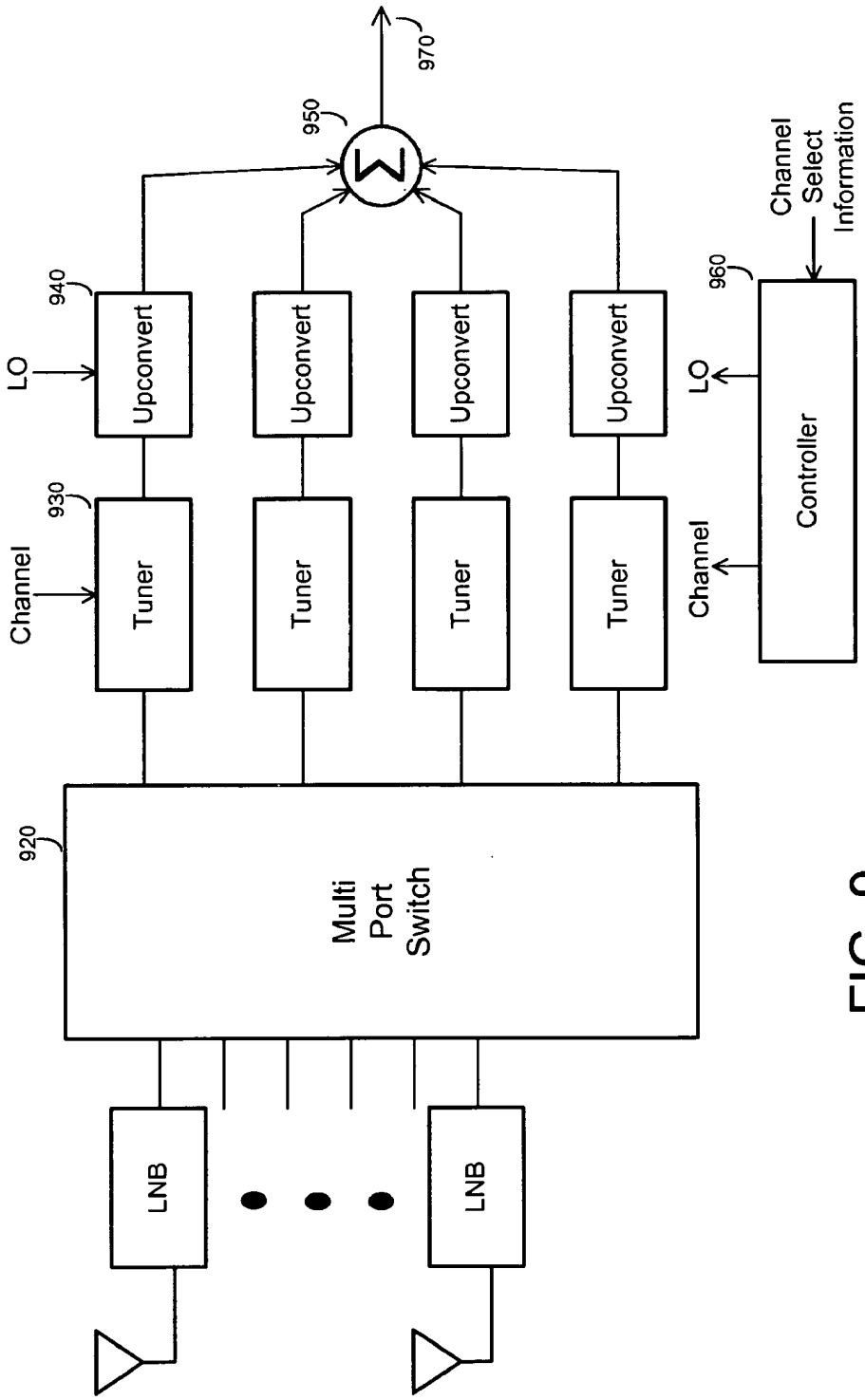

970
950
940
LO
Upconvert
Upconvert
Upconvert
Upconvert
930
Channel
Tuner
Tuner
Tuner
Tuner
920
Multi
Port
Switch
LNB
LNB
960
Channel
Select
Information
LO
Channel
Controller

FIG. 9

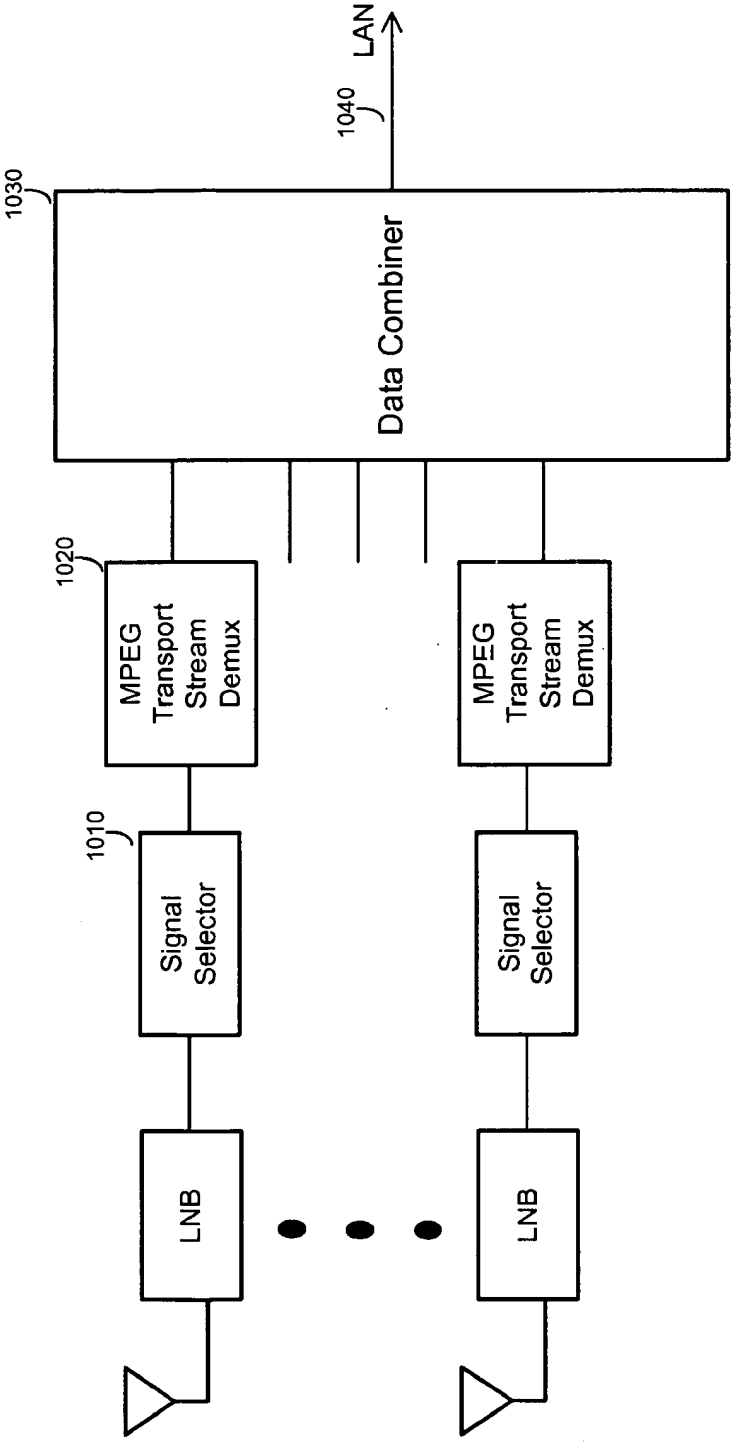

LAN
1040
1030
Data Combiner
1020
MPEG Transport Stream Demux
MPEG Transport Stream Demux
1010
Signal Selector
Signal Selector
LNB
LNB

FIG. 10

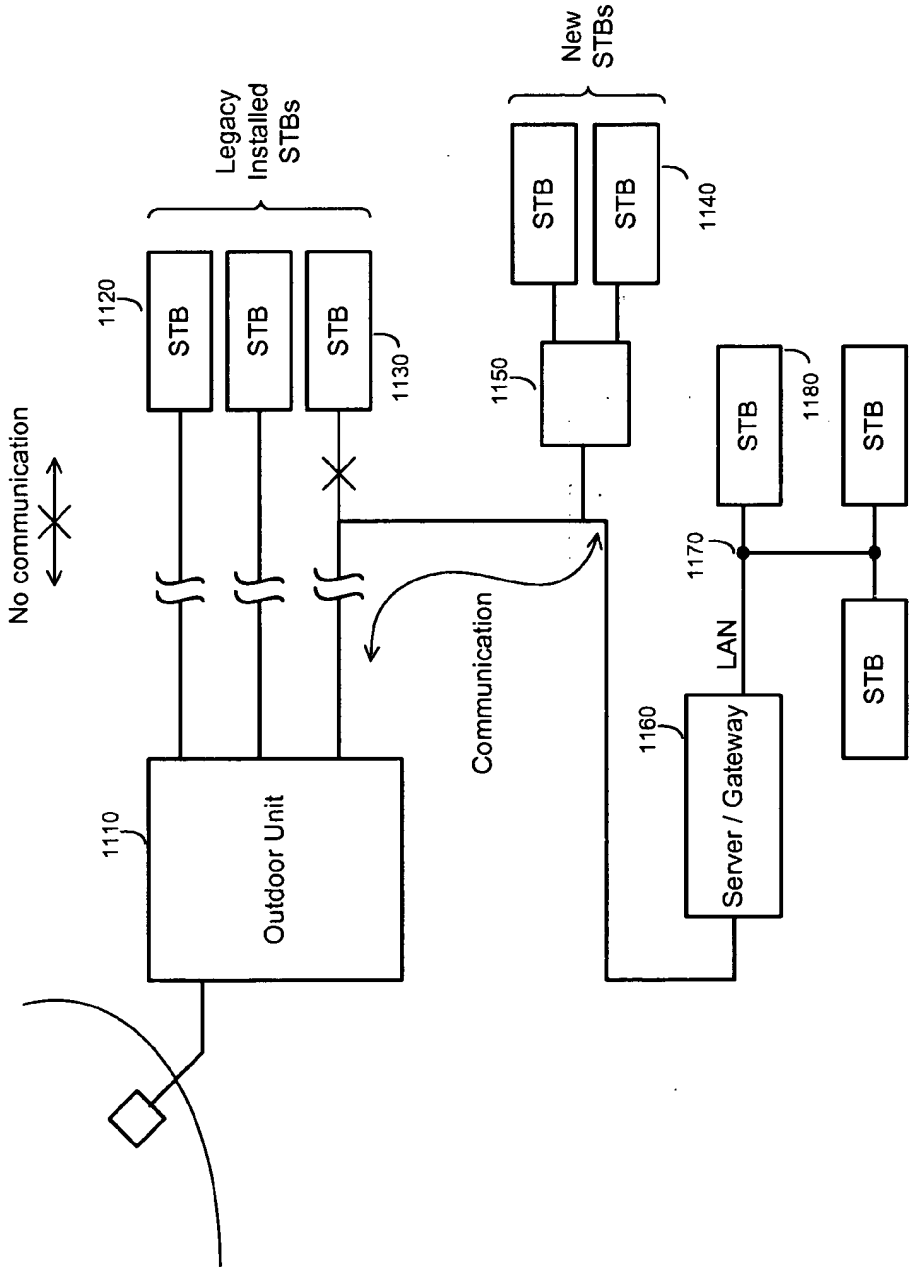

Legacy Installed STBs
New STBs
STB
1120
1130
1140
1150
1160
1170
1180
1110
Outdoor Unit
No communication
Communication
LAN
Server / Gateway

FIG. 11

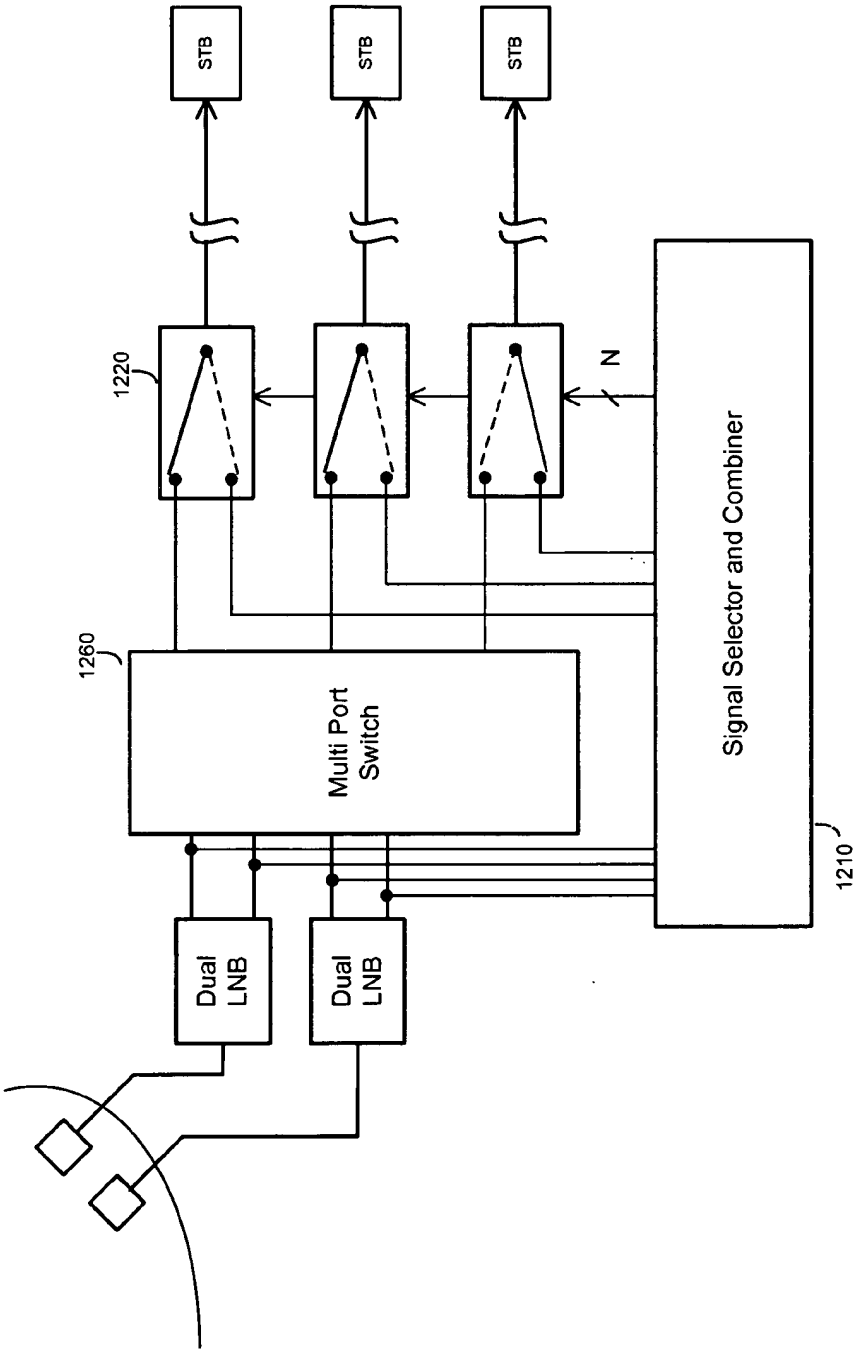

STB
STB
STB
1220
N
Signal Selector and Combiner
1260
Multi Port Switch
1210
Dual LNB
Dual LNB

FIG. 12

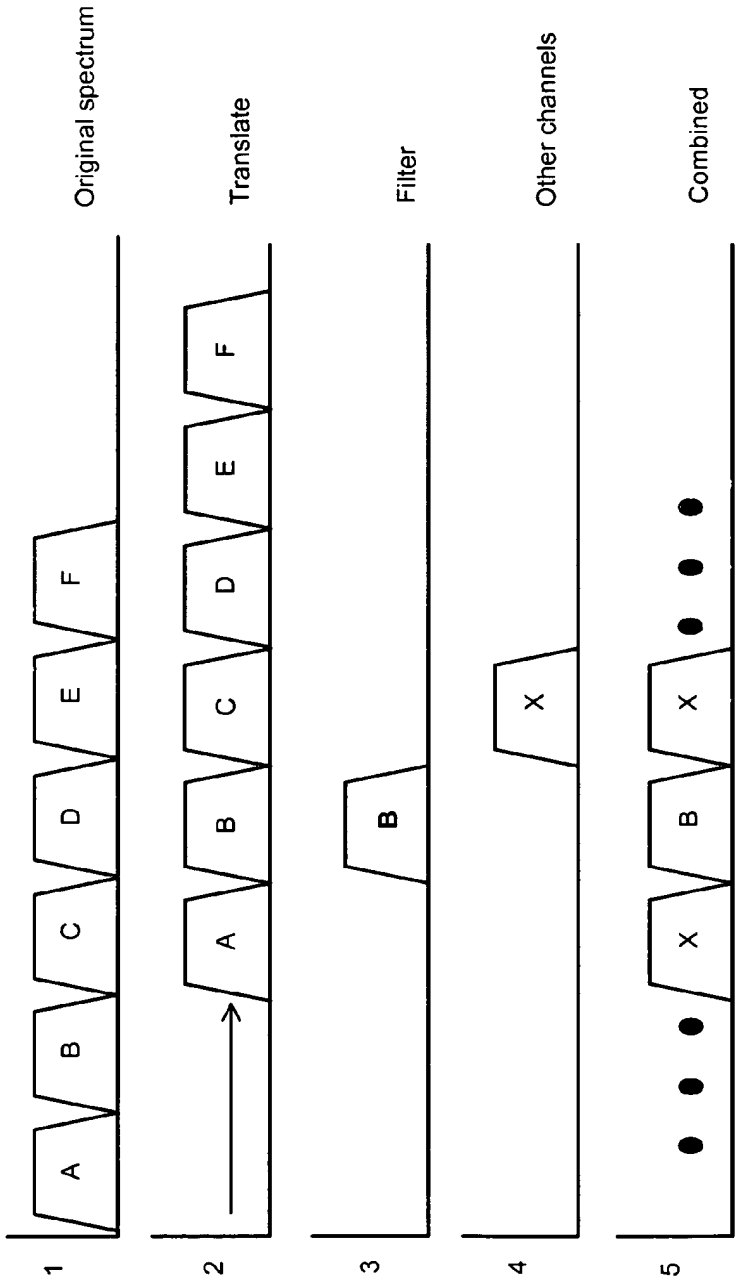

Original spectrum
Translate
Filter
Other channels
Combined
A
B
C
D
E
F
X
1
2
3
4
5

FIG. 13

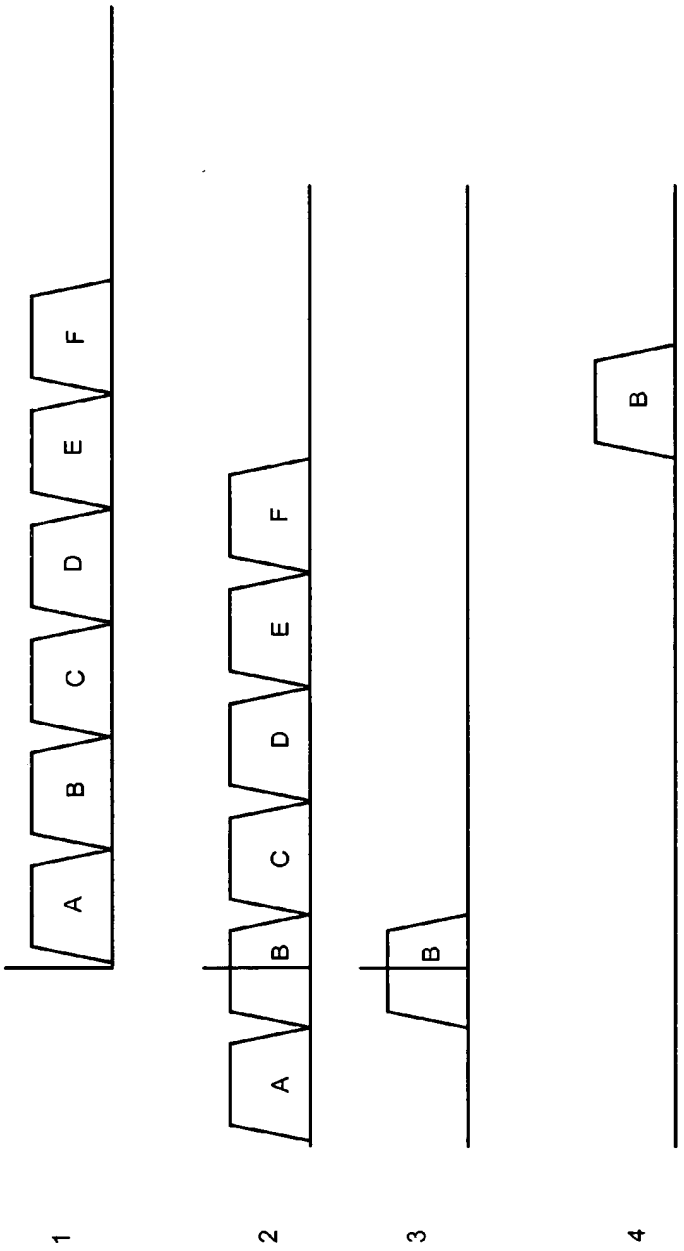

A
B
C
D
E
F
1
2
3
4
Translate to baseband, filter, translate to channel frequency

FIG. 14

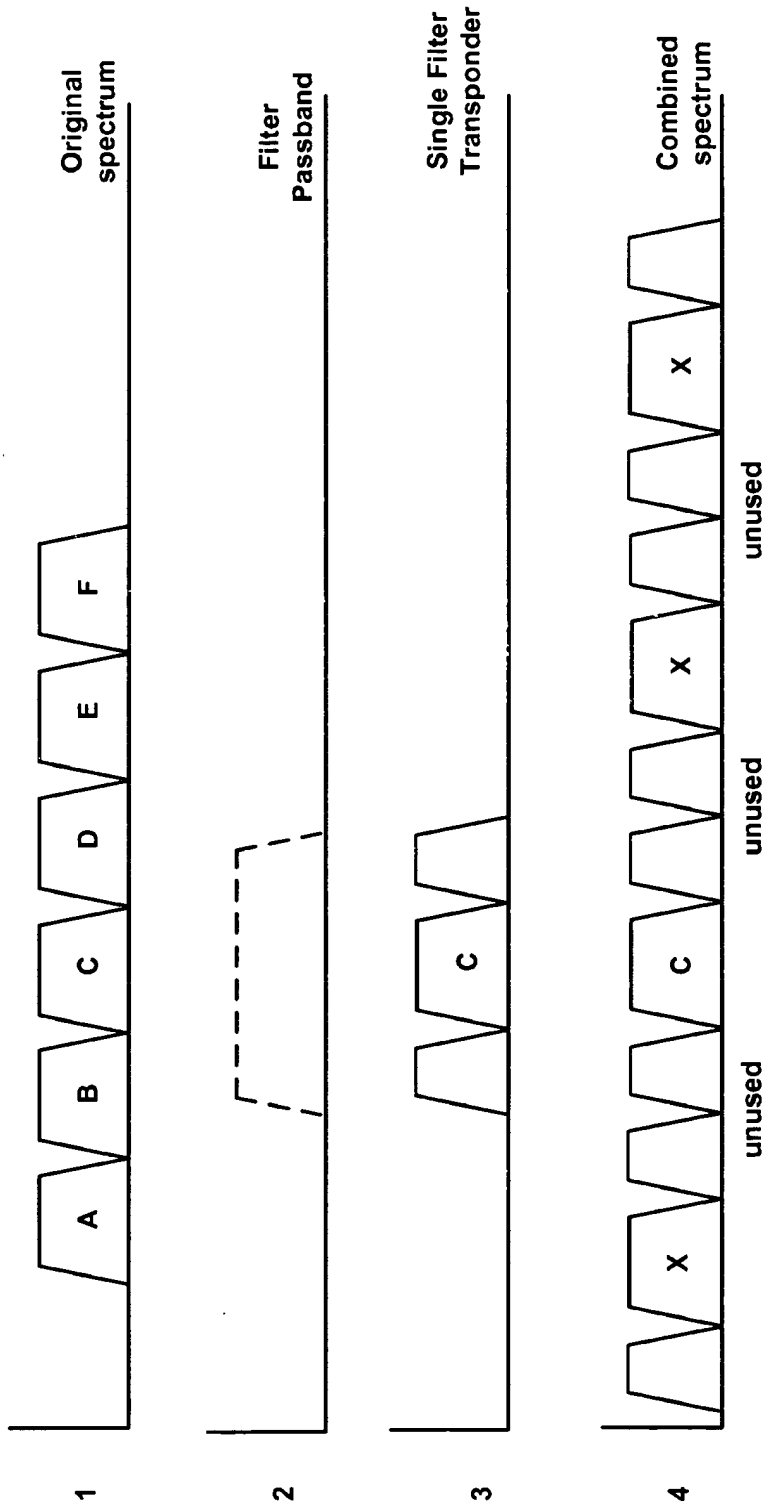

Original spectrum
A
B
C
D
E
F
1
Filter Passband
2
Single Filter Transponder
C
3
Combined spectrum
X
unused
C
unused
X
unused
X
4

FIG. 15

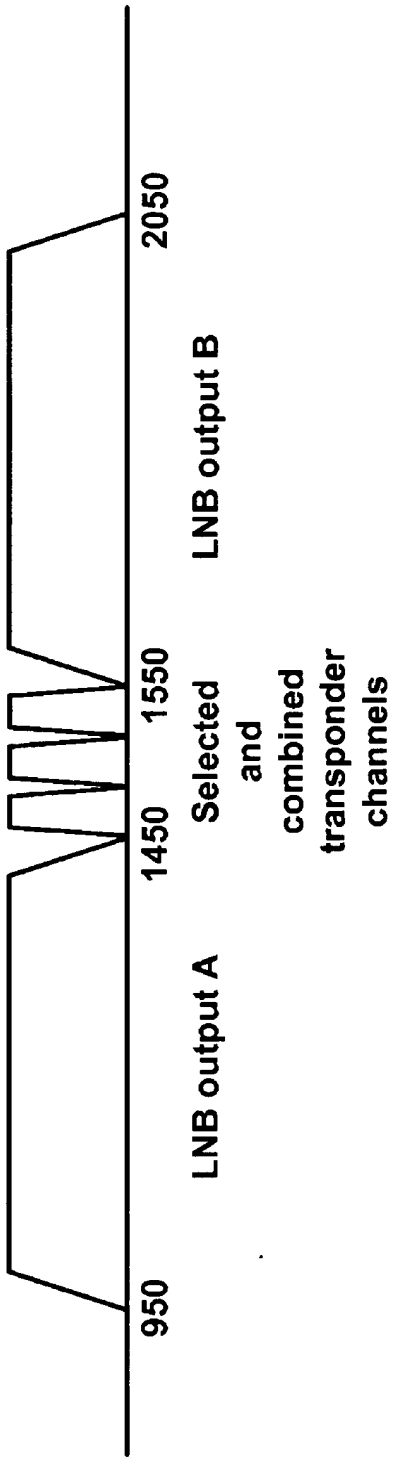
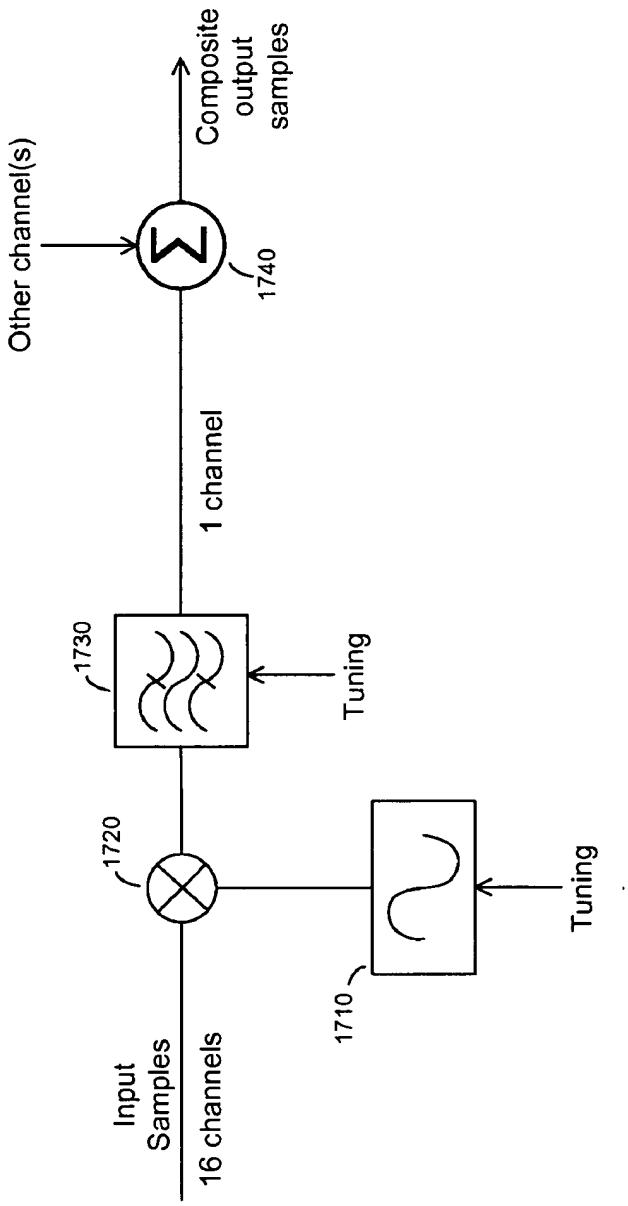

950
LNB output A
1450
Selected and combined transponder channels
1550
LNB output B
2050

FIG. 16



Digital Frequency translator and filter with summer

FIG. 17

SIGNAL SELECTOR AND COMBINER FOR BROADBAND CONTENT DISTRIBUTION

RELATED APPLICATIONS

This application claims priority to U.S. provisional patent application No. 60/345,965 filed Nov. 7, 2001 entitled "Signal Selector and Combiner for Broadband Content Distribution"; U.S. provisional patent application No. 60/333,722 filed Nov. 27, 2001 entitled "Signal Selector and Combiner for Broadband Content Distribution"; and U.S. provisional patent application No. 60/358,817 filed Feb. 22, 2002 entitled "Signal Selector and Combiner for Broadband Content Distribution", each of which is incorporated herein by reference.

BACKGROUND

Referring to FIG. **1**, a satellite receiver outdoor unit (ODU) **110** typically comprises a dish antenna **150**, one or more antenna feed horns **130**, one or more low noise amplifier and block down converters (LNB) **140**, and an optional multiport cross point switch **160**. Dish **150** collects and focuses received signal power onto antenna feed horns **130** which couples the signal to LNBs **140**. A single dish **150** may have multiple feed horns **130** wherein each feed receives a signal from a different satellite in orbit. An installation may have more than one dish, feed, and LNB assemblies. The cross point switch **160** allows connection of the outdoor unit **110** to more than one integrated receiver decoder (IRD) **180** located inside the building. IRDs are commonly called set top boxes (STBs) arising from their typical installed location on top of TV sets. The LNB **140** converts the signal transmitted by a satellite in Earth orbit, for example C band, Ku band, or another frequency band, to a lower intermediate frequency (IF) suitable for transmission through coax inside a building. For example, L band IF (950 to 1450 MHZ) with RG-6 or RG-11 coax cable is commonly used. The IRD **180** tunes one transponder channel, demodulates the IF signal from the LNB down to base band, provides channel selection, conditional access, decodes the digital data to produce a video signal, and generates an RF output to drive a television.

A satellite outdoor unit may have as many as three or more LNBs each with two receiving polarizations. The received polarization is selected by sending a voltage or other control signal to the LNB. In this configuration there are six possible 500 MHz signals that may be selected by the multiport cross point switch to be routed to each IRD. The 500 MHz signal is typically comprised of 16 transponder signals of 24 MHz bandwidth each with a guard band in between each transponder signal. Other transponder bandwidths are used such as 36 MHz, 54 MHz with a single channel or shared by two TV signals, and 43 MHz.

A problem with the conventional approach to connecting an outdoor unit to IRDs is that multiple cables are required to be run from the outdoor unit: one cable for each room where an IRD is located. When a new IRD is added another cable must be installed. In an application using a media server, a central processor for all video signals, multiple cables are needed to route signals from the ODU to the server.

FIG. **4** shows a representative spectrum of the signal output by an LNB. In a conventional satellite ODU this signal is routed through a cross point switch to one of the IRDs. Note that all transponder channels in the signal are from a single LNB and from the same polarization satellite signal. The cross point switch allows any of the cables connected from the ODU to the IRDs to be switched to any of the LNBs. A dedicated cable for each IRD is needed because in general each IRD is not using the same LNB and polarization at the same time. A server requires access to several LNB signals simultaneously, thus requiring several cables.

U.S. Pat. No. 6,134,419, incorporated herein by reference, by Williams assigned to Hughes Electronics, addresses part of the problem. The Williams patent recognizes that the bandwidth of the signal from each of the two polarizations is too broad to be transmitted over standard RG-6 or RG-59 cable, particularly when combined with the cable CATV signal. Williams addresses this problem using a transmodulator, by demodulating and remodulating to a different modulation scheme the RHCP and LHCP signals using a tuner, decoder, packetizer, cable encoder, and up converter for each of 32 transponder channels. The transmodulator outputs a signal with a higher-level modulation scheme to reduce the bandwidth occupied by the satellite signals. In the example provided, the QPSK signals from the LNBs are transmodulated to 128-QAM, reducing the bandwidth from 1000 MHz to 192 MHz. At the set top box (STB) the 128 QAM signal is demodulated and processed to produce an NTSC analog video signal sent to a television set.

One problem with the Williams approach is the circuit complexity due to the 32 tuner paths required in the transmodulator. For an increase in the number of satellite signals, this problem becomes more pronounced. Williams discloses modulation using 128-QAM, which requires a higher signal to noise ratio (SNR) than QPSK and is it more susceptible to impairment from multipath present in a cable environment.

U.S. Pat. No. 5,959,592 incorporated herein by reference, by Petruzzelli addresses combining both the left hand circular polarized (LHCP) and right hand circular polarized (RHCP) signals into one signal that is transmitted from the ODU. In the disclosed band stacking approach, the output of two low noise amplifiers (LNAs), each 500 MHz wide, are frequency translated to different IF frequencies and summed into a signal with a bandwidth of more than 1000 MHz. In one example disclosed, the different IF bands are 950 to 1450 MHz and 1550 to 2050 MHz. The problem with this approach is that the resulting bandwidth is very wide and becomes impractical when the number of LNB signals increases because each LNB output requires 500 MHz of bandwidth on the cable.

Satellite systems are described generally in G. E. Lewis, "Communication Services via Satellite" Butterworth-Heinemann Ltd. 1992.

SUMMARY OF THE INVENTION

A channel selecting and combining solution is used in the outdoor unit where one or more transponder channels are selected from each LNB output. The transponder channel or channels needed from each LNB are selected by a filter. Each selected transponder signal may be translated to a new channel frequency. The selected transponder channels are combined to form a composite signal. All of the selected, translated, and combined transponder channels are transmitted over a single cable to a gateway unit that extracts the channels to distribute to the IRDs. The gateway can frequency translate each transponder channel to its original frequency. Alternatively, the IRDs connect directly from the cable or through a splitter and tune the desired transponder channels. A channel translation mapping table is used to

coordinate the channel assignment between the original channels and new channels. In another alternative embodiment, the gateway transmits the video information over a digital data network.

LNB outputs can be sampled by a broadband A/D converter and filtered with a digital filter to select a transponder channel. Alternatively, a tuner can select a transponder channel. The selecting process extracts from the wide band LNB output a narrow band transponder channel.

Each IRD communicates the channels it needs to receive, directly or indirectly, to the signal selector. This information is used to select the transponder channel to combine in the signal selector output signal, the ODU downlink. New IRD designs can incorporate a signaling channel that uses unoccupied regions of the frequency spectrum of the cable, or a wireless communication link, to communicate the channel information. To provide compatibility with existing IRDs, the channel information can be communicated by an IR or RF auxiliary channel to the gateway or outdoor unit.

Many newer homes have coaxial cable installed that runs to a central location. In the present invention a gateway is located at the central location that receives the combined signal from the outdoor unit and distributes the signals to the IRDs. An IRD requests a channel through an IR or RF signal communicated to the gateway. The RF communication can be in the cable connecting the IRD to the gateway or a wired or wireless signal.

The present invention requires only one cable wire to be routed from the outdoor unit to inside the building or to a gateway. Additional IRDs can be added without any installation effort needed on the outdoor unit. In certain configurations the invention eliminates the cross point switch.

The present invention can be used along with other signals transmitted on the distribution cable. The combined transponder signal can occupy a predetermined region of the frequency spectrum while another service, such as CATV can occupy a different region. Another example of shared use of the cable is along with a single or band stacked satellite signal. In this example, frequencies such as 950–1450 and 1550–2050 are used by a conventional satellite system, and frequencies outside and between these frequency bands are occupied with a combined transponder signal according to the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** Shows a prior art configuration of a satellite TV installation.

FIG. **2** shows a satellite TV installation according to the present invention.

FIG. **3** shows a block diagram of a selector and combiner according to the present invention.

FIG. **4** Shows a diagram of the frequency spectrum of individual LNB output signals according to the prior art.

FIG. **5** shows a diagram of the frequency spectrum of individual LNB output signals and the frequency spectrum of the composite RF signal comprising selected transponder signals in accordance with the present invention.

FIG. **6** shows an embodiment of the present invention wherein the sampled data is distributed digitally to channel selector filters.

FIG. **7** shows an embodiment of the present invention wherein the selected channel data is distributed digitally to the up converters.

FIG. **8** shows an embodiment of the present invention wherein the each LNB has a dedicated selector and up converter.

FIG. **9** shows an embodiment of the present invention wherein tuners and up converter are used to select and combine transponder channels.

FIG. **10** shows an embodiment wherein selected channel are processed by an MPEG transport stream demultiplexer and combined as data packets for digital LAN transmission.

FIG. **11** shows a satellite TV installation according to the present invention providing compatibility with existing installed STBs and new STBs and using a server/gateway.

FIG. **12** shows details of an outdoor unit providing compatibility with new and existing STBs.

FIG. **13** shows the frequency spectrum of signals at various points in the signal processing.

FIG. **14** shows the frequency spectrum of signals in another embodiment of the invention using base band processing.

FIG. **15** shows the frequency spectrum of signals filtered and combined with excess bandwidth.

FIG. **16** shows the frequency spectrum of conventional LNB signals combined with selected transponder channels in accordance with the present invention.

FIG. **17** shows one example of a frequency translator and filter.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **2**, a satellite TV installation according to the present invention is shown. Signal selector **250**, part of satellite outdoor unit **210**, extracts the needed transponder channels from each of the LNB outputs and combines the channels into one composite signal transmitted on cable **220**. Gateway **230** receives the signals and provides distribution to the IRDs located in the building. Controller **255** is responsible for communicating channel map, control, and status information with gateway **230** and IRDs **240**. Controller **255** also tunes filters and local oscillators in the signal selector and maintains the channel map specifying the assigned frequency slots for transponder channels. Alternatively, the channel map can be maintained by gateway **230**.

Gateway **230** can be a simple power splitter/summer allowing the IRDs to connect directly to the cable. Gateway **230** would be located inside the home in a convenient location that allows connection to the IRDs **240**. Gateway **230** is designed to pass signaling from IRDs **240** to ODU **210** that contains the channel selection information.

Each LNB output signal is applied to a signal selector that extracts zero, one, or more transponder channels to be combined into a composite signal.

Refer to FIG. **3**. In an embodiment of the present invention, a quadrature down converter is used to produce I and Q analog signals. The down converter is comprised of a local oscillator **382**, phase splitter **384** to produce an in-phase and quadrature-phase LO, two mixers **310**, and two filters **320**. The filters **320** reject the undesired mixing products. The I and Q signals are sampled by high-speed broadband A/D converters **330** to create I and Q digital samples. The samples are N bits wide, where N is selected to limit the degradation to the signal to an acceptable level. The entire 500 MHz band is digitized by this operation. All further digital processing is done using complex operations applied to the I and Q digital samples. The sample rate is 500 MHz or higher.

The resolution of the A/D converters is in the range of 4 to 12 bits. To sample and reproduce a QPSK signal 6 to 8 bits would be adequate. More bandwidth efficient modulation

such as 8PSK would require more bits of resolution. The selection of resolution is based on considering power consumption, SNR, and cost.

A coherent LO generated by carrier tracking is not needed since the sampled data is not decoded in the ODU. An unknown carrier offset is present between the LO and the carrier of the received signal. A small additional carrier offset is introduced by the down conversion process but will be removed in the carrier recovery operation in the IRD. It is desirable that the LO carrier noise be low enough to be tracked out by the carrier loop in the IRD.

Digital filtering **340** is used to select one or more of the transponder output signals. The digital filter may operate by applying a band pass filter transfer function to the broadband signal to isolate a single transponder channel. The filter uses known digital architectures such as finite impulse response (FIR) or infinite impulse response (IIR). The filter is tuned by programming a set of filter coefficients to select a specific pass band. Frequency domain filter can also be employed using FFT or DFT architectures. Other filtering techniques include polyphase filter structure. These filtering techniques are well known in the digital signal processing field. References covering digital filtering include Thomas J. Cavicchi "Digital Signal Processing" John Wiley & Sons, 2000; Sanjit K. Mitra, "Digital Signal processing, a Computer Based Approach" McGraw-Hill, 2001; Proakis and Manolakis, "Introduction to Digital Signal Processing", Macmillan Publishing, 1988; DSP and applications, Analog Devices.

Referring again to FIG. **3**, the selected transponder channel is then frequency translated to a new carrier frequency. The selected and frequency translated digital signal is converted to an analog signal using a D/A converter for the I and Q components. One approach is to convert the digitally filtered signal to the analog domain using a D/A converter **350**, then using a quadrature modulator with mixers **360**, phase splitter **388**, LO **386**, and summer **380**. Alternatively, this can be done by a digital mixing operation where a rotating phasor is multiplied by the data samples to translate their frequency, then converting the frequency shifted digital signal to an analog signal with a D/A.

LO **386** is variable to allow the selected channel to be frequency translated to any of the channels available in the band. Alternatively, the LO can be fixed at different a frequency for each of the channel selectors.

Alternatively, a single transponder channel can be selected by translating the spectrum down in frequency to place the selected channel at base band then applying a low pass filter transfer function to isolate a single channel. The translation can be done by a digital mixing operation wherein the sample data is multiplied by a data sequence representing a carrier frequency. A post-mixing filter rejects the undesired mixing terms.

FIG. **14** shows the frequency spectrum of the signal as it is processed. The original spectrum **1** is frequency translated to locate the selected transponder channel at base band, as shown in spectrum **2**. A low pass filter then passes one transponder channel and removes signal information from the other transponder channels, shown in spectrum **3**. This signal is then converted to an analog signal, mixed to a new frequency, and summed with other channels in the analog domain.

One summer input is provided for each signal selectors. This is a broadband signal comprising up to 16 or 32 channels. Alternatively, a summer combines the analog I and Q signals from all the signal selectors.

Two basic approaches to combining are possible. One approach is to combine digitally filtered signals in the digital domain. This can be achieved with all filtered transponder channels to be combined presented at a sample rate equal to the composite output rate. The other approach is to combine the selected signals in the analog domain. This leads to two possible approaches to filtering. One is to implement filters with the same input and output sample rate. The other approach is to filter with an output sample rate that differs from the input sample rate.

An example of a digital combining embodiment, a 500 msps broadband sampling of the LNB output could be filtered to produce a 500 msps output stream representing one or more transponder channels. Each transponder channel may be frequency translated to the desired new carrier frequency, then filtered to produce a single transponder signal that can be combined with other similarly selected transponder channels.

FIG. **13** shows the frequency spectrum of a sample stream as it is processed. The original spectrum **1** is frequency translated to locate the selected transponder channel at the desired frequency, as shown in spectrum **2**. A band pass filter then passes one transponder channel and removes signal information from the other transponders channels, shown in spectrum **3**. This filtering operation selects one transponder. In this example transponder channel B is selected. The sample stream for the selected channel is added to the sample stream from other filtering sections, represented in spectrum **4**, to produce a composite sample stream in spectrum **5**. Other selected channels are represented by channels labeled X.

FIG. **17** shows a block diagram of the processing elements to perform these steps. Local oscillator (LO) **1710** feeds mixer **1720** and is then band pass filtered by filter. LO is variable to allow the selected channel to be frequency translated to any of the channels available in the band. Filter **1730** has a programmable pass band frequency, tuned by loading different filter coefficients. Summer **1740** adds the sample stream to other sample streams. Several transponder channels are selected, each requiring one input to an adder. One embodiment uses a two input adder for each filter channel to implement a pipeline adder. The time delay introduced by a pipeline adder does not present a problem to the system because the receivers are each demodulating one transponder and the relative time delay is not apparent.

The frequency translation can occur either before or after the filtering operation. An advantage to translating first followed by filtering is that the filter removes the unwanted mixing terms generated. In either case, a rotating phasor is multiplied by the data samples to translate their frequency.

An example of an analog-combining embodiment, the digital filters may have an output sample rate that differs from the input sample rate. This can be inherent in the filtering operation or result from a down sampling done after filtering. Down sampling after the selecting filter is possible because the single channel the bandwidth is narrower than the A/D output and fewer samples are needed to represent the signal.

The spectrum is placed at the desired RF frequency by choosing the LO frequency driving the up converters. One example would be 950 to 1450 MHz, a standard IF frequency for DBS systems. This frequency band is compatible with standard set top box (STB) hardware. Other IF frequencies could be used. Using this technique, standard STB hardware can receive the new composite signal and demodulate and decode the video and audio signals. Specific TV channels are located at new transponder frequencies. A

mapping table allows the IRD/STB to tune to the correct transponder channel. The bandwidth of the spectrum can be 500 MHz for a 16-transponder system, 1000 MHz for a 32-transponder system, or other bandwidths according to the number of transponder channels present on the cable. If the system uses band stacking, the A/D converter can directly sample the 1000 MHz IF signal, with or without a frequency translation, or the two LNB polarizations can be separated into two 500 MHz signals each digitized with separate A/D converters.

Alternatively, the IF signal from the LNB can be directly band pass sampled by a single A/D converter. The IF signal can be frequency translated to a different IF frequency before band pass sampling. Band pass sampling requires a higher speed A/D converter than base band sampling, but only a single A/D.

One pair of A/D converters is provided for each LNB output. Alternatively, the LNB output can be band pass sampled using a single A/D converter. At a given point in time some LNB outputs may not be accessed by a user. If no transponder channel is selected from a particular LNB output, the A/D converters associated with that LNB output may be switched off to reduce power consumption and heat generation, or reallocated to process another LNB output.

The A/D digitizes the entire LNB output signal; therefore all transponder channels are available in the sampled data. More than one transponder channel may be selected from the A/D data to be combined in the composite signal. When all A/D are powered up any combination of transponder channels from any LNB output can be combined into the composite signal for distribution to the gateway and STBs.

FIG. **5** shows a frequency spectrum of the composite signal. Each of the available channels can be occupied with any transponder channel of any polarization from any LNB. One or more channels are used by each active IRD connected to the system. The number of transponder channels in the composite signal can be from as few as 2 to as many as 32, depending on the number of simultaneous channels needed in the system.

In general, the selecting and combining process will result in transponder channels located at different frequencies than where originally found. A translation table maps original channel locations on the selector input to new channel locations on the selector output. This map created and maintained by a controller located in the ODU or the gateway and is communicated to the IRDs or other devices in the network.

The channel selector performs a frequency selective filtering operation to select the desired transponder frequency. The transition band of this filter is steep, passing the selected transponder channel and rejecting adjacent transponder channels. The transition region available is derived from the guard band between channels. This can be as small a few Mega-Hertz. If the LNB carrier offset is large, a shift in the spectrum will result in the selecting filter cutting off part of the desired spectrum and passing part of an adjacent channel. For this reason a carrier offset estimate is desirable. Since all transponder channels from a given LNB will have approximately the same offset, it is only necessary to monitor one transponder channel from each LNB to determine the offset for all channels. Any of several know techniques for estimating the carrier offset may be employed. One example is two use two filters each approximately half the transponder bandwidth. By measuring the ratio of power from each filter output, an estimate of the carrier offset can be determined. Once the carrier offset is estimated, the sampled signal can be multiplied by a rotating phasor value to digitally shift the spectrum back to the nominal position. Alternatively, this frequency offset correction can be done in the analog domain, or a combination of digital and analog approaches.

Another approach to addressing the unknown carrier offset in the LNB is to use a wider filter to select transponder channels, wherein the bandwidth of the filter passes the selected transponder and part of the adjacent spectrum. In this way, if the transponder signal is not centered in the filter bandwidth the band edges will not be attenuated by the filter roll off. This excess bandwidth will allow some energy from the neighboring transponder signals. A wider channel separation is needed on the combined signal, for example the selected transponders can be spaced twice the conventional spacing. This approach makes less efficient use of the cable spectrum but simplifies the hardware implementation by reducing the requirement of or eliminating the carrier offset correction. Additionally, a less steep filter roll off is possible.

FIG. **15** shows the signal spectrum as it is processed. Spectrum **1** is a representative original spectrum. Spectrum **2** shows the filter pass band characteristic, which is wider than one transponder channel. Spectrum **3** is the result of filtering one transponder channel. Spectrum **4** is a composite of several transponder channels. A region between the selected channels is unused. The exact shape of the unused spectrum will be dependent on the filter roll-off characteristics, but is not significant. The objective is to pass the selected transponder signal without distortion.

The approach of using a filter with excess bandwidth technique is also useful for implementing the invention using an analog approach. A filter with a stop band substantially wider than the transponder channel allow using filters with more gradual transition band, and is therefore simpler to implement. The excess bandwidth can range from less than 5% to 100% wider than the transponder bandwidth.

FIG. **6** shows a variation of the present invention that uses a cross point switch or shared bus **640** to distribute data from the A/Ds to the channel selecting filters. The cross point switch, also called crossbar switch, allows any signal input to be passed to any output. It can take the form of a data selector or multiplexer. Implemented as a shared bus, data sinks receive signals from data source using a time-multiplexed bus. Either a cross point switch or a shared bus can be unidirectional or bidirectional. The cross point principle applies to digital signals and analog signals. LNB outputs are quadrature down converted **620** and sampled by dual A/D converters **630**. The parallel data is routed through cross point switch **640** so that any filter has access to any A/D data. Filter/selector **650** selects the desired transponder channel that is then up converted by quadrature modulator **660**. All selected channels are combined in summer **670**.

FIG. **7** shows a variation where the cross point switch **740** is located after the selecting filter **720**. In this configuration the selecting filter **720** may also include a down sampler to reduce the bus traffic bandwidth in the cross point switch **740**. Down sampling is possible because after selecting a single desired channel the bandwidth is narrower and fewer samples are needed to represent the signal. One or more selecting filters **720** may be connected to the output of each A/D, each filter **720** selecting one transponder channel.

FIG. **8** shows a configuration wherein each LNB has a dedicated selecting filter and up converter. The selecting filter may digitally select multiple channels from the broadband A/D data to drive the up converter and DAC.

FIG. **9** shows another alternative where analog tuners **930** select desired transponder channels that are up converted by up converter **940**. All signals are combined by summer **950**

to drive the signal cable **970** from the ODU. A multiport switch **920** allows any tuner to connect to any LNB output. The number of signal selecting paths comprising tuner **930** and up converter **940** is selected based on the maximum number of simultaneous users. A multiple-tuner personal video recorder would use more than one signal. Controller **960** receives channel select information either from the cable or a separate data channel such as infrared (IR) or wireless RF link or other source. Channel select information from the controller **960** programs the tuner **930** and up converter **940** LO. Channel select information can come to the controller over a wireless remote control signal or using signaling sent over the cable.

Up converters **940** can operate at a fixed LO frequency with one up converter **940** being assigned to each user connected on the cable. The various LO frequencies are unique. Alternatively, the down conversion process of each tuner **930** can be set to down convert directly to a predetermined IF frequency which is unique for each selected signal, thereby eliminating a separate up converter. A simplified IRD can be used with this approach wherein the IRD needs only tune to a single selectable IF frequency. The tuning range is narrower than a convention 500 MHz tuner and the channel selection is limited to as few as four choices compared to up to 16 or more in a convention IRD tuner.

FIG. **10** shows another alternative where signal selector **1010** selects a transponder channel. MPEG transport stream demultiplexer **1020** extracts a specific video program that is combined by data combiner **1030**. Several MPEG streams are multiplexed as needed, and packets are formatted for transmission on a digital network. A digital LAN **1040** connects directly to the ODU. Channel information is communicated to the ODU through the LAN.

FIG. **11** shows another alternative used where new STBs are used with existing STBs. ODU **1110** supplies a signal to each of the connected cables according to the type of STB attached to the cable. Existing legacy STBs **1120** are supplied with an IF signal as in a conventional system, and the STBs **1120** will tune to a single transponder channel. New STBs **1140** will be supplied with a composite signal according to the present invention comprising all the transponder channels that are selected; the new STB **1140** will tune and decode the requested channel.

A new STB **1140** can be installed in place of an existing STB **1130** by simply connecting the new STB **1140** to the cable in place of the existing STB **1130**. More than one new STB **1140** can be installed by using a signal splitter **1150** to provide a signal to multiple STBs. New STBs use a signaling system for selecting transponder channels that passes through the splitter to the ODU. Existing STBs will each have a dedicated connection to the ODU, as provided in the original installation. This is required because existing STBs use voltages or other control means to select LNB outputs that do not support multiple STBs on a single cable.

Also in FIG. **11**, server/gateway **1160** receives the composite transponder signal, decodes specific programs, and distributes the program information in packetized MPEG over a digital local area network (LAN) **1170** to STBs **1180**. Ethernet or other LAN technology is suitable for this function.

A new STB operating in accordance with the present invention is provided with a means of communication with the signal selector and combiner in the ODU. At power up or at periodic intervals the ODU or the STB initiates communication over the attached cable. This communication can be an in band or out of band signal. The ODU polls the STBs connected to determine if the STB is a conventional STB or new design STB. Because conventional STBs will not respond to the polling request, the absence of response is an indication of a conventional STB. A new STB will respond to the polling request and establish communication with the ODU.

The means of communication on the cable can be a TDMA frame structure with slots assigned to each STB, a frequency division multiplex (FDM) approach with unique frequencies assigned to each STB, or any other known technique for two-way communication by multiple devices over a signal channel. An extension of DiSEqC protocol commonly used for satellite dish control can be used for this communication. DiSEqC uses a gated 22 kHz carrier to communicate binary data and can be adapted for use to transfer data needed. The data rates are low for this communication path. Device configuration, channel mapping, and channel requests are among the types of data communicated between the ODU and STB.

Referring to FIG. **12**, signal selector and combiner **1220** taps the signals output from each LNB to provide the transponder selection function. Switch **1220** is under control of the signal selector and combiner **1210**. Switch **1220** will be actuated to supply either a conventional signal from multiport switch **1260** or the composite transponder signal from signal selector and combiner **1210**. Switch **1220** can be a solid-state device or electromechanical relay.

Referring to FIG. **16**, another application of the present invention is to provide selected transponder signals along with other services transmitted on the same cable wiring. The selected transponder signals can be transmitted in unoccupied regions of the cable, such as above, below, or between broadband satellite signals. The number of transponder channels transmitted can be adapted to the available spectrum. In one example, 950 MHz to 1450 MHz is used by one conventional LNB output signal; 1550 MHz to 2050 MHz is used by another conventional LNB output, leaving 1450 MHz to 1550 MHz available. One or more selected transponder channels from any LNB can be inserted into this region. Suitable guard bands need to be provided to prevent interference, for example 3 transponder channels at 31.25 MHz spacing uses 93.75 MHz. Another example of this application is to combine a standard CATV signal occupying 50 to 750 MHz with selected satellite transponder channels that are combined and transmitted at frequencies above the CATV band.

Using the present invention, any number of transponder channels can be selected and combined. Conventional IRD tuners are designed to tune channels anywhere in a 500 MHz or 1000 MHz range, requiring a wide tuning range for the front-end filter and LO. In an application where few channels are needed, the tuner range can be narrower, thus simplifying the design and lower cost. For example, a residential installation may typically have four television sets, some tuning only one channel at a time; others tune two channels in the case of picture in picture (PIP) or personal video recorder (PVR). This application would require 4 to 8 channels be distributed in the house simultaneously. A tuner would be required to tune over a 125 MHz to 250 MHz range.

Several variations in architecture are possible using the present invention. At each stage in the signal path, alternatives are available for implementation. Specific functions can be implemented in the analog domain or digital domain. Dedicated resources can be provided for each possible connection, or a pool of resources can be used. Dedicated resources insure that the peak demand can be satisfied unconditionally, but leads to unused capacity. Pooling

enables a trunking efficiency to be realized and exploits statistical properties of usage to address most requirements.

A pool of A/D converters that can accept a signal from any LNB output through an RF crossbar switch. The number of simultaneous LNB signals that can be processed is limited to the number of A/D converters provided. Alternatively, dedicated A/D converters, one connected to each LNB output allows all LNBs to be processed if needed.

A pool of filter/selectors connected to a common bus, the pool size dictating the number of simultaneous transponder channels that can be selected. Alternatively, a predetermined number of filters can be attached to each A/D converter.

The filters/selectors can be grouped with each LNB or can be a common resource available to process any signal from any LNB. This choice trades off circuit complexity of implementing more filters with circuit complexity of routing LNB outputs through a crossbar switch.

Each of the operations of mixing, filtering, and combining can be done as an analog operation or digital operation.

Partitioning of functions can take a number of forms. The circuitry can be implemented in a monolithic integrated circuit (IC), a hybrid, discrete components, or a combination of technologies.

Another application of the present invention is to simplify upgrades to an existing system. A dual tuner STB that enables viewing and recording of two different channels requires two input cables to allow any combination of LNB signals to be received. A single cable input would be limited to viewing and recording two channels from the same LNB output. When the upgrade is performed, the installation of an additional cable is difficult. By selecting and combining the desired channels at the ODU a single cable can be used to transmit all channels. A re-map of channel locations occurs. A conventional dual tuner STB can be used with this approach by providing a splitter at the input to the STB that supplies the composite signal to both cable inputs. A software upgrade to the STB may be needed to support the channel re-mapping.

Other implementations for signal processing include: No cross point switch, digitize, digital filter select, frequency translate, RF combine; cross point switch, analog tuner select, frequency translate, RF combine; digitize, digital filter select, digital network combine; digitize, digital filter select, decode, MPEG stream over a network; digitize, digital filter select, decode, MPEG to analog, restack channels, RF combine. One skilled in the art will recognize that many variations are possible to implement the present invention of selecting signals and combining onto a signal cable.

Another property of the present invention is that the process of digitizing, selecting, and combining is modulation independent. Either a digital or analog selecting and combining approach can be designed to process any form of phase/amplitude modulation. Although the dominant modulation type in direct broadcast satellite systems is QPSK, alternatively BPSK, 8-PSK or multi-level QAM and PSK signals can be distributed in the same way.

What is claimed is:

1. A signal distribution system for distributing a plurality of low noise amplifier and block converter (LNB) signals from a satellite outdoor unit (ODU) over a coaxial cable to an integrated receiver decoder (IRD) comprising:

a signal selector that receives a plurality of broadband LNB signals comprising a plurality of transponder signals, the signal selector is responsive to transponder select information transmitted by an IRD and selects a plurality of transponder signals from at least one broadband LNB signal based on the transponder select information;

a frequency translator coupled to the signal selector that is capable of shifting the selected transponder signals to new carrier frequencies to produce RF signals; and

a signal combiner coupled to at least one frequency translator capable of combining at least two RF signals to produce a composite signal;

wherein the modulation of the composite signal is the same as the modulation of the broadband LNB signals and wherein the composite signal is transmitted on the coaxial cable;

whereby the composite signal is transmitted to the IRD.

2. The signal distribution system of claim 1 further comprising a plurality of IRDs and wherein the composite signal is transmitted on a single cable connected to the ODU and all IRDs receive channels extracted from the composite signal.

3. The signal distribution system of claim 1 wherein the signal selector comprises an analog to digital converter and a digital filter.

4. The signal distribution system of claim 1 wherein the signal selector comprises a tuner.

5. The signal distribution system of claim 1 further comprising an integrated receiver decoder (IRD) connected to the coaxial cable with a plurality of tuners within the IRD, wherein each tuner within the IRD receives the composite signal and each tuner uses at least one transponder signal.

6. The signal distribution system of claim 1 wherein transponder select information is transmitted over the same cable as the composite signal.

7. The signal distribution system of claim 1 wherein transponder select information is transmitted over a wireless link.

8. A signal distribution system for distributing signals comprising a plurality of channels from a plurality of sources between a first unit and a second unit over a communication medium comprising:

means in the first unit responsive to information transmitted by the second unit for extracting selected channels from each of the plurality of sources and combining the selected channels into a composite signal without demodulating channels and without changing the modulation of the channels and transmitting the composite signal over the medium; and

means in the second unit for receiving the composite signal and demodulating and decoding at least one channel; and

means in the first unit and second units for bi-directionally communicating control information between the second unit and the first unit.

9. The signal distribution system of claim 8 wherein the control information comprises channel selection requests originating from the second unit and the control information comprises channel mapping information originating from the first unit.

10. The signal distribution system of claim 8, further comprising a means in the first unit for carrier offset correction.

11. The signal distribution system of claim 8 wherein the first unit is a satellite outdoor unit and the second unit is a satellite integrated receiver decoder unit.

12. The signal distribution system of claim 11 wherein the communication medium consists of a single coaxial cable connected to the satellite outdoor unit.

13. The signal distribution system of claim 12 wherein the means for communicating uses the same communication medium as the composite signal.

14. A method of communicating a plurality of transponder signals from a satellite outdoor unit (ODU) that receives a plurality of satellite broadband signals to an integrated receiver decoder (IRD) over a single cable connected to the ODU, the method comprising the steps of:

communicating a transponder request signal to the ODU from the IRD;

in the ODU, selecting a plurality of transponder signals extracted from the received satellite broadband signals, wherein the selecting is responsive to the transponder request signals;

combining selected transponder signals into a composite signal;

transmitting the composite signal over the single cable from the ODU to the IRDs, wherein the modulation of the transponder signal is not altered by the steps of selecting, combining, and transmitting.

15. The method of claim 14 wherein the step of selecting a transponder signal comprises the step of: filtering a transponder signal with a band pass filter having a bandwidth ranging from 5% to 100% wider than the bandwidth of the transponder signal.

16. The method of claim 14 wherein the step of combining comprises frequency translating the selected transponder channels to a variable frequency before combining.

17. The method of claim 15 further comprising frequency translating the selected transponder channels to a predetermined frequency before combining.

18. The method of claim 14 further comprising the step of splitting the composite signal inside a home and distributing to a plurality of IRDs.

19. The method of claim 14 wherein the transponder request signal is transmitted over the cable from an IRD and all IRDs receive the same composite signal.

20. The method of claim 14 wherein the transponder request signal is transmitted over a wireless link to the ODU.

21. The method of claim 14 further comprising the steps of:

frequency translating the selected transponder channels to a variable frequency before combining; and

splitting the composite signal inside a home and distributing to a plurality of IRDs.

22. The method of claim 21 wherein the transponder request signal is transmitted over the cable from an IRD.

23. The method of claim 21 wherein the transponder request signal is transmitted over a wireless link to the ODU.

* * * * *

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of Gurantz et al.	)	Group Art Unit: TBD
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	)	Examiner: TBD
U.S. Patent No. 7,130,576	)	
	)	
Patent Date: October 31, 2006	)	
	)	
For: SIGNAL SELECTOR AND COMBINER FOR BROADBAND CONTENT DISTRIBUTION	)	
	)	
	)	
	)	

Mail Stop: *Ex Parte* Reexamination
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

INFORMATION DISCLOSURE STATEMENT

Sir:

In accordance with 37 C.F.R. §§ 1.56, 1.97 and 1.98, Applicant submits the attached form which identifies documents that might be deemed material to the reexamination of the above-identified patent.

Applicant respectfully requests that the identified documents be considered in the reexamination of this patent, and that such consideration be made of written record in the patent file.

Dated: December 20, 2006

Respectfully submitted,

SHEPPARD MULLIN RICHTER & HAMPTON LLP

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(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	TBD
Filing Date	TBD
First Named Inventor	Itzhak GURANTZ
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	05JM-127751

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 4,953,184		Simone	
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		US- 5,285,284		Takashima et al.	
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		US- 6,353,463		Seo	
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] "Number[4] "Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
		EP 1009113				
		EP 0757489				

Examiner Signature		Date Considered	

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Sheet 2 of 2

Complete if Known	
Application Number	TBD
Filing Date	TBD
First Named Inventor	Itzhak GURANTZ
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	05JM-127751

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
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		Thomson Consumer Electronics "RCA DirectTV Receiver with UltimateTV Service Setup Guide" WebTV Networks, Inc. 2000	

Examiner Signature		Date Considered	

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APPENDIX A

Appendix A

Summary of the Prosecution History of United States Patent No. 7,130,576 Patent

1. Original Application

United States Patent No. 7,130,576 (the "'576 patent") was applied for on November 11, 2002, under application Serial Number 10/289/011. The application claimed priority to application 60/345,965 (filed November 7, 2001) and listed Itzhak Gurantz, Ladd El Wardani, and Michael Landry as inventors. The application also listed twenty-three (23) claims, three of which were independent – Claims 1, 8, and 14. These independent claims claimed:

1. A signal distribution system for distributing a plurality of signals over a communication channel to a receiver comprising: a signal selector that receives a plurality of wideband signals comprising a plurality of narrowband signals and selects at least one narrowband signal from at least one wideband signal; a frequency translator coupled to the signal selector that is capable of shifting the selected narrowband signal to a predetermined carrier frequency to produce an RF signal; and a signal combiner coupled to at least one frequency translator capable of combining at least two RF signals to produce a composite signal; whereby the composite signal is transmitted to the receiver.

8. A signal distribution system for distributing signals comprising a plurality of channels from a plurality of sources between a first unit and a second unit over a communication medium comprising: means in the first unit for selecting channels from a plurality of sources and combining the selected channels into a composite signal and transmitting the composite signal over the medium; and means in the second unit for receiving the composite signal; and means in the first and second units for bi-directionally communicating control information between both units.

14. A method of communicating a plurality of transponder signals from a satellite outdoor unit (ODU) to integrated receiver decoders (IRDs) over a single cable connected to the ODU, the method comprising the steps of: communicating a transponder request signal to the ODU; in the ODU, selecting a transponder signal responsive to the transponder request signal; combining selected transponder signals into a composite signal; transmitting the composite signal over the single cable from the ODU to IRDs.

2. First Office Action and Response to First Office Action

On April 26, 2005, the Examiner rejected all twenty three claims. Claims 1-9 and 11-23 were rejected as anticipated under 35 U.S.C. 102(e) by Williams [US 6,493,873] and claim 10 was rejected as obvious under 35 U.S.C. 103(a) over Williams in view of Seo [US 6,437,837].

On August 9, 2005, the patentee responded to this office action. The patentee distinguished itself from Williams on the grounds that the claimed invention does not transmodulate and all decoding of the tranponder signals occurs in the IRDs.

The patentee argued that these changes rendered the invention patentable. "An important distinction between applicant's invention and the Williams reference is that Williams uses transmodulation where the applicant's invention does not transmodulate, but instead applicant's invention selects transponder channels and combines the selected transponder signals using the original modulation of the transmission from the satellite. ... Because applicant's invention selects and combines the original satellite signal without demodulation and without altering the modulation, the extra steps in Williams of decoding and re-encoding in the selector and combiner is avoided." Furthermore, "[t]he applicant's invention allows the use of the standard satellite intermediate-frequency (IF) frequency band for distribution from the ODU to the IRD and standard IRD hardware that is designed to accept QPSK modulated transponder signals. ...

According to the claims presented, decoding of transponder signals is not performed in the signal selector and combiner. Decoding of the transponder is signals is performed only in the IRDs."

Furthermore, "[t]he broadband and reduced-in-bandwidth in Williams pertain to the signal bandwidth before and after transmodulation. There is no transmodulation in applicant's invention. A transponder signal in applicant's invention is selected and combined without altering the modulation."

In response to the rejections under 35 U.S.C. 102(e), and to clarify the differences between the claimed invention and the Williams reference, the patentee amended Claims 1, 8, 14, 15, and 17. These claim 1 was amended as follows:

1. A signal distribution system for distributing a plurality of low noise amplifier and block (LNB) signals over a communication channel to a receiver comprising: a signal selector that receives a plurality of ~~wideband~~ broadband LNB signals comprising a plurality of ~~narrowband~~ transponder signals and selects at least one ~~narrowband~~ transponder signal from at least one ~~wideband~~ broadband signal; a frequency translator coupled to the signal selector that is capable of shifting the selected ~~narrowband~~ transponder signal to a predetermined carrier frequency to produce an RF signal; and a signal combiner coupled to at least one frequency translator capable of combining at least two RF signals to produce a composite signal; wherein the modulation of the composite signal is the same as the modulation of the broadband LNB signals; whereby the composite signal is transmitted to the receiver.

According to the patentee this amendment "clarify[ied] the distinction that the broadband LNB signal [in Williams] is the full LNB output comprising many transponder channels; and amended claim 1 uses the term transponder signal to clarify that the selected signal is a

transponder signal, a subset of the full broadband LNB signal." The patentee also argued that "claim 1 is further modified to clarify that the modulation of transponder channels is not changed in the process of selecting and combining by including the limitation wherein the modulation of the composite signal is the same as the modulation of the broadband LNB signals. This continuity in the modulation is distinct from Williams where the modulation is changed to reduce the bandwidth of the transponder signals." On these basis the patentee contended that the claimed invention was patentable.

Claim 8 was amended to read:

8. A signal distribution system for distributing signals comprising a plurality of channels from a plurality of sources between a first unit and a second unit over a communication medium comprising: means in the first unit for selecting channels from a plurality of sources and combining the selected channels into a composite signal without demodulating channels and without changing the modulation of the channels and transmitting the composite signal over the medium; and means in the second unit for receiving the composite signal and demodulating and decoding at least one channel; and means in the first and second units for bi-directionally communicating control information between both units.

According to the patentee this amendment "expressly recite[s] that the channel selection combining is performed without demodulating channels and without changing the modulation of the channels. Further, claim 8 has been amended to include the limitation that demodulating and decoding at least one channel is performed in the second unit, not the first unit, as in Williams, where selecting and combining is performed."

Claim 14 was amended to read:

14. A method of communicating a plurality of transponder signals from a satellite outdoor unit (ODU) to integrated receiver decoders (IRDs) over a single cable connected to the ODU, the method comprising the steps of: communicating a transponder request signal to the ODU; in the ODU, selecting a transponder signal responsive to the transponder request signal; combining selected transponder signals into a composite signal; transmitting the composite signal over the single cable from the ODU to IRDs, wherein the modulation of the transponder signal is not altered by the steps of selecting, combining, and transmitting.

According to the patentee this rendered claim 14 patentable "to expressly recite that the modulation of the transponder signal is not altered by the steps of selecting, combining, and transmitting to clearly distinguish the claim from Williams. In Williams, the modulation is changed by transmodulation from QPSK to QAM. This negative limitation is inherent in the applicant's disclosure of the techniques for selecting, frequency, translating, for example using digital or analog filters or tuners, which do not alter modulation. ... Selecting a transponder signal in claim 14 is performed in the ODU, in contrast to Williams where selecting is done in the transmodulator."

Claim 15 was amended to read:

15. The method of claim 14 wherein the step of selecting a transponder signal comprises the step of: filtering a transponder signal with a band pass filter having a bandwidth ~~substantially~~ ranging from 5% to 100% wider than the bandwidth of the transponder signal.

Thus, the claim was "amended to include the limitation of the selecting band pass filter having a bandwidth ranging from 5% to 100% wider that the bandwidth of the transponder signal[.] ... The bandpass filtering of Williams is 500 MHz wide and spans all the transponders output from one polarization component of the LNB."

And claim 17 was amended to depend from claim 14.

17. The method of claim [[14]] 15 further comprising frequency translating the selected transponder channels to a predetermined frequency before combining.

With regards to the rejection of claim 10 under 103(a), the patentee argued that "[t]he carrier offset correction of the present invention is not performed in a television receiver, as disclosed in Seo. The present invention employs carrier offset correction to properly filter the selected signals and to avoid interference with adjacent channels, not co-channel interference as in Seo[ ]. There is no suggestion or motivation to modify the teaching of Williams or Seo to incorporate carrier offset correction because Williams teaches the full demodulation of the received signal, which includes carrier recovery and removal as part of the demodulation process. In Seo, there is no signal selecting and combining operation and no suggestion of application of the teaching of Seo to signal selecting and combining." It should be noted that the U.S. Supreme Court just heard oral arguments on whether the suggestion or motivation argument is proper grounds for determining that a claimed invention is patentable and a final decision on this issue is expected by June 2007. [CITE TO KSR CASE]

3. Second Office Action and Response

The patentee's arguments were unpersuasive and, on October 27, 2005 the examiner again rejected all 23 claims. Independent claims 1, 8, and 14 were rejected under 35 U.S.C. 102(e) as anticipated by Shah [US 6,441,797], as were dependant claims 2, 5, 9, 11-13, 16, and 17. Dependent claims 6 and 19 were also rejected under 102(e) as anticipated by Williams [US 6,493,873]. Furthermore, several dependant claims were rejected under 35 U.S.C. 103(a). Dependant claim 3 was rejected under 103(a) as being unpatentable over Shah in view of

Williams. Claim 4, 7, 10, and 21-23 were rejected over Williams. Claim 10 was rejected over Shah in view of Seo [US 6,437,837]. And claim 15 was rejected over Shah in view of Lindell [US 2003/0008628].

In response to this Second Office Action, the patentee argued that the claimed invention was patentable over Shaw because "the disclosure of Shaw teaches multiple cables running from ODU to the IRDs; the IRDs select a full satellite/LNB signal to be transmitted in its corresponding cable; and the IRD control of the multi-switch selects full satellite/LNB signals, not individual transponder signals. The transponder combiner is fixed, the combined signal is a fixed set of transponder channels received from two or more satellites, the combined signal does not change in response to IRD select signals or commands.

"In the applicants' invention, a single cable can run from the selector and combiner, which can be in the ODU, to the inside of the building. The signal is split inside the building using a gateway or splitter device to distribute a composite signal to IRDs. The IRD commands to the selector requests individual transponder signals from the satellite signals output by any one of the LNBs. The signal selector selects the transponder signals requested from each IRD, combines all fo the selected transponder signals into a composite signal, then transmits the composite signal into the building and to the IRDs. Each IRD can receive the same composite signal, sent preferably over a single cable, and tunes its requested transponder signal for decoding and display on a television connected to the IRD. The composite signal changes based on the collection of transponder select signals from each of the IRDs. In Shah, a different signal is sent to each IRD over a separate cable for each IRD. In Shah, the combined signal does not change with the LNB select signals from each of the IRDs.

The patentee further amended claims 1,2, 5-7, 8, 12, 14, 16 and 19. Claim 1 was amended to read:

1. A signal distribution system for distributing a plurality of low noise amplifier and block (LNB) signals from a satellite outdoor unit (ODU) over a ~~communication channel~~ coaxial cable to ~~a receiver~~ an integrated receiver decoder (IRD) comprising: a signal selector that receives a plurality of broadband LNB signals comprising a plurality of transponder signals, the signal selector is responsive to transponder select information transmitted by an IRD and selects ~~at least one~~ a plurality of transponder signals from at least one broadband signal based on the transponder select information; a frequency translator coupled to the signal selector that is capable of shifting the selected transponder signals to ~~a predetermined~~ new carrier frequencies[[y]] to produce [[an]] RF signals; and a signal combiner coupled to at least one frequency translator capable of combining at least two RF signals to produce a composite signal; wherein the modulation of the composite signal is the same as the modulation of the broadband LNB signals and wherein the composite signal is transmitted on the coaxial cable; whereby the composite signal is transmitted to the ~~receiver~~ IRD.

According to the patentee this amendment "incorporate[s] the limitations that the signal selector is responsive to transponder select information transmitted by an integrated receiver decoder (IRD), that the selection is responsive to and based on the transponder select information, that the frequency translation is to new frequencies, and that the composite signal is transmitted on the coaxial cable. ... Shah does not teach a transponder selector or combiner responsive to IRD commands." The patentee further argued that "in Shah, the frequency translator is part of the LNB, whereas in the applicant's invention and claim, the frequency translator operates on the signal output from the LNB[.]"

Claim 2 was amended to read:

2. The signal distribution system of claim 1 further comprising a plurality of IRDs and wherein ~~the communication channel~~ the composite signal is transmitted on a single cable connected to the ODU and all IRDs receive channels extracted from the composite signal.

The patentee contended that "[t]hese amendments and the original limitations distinguish the claim further from Shaw, in which a single cable connects between the combiner and the multi-switch within the ODU, but the ODU in Shaw has several cables connected to the ODU carrying the combined signal or other LNB signals to the IRDs. The IRDs in Shah do not extract channels from the combined signal but instead some IRDs receive other signals that are [sic] do not result from selecting and combining transponder channels."

Claim 5 was amended to read:

5. ~~The signal distribution system of claim 1 wherein the signal selector is responsive to channel select information transmitted by a receiving unit.~~ The signal distribution system of claim 1 further comprising an integrated receiver decoder (IRD) connected to the coaxial cable with a plurality of tuners within the IRD, wherein each tuner within the IRD receives the composite signal and each tuner uses at least on transponder signal.

Claim 8 was amended to read:

8. A signal distribution system for distributing signals comprising a plurality of channels from a plurality of sources between a first unit and a second unit over a communication medium comprising: means in the first unit responsive to information transmitted by the second unit for extracting selected~~ing~~ channels from [[a]] each of the plurality of sources and combining the selected channels into a composite signal without demodulating channels and without changing the modulation of the channels and transmitting the composite signal over the medium; and

means in the second unit for receiving the composite signal and demodulating and decoding at least one channel; and means in the first and second units for ~~bi-directionally~~ communicating control information the second unit to the first unit ~~between both units~~.

According to the patentee, these amendments render the claimed invention patentable because, "[i]n Shah, the selecting and combining transponders is fixed and not responsive to information transmitted for a second unit. The control in Shah does not affect the extraction of combining of transponders, but only affects which LNB output is made available to a particular IRD. The selection at the multi-switch controlled by IRDs in Shah can select the combined signal or an unaltered LNB output, but cannot control the selection of channels combined into a composite signal."

Claim 12 was amended to read:

12. The signal distribution system of claim 11 wherein the communication medium ~~is a~~ consists of a single coaxial cable connected to the satellite outdoor unit.

According to the patentee this amendment "clearly distinguish[es] the claim from Shah, which teaches several cables connected to the ODU."

Claim 14 was amended to read:

14. A method of communicating a plurality of transponder signals from a satellite outdoor unit (ODU) that receives a plurality of satellite broadband signals to an integrated receiver decoders (IRDs) over a single cable connected to the ODU, the method comprising the steps of: communicating a transponder request signal to the ODU from the IRD; in the ODU, selecting a plurality of a transponder signals extracted from the received satellite broadband signals, wherein the selecting is responsive to the transponder request signal; combining selected transponder signals into a composite signal; transmitting the composite signal over the single cable from the

ODU to the IRDs, wherein the modulation of the transponder signal is not altered by the steps of selecting, combining, and transmitting.

According to the patentee this amendment made the invention patentable over Shah because the claimed invention "select[s] a plurality of transponder signals extracted from the received satellite broadband signals, wherein the selecting is responsive to the transponder request signals [and this] is not taught by Shaw."

The patentee amended claim 16 to read:

16. The method of claim 14 ~~further~~ wherein the step of combining comprises~~ing~~ frequency translating the selected transponder channels before combining.

And amended claim 19 to read:

19. The method of claim 14 wherein the transponder request signal is transmitted over the cable from an IRD and all IRDs receive the same composite signal.

With regards to the rejections under 35 U.S.C.103(a) the patentee argued that the amendments to Claim 8 should overcome the 103 rejection, and claim 10 was "amended to include the limitation that the frequency offset if performed in the first unit containing the selector and combiner to distinguish from Shaw, where offset correction is performed in a television." Furthermore, "[t]he carrier offset correction of the present invention, and as recited in amended claim 10, is not performed in a television receiver, as disclosed in Seo. The present invention employs carrier offset correction to properly filter the selected signal to avoid interference with adjacent channels, not co-channel interference as in Seo. There is no suggestion or motivation to modify the teaching of Shah or Seo to incorporate carrier offset correction into a signal selector and combiner."

With regards to claim 15, the patentee argued that the amendments to claim 14 should render claim 15 patentable.

4. Third Office Action and Response

On March 29, 2006, the examiner again rejected claims 1-23. Claims 1, 6, 8, 9, 11, 13, 16, and 17 were rejected under 35 U.S.C. 102(e) as anticipated by Shaw [US 6,441,797]. Claims 2-5, 12, 14, 18, 19, and 21-23 were rejected under 35 U.S.C. 103(a) as unpatentable over Shah in view of Williams [US 6,493,873]. Claim 10 was rejected under 35 U.S.C. 103(a) as unpatentable over Shaw in view of Seo [US 6,437,837]. And claim 15 was rejected under 35 U.S.C. 103(a) as unpatentable over Shah and Williams in view of Lindell [US 2003/0008628].

In response to this third office action, the patentee conducted an interview with the examiner and amended claims 8, 16, and 21. The interview "included an explanation of the distinction between the claimed invention and the Shaw reference. Specifically, it was explained that the Shaw reference uses a conventional multi-switch controlled by an IRD to connect one of the input cables to one of the output cables. A whole wideband source that comprises many transponder channels is selected by the multi-switch. The multi-switch does not select individual transponder channels under control of an IRD. Individual transponder channel within the wideband signal are not selected by the multiswitch. In Shah, certain fixed transponders are relocated and masked. There is no programmability or control over the transponders selected or the relocated frequency; it is fixed. The relocation and masking in Shah is not responsive to signals from the IRDs, only the multi-switch, which select a wideband signal, is responsive to signals from the IRDs." The patentee also argued that the claimed invention "include[s] the limitation of transponder selection responsive to a signal transmitted by an IRD. This limitation is not found in Shah."

Furthermore, the patentee stated that the "disclosure of Shah teaches multiple cables running from the ODU to the IRDs; the IRDs select a full satellite/LNB signal to be transmitted in its corresponding cable; and the IRD control of the multi-switch selects full satellite/LNB signals, not individual transponder signals. The transponder combiner is fixed, the combined signal is a fixed set of transponder channels received from two or more satellites, and the combined signal does not change in response to IRD select signals or commands. The selection of a cable connection at a multi-switch by the IRD does not influence the transponder selection, relocation, or combining."

In contrast, in the claimed "invention, a single cable can run from the selector and combiner, which can be in the ODU, to the inside of the building. The signal is split inside the building using a gateway or splitter device to distribute a composite signal to IRDs. The IRD commands to the selctor requests individual transponder signals from satellite signals output by any one of the LNBs. The signal selector selects the transponder signals requested from each IRD, combines all of the selected transponder signals into a composite signal, then tramsits the composite signal, sent preferably over a single cable, and tunes its requested transponder signal for decoding and display on a television connected to the IRD. The composite signal changes based on collection of transponder select signals from each IRD. In Shah, a different signal is sent to each IRD over a separate cable for each IRD. In Shah, the combined signal does not change with the LNB select signals from each of the IRDs." The patentee also "noted that in Shah, the frequency translator is part of the LNB, whereas in the applicant's invention and claim, the frequency translator operates on the signal output from the LNB[.]"

With regards to Williams, the patentee contended that "Williams transmodulated the LNB signals, converting QPSK to QAM, the applicant's invention does not transmodulate."

The patentee also amended claim 8 to read:

8. A signal distribution system for distributing signals comprising a plurality of channels from a plurality of sources between a first unit and a second unit over a communication medium comprising: means in the first unit responsive to information transmitted by the second unit for extracting selected channels from each of the plurality of sources and combining the selected channels into a composite signal without demodulating channels and without changing the modulation of the channels and transmitting the composite signal over the medium; and means in the second unit for receiving the composite signal and demodulating and decoding at least one channel; and means in the first and second units for bi-directionally communicating control information between ~~from~~ the second unit ~~to~~ and the first unit.

According to the patentee this distinguished its invention from Shah because "[i]n Shah, control information is not communicated bi-directionally, but only from the IRD to the outdoor unit for the purpose of selecting a cable at the multi-switch."

Claim 16 was amended to read:

16. The method of claim 14 wherein the step of combining comprises frequency translating the selected transponder channels to a variable frequency before combining.

The patentee contended that this distinguished its invention from Shah because "Shah relocates transponders to a fixed frequency."

And the patentee amended claim 21 to read:

21. The method of claim 14 further comprising the steps of: frequency translating the selected transponder channels to a ~~predetermined~~ variable frequency before combining; and splitting the composite signal inside a home and distributing to a plurality of IRDs.

According to the patentee this rendered the claimed invention patentable of Shah and Williams because "Shah relocates transponders to a fixed frequency."

With regards to the 103(a) rejection of claim 10, the patentee distinguished the claimed invention from Seo on the grounds that "[t]he important distinction between Seo and the present invention is that Seo teaches a method of preventing co-channel interference, specifically, when an analog television channel is occupying the same frequency as a digital television channel. [But,] the present invention uses frequency offset to avoid adjacent channel interference. Adjacent channels are not occupying the same frequency but are next to each other in the band. Additionally, Seo's technique is employed in the TV receiver. The frequency offset of the present invention takes place in the selector/combiner."

With regards to the rejections under 103(a), the patentee argued that claims 2 and 12 were patentable over Williams and Shah because there was "no motivation to combine the single cable teaching of Williams with the multiple cable approach of Shah."

Similarly, with regards to claim 14, the patentee argued that in addition to its amendment to claim 14, there was "no motivation to combine the single cable teaching of Williams with the fixed transponder and multiple cable teaching of Shah."

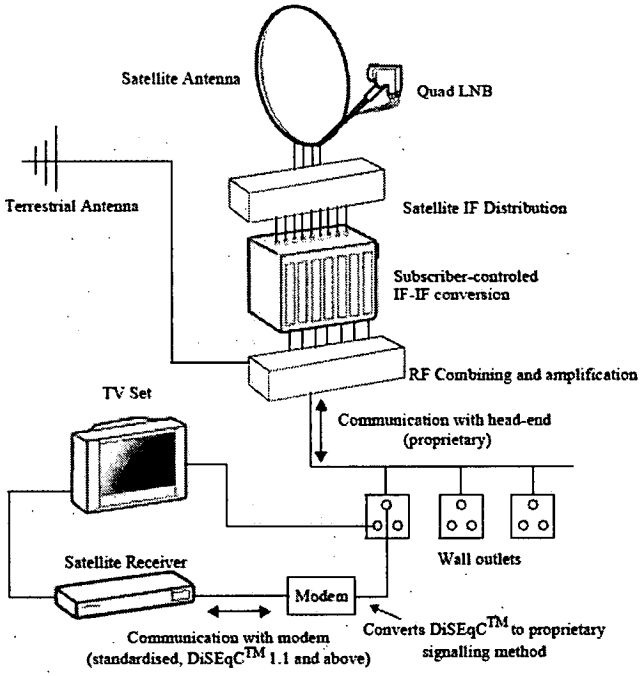
The patentee also argued that claim 15 was "patentable in light of the amendments and arguments for claim 15."

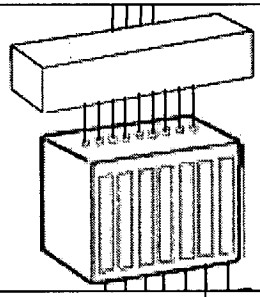
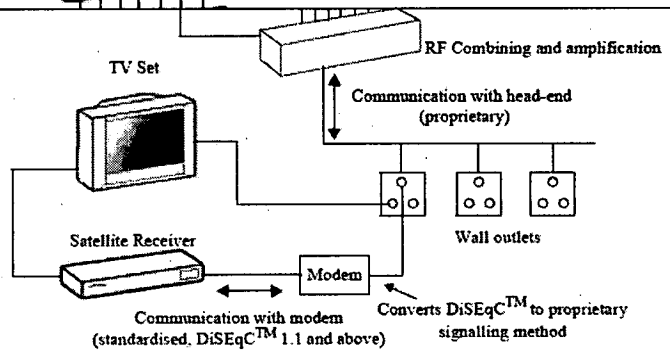
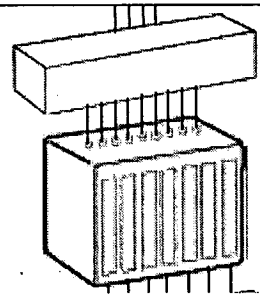
The examiner allowed all claims as amended following this response.

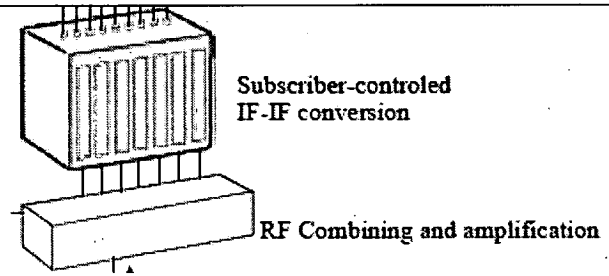
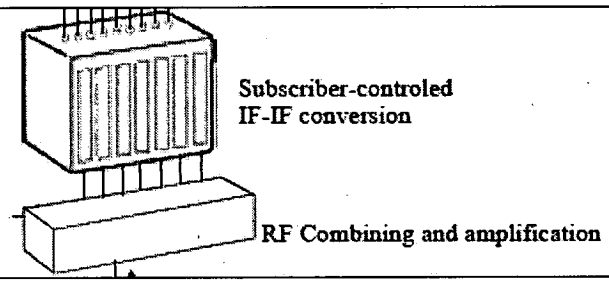
APPENDIX B

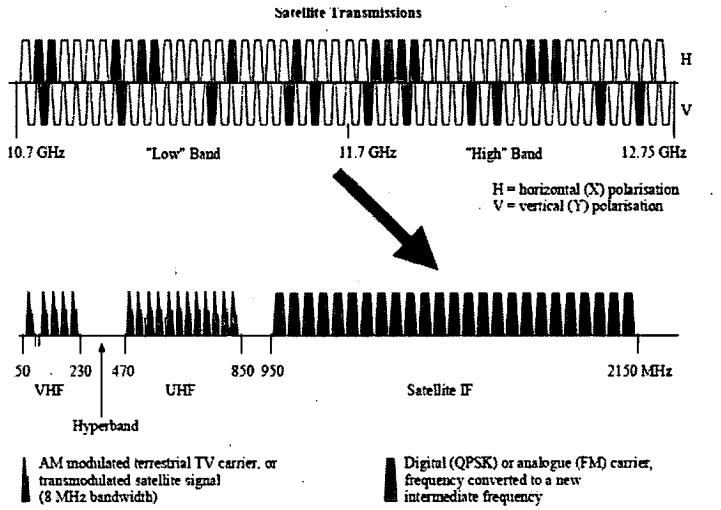
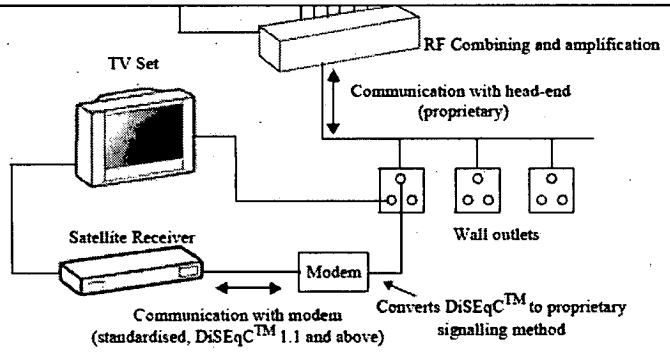
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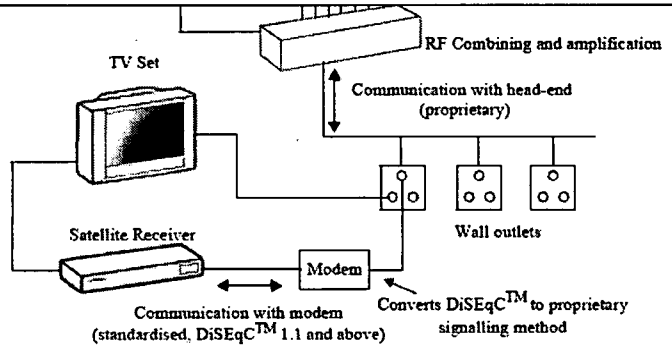
PART I: Applicability of the Eutelsat Installers Guide to the Claims of the '576 patent

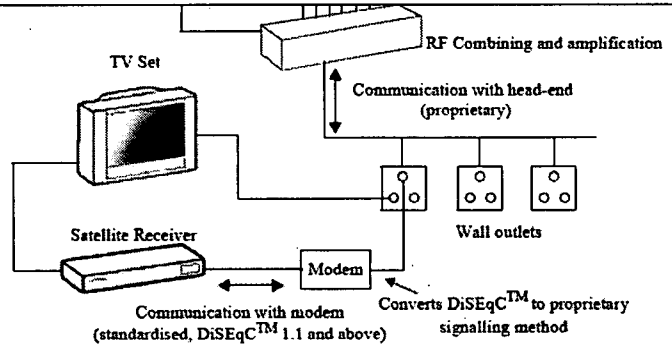
Claim 1	Eutelsat Installers Guide	Notes/Description
1. A signal distribution system for distributing a plurality of low noise amplifier and block converter (LNB) signals from a satellite outdoor unit (ODU) over a coaxial cable to an integrated receiver decoder (IRD) comprising:	Figure 11:  Figure 11 : Architecture of a System with a Remote Controlled Head-End	Figure 11 of the Eutelsat Installers Guide illustrates a Quad LNB outputting a plurality of LNB signals (in this case, four). Transponder signals extracted from the LNB output are distributed over the coaxial cable illustrated as coming from the RF Combiner. This composite output is distributed via a single cable to each of the wall outlets, which, as illustrated can be connected to a Satellite Receiver. Page 20 refers to the Satellite Receiver as an IRD.

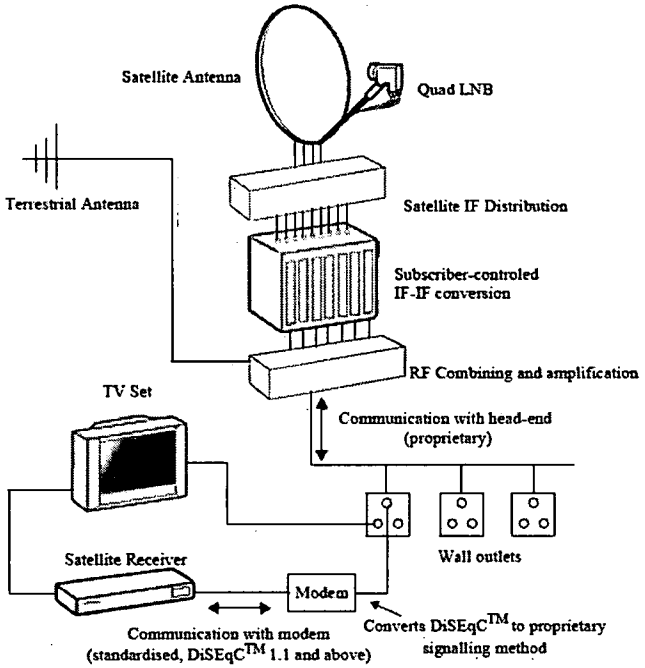
a signal selector that receives a plurality of broadband LNB signals comprising a plurality of transponder signals,		Figure 11 illustrates the four broadband LNB output signals supplied to an IF Distribution Unit for distribution to Subscriber-controlled IF-IF converters.
the signal selector is responsive to transponder select information transmitted by an IRD		Figure 11 illustrates that the IRD sends a DiSEqC signal to the outdoor unit. Page 20 states that the IRD generates the commands, and page 19 (last paragraph) states that this is "so that remote channel selection can be carried out." Note, page 28 states that the modem is only needed to convert to a different proprietary signaling method.
and selects a plurality of transponder signals from at least one broadband LNB signal based on the transponder select information;		The IF-IF converters select transponder signals (referred to as channels in both the '576 patent and in the Eutelsat Installers Guide). As stated immediately above the channel selection is based on information from the IRD .

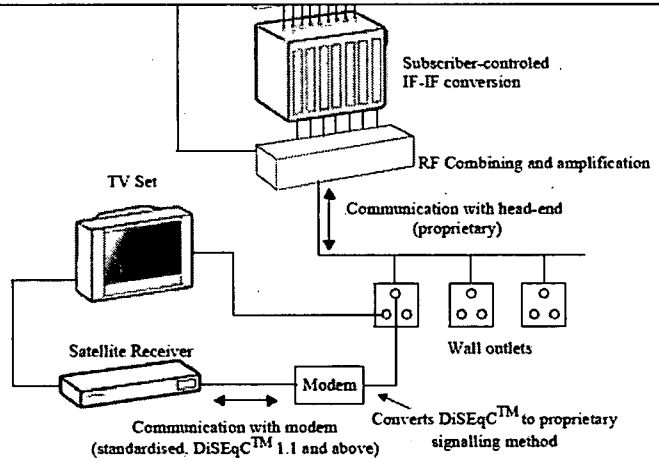
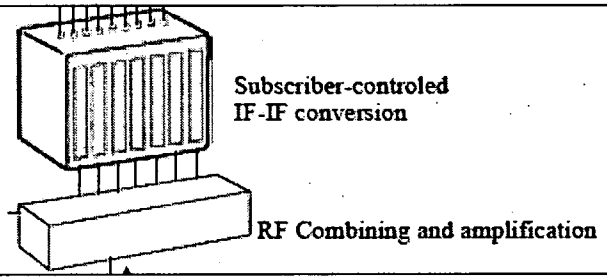
a frequency translator coupled to the signal selector that is capable of shifting the selected transponder signals to new carrier frequencies to produce RF signals;		The IF-IF converters frequency translate the IF signals from their original position in their respective broadband LNB signals to their new position for placement in the composite signal. Additionally, page 15, second paragraph, states that the IF to IF conversion rebuilds the satellite IF spectrum so that it is suitable for transmission on a single cable (i.e., as a composite signal).
and a signal combiner coupled to at least one frequency translator capable of combining at least two RF signals to produce a composite signal;		Figure 11 illustrates that a signal combiner combines the RF signals to produce a composite signal The fact that terrestrial signals can also be combined (or not) is irrelevant.

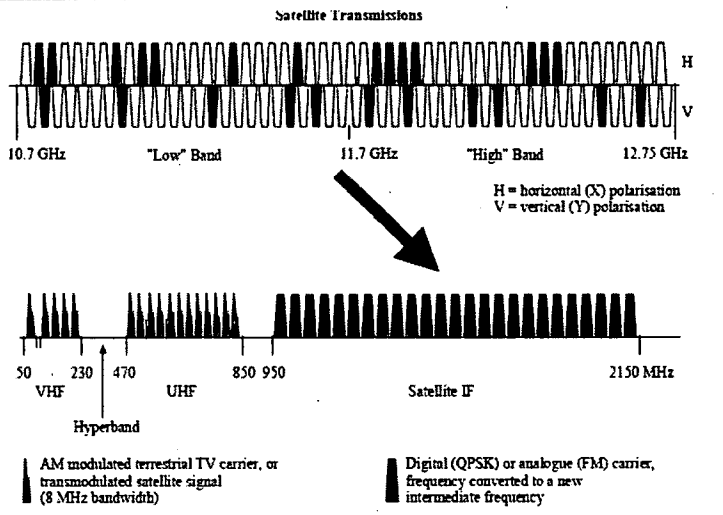
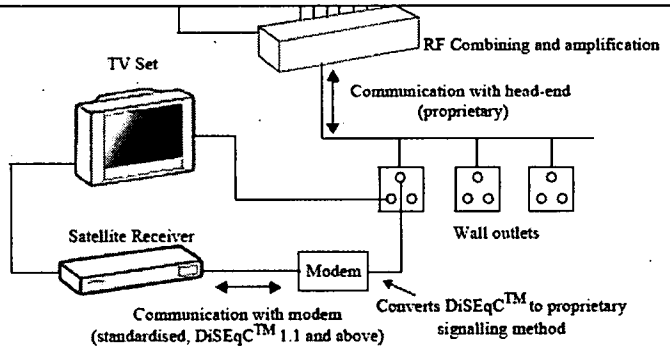
wherein the modulation of the composite signal is the same as the modulation of the broadband LNB signals	 **Figure 7 : Broadband Signal Spectrum for an IF-IF Distribution Network**	Figure 7 illustrates the composite signal constructed from channels extracted by the IF-IF converters (selected channels represented as shaded polygons). Figure 7 shows that the channels can remain QPSK modulated signals in the composite signal.
and wherein the composite signal is transmitted on the coaxial cable; whereby the composite signal is transmitted to the IRD		Figure 11 illustrates that the composite signal is sent on a coaxial cable from the combiner to the satellite receiver (IRD).

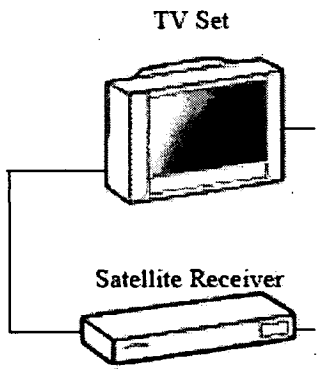
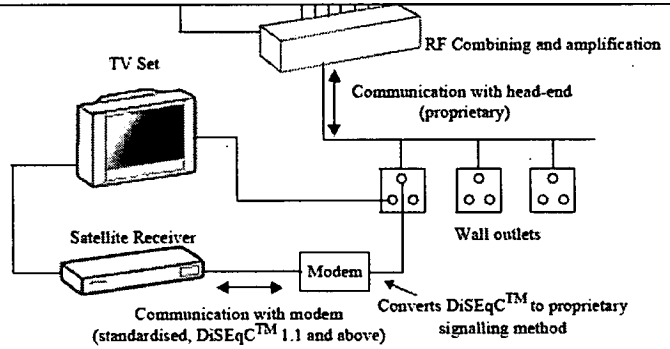
Claim 2	Eutelsat Installers Guide	Notes/Description
The signal distribution system of claim 1 further comprising a plurality of IRDs and wherein the composite signal is transmitted on a single cable connected to the ODU and all IRDs receive channels extracted from the composite signal.		Figure 11 illustrates a plurality of wall outlets, each of which can support an IRD as exemplified by the IRD connected to the first wall outlet. As stated above with respect to claim 1, the composite signal is illustrated as being transmitted on a single cable. All IRDs connected to a wall outlet on the 'tree' can receive the composite signal.

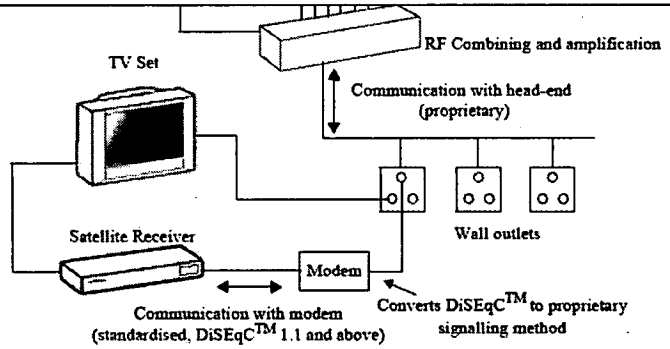
Claim 6	Eutelsat Installers Guide	Notes/Description
The signal distribution system of claim 1 wherein transponder select information is transmitted over the same cable as the composite signal.		Figure 11 illustrates that the transponder select information (i.e., DiSEqC channel selection) is sent over the same cable as the composite signal.

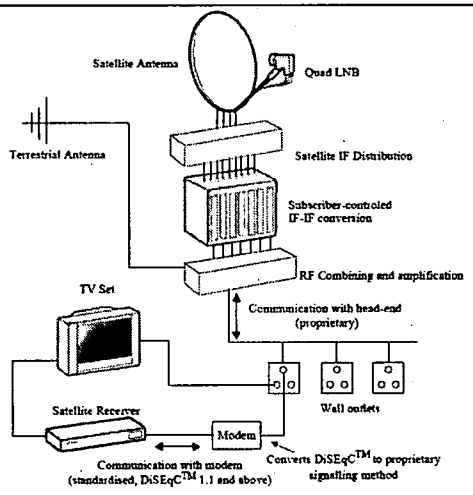
Claim 8	Eutelsat Installers Guide	Notes/Description
A signal distribution system for distributing signals comprising a plurality of channels from a plurality of sources between a first unit and a second unit over a communication medium comprising:	 Figure 11 : Architecture of a System with a Remote Controlled Head-End	Figure 11 illustrates a signal distribution system, for satellite television signals. As described above, the broadband satellite signals each contain a plurality of individual transponder signals, or channels. Extracted or selected channels from their source (either the satellite signal itself, or the downconverted broadband LNB output) are sent from the outdoor unit to the IRD over a communication medium (coaxial cable).

means in the first unit responsive to information transmitted by the second unit for extracting selected channels from each of the plurality of sources		The text at page 19, last paragraph, states that communication (i.e., information transmission) between the IRD and the selection equipment is used to perform channel selection (i.e., to extract channels from the LNB output signals).
and combining the selected channels into a composite signal		Figure 11 illustrates a signal combiner combines two RF signals to produce a composite signal

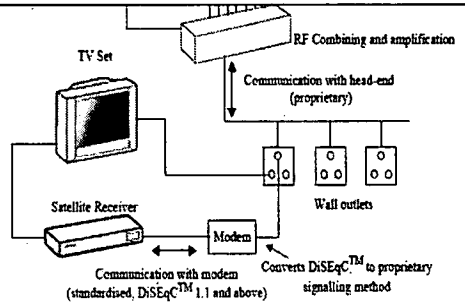
without demodulating channels and without changing the modulation of the channels	 Figure 7 : Broadband Signal Spectrum for an IF-IF Distribution Network	Figure 7 illustrates construction of a composite signal from a plurality of broadband signals, using channels extracted by the IF-IF converters (selected channels represented as shaded polygons). Figure 7 notes that the channels can remain QPSK modulated signals in the composite signal. Thus, the modulation is not changed and the signals are not demodulated.
and transmitting the composite signal over the medium;		Figure 11 illustrates that the composite signal is sent on a coaxial cable from the combiner to the satellite receiver (IRD).

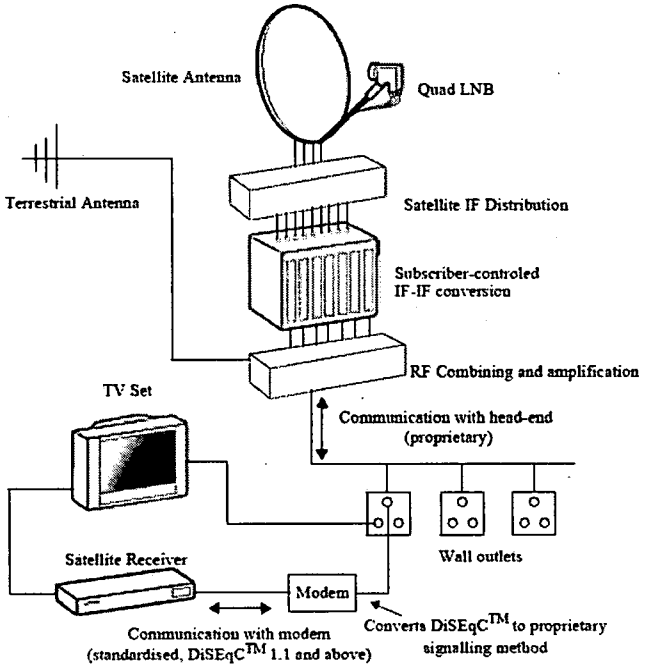
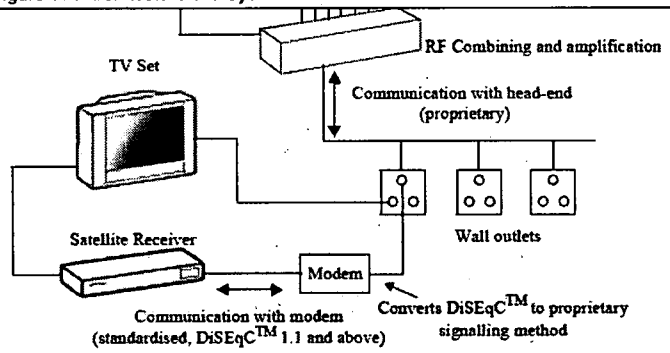
and means in the second unit for receiving the composite signal and demodulating and decoding at least one channel;		The Satellite receiver, or IRD, tunes to a channel in the composite signal and demodulates and decodes that channel so that it can be displayed on the TV Set. Note, that the other TV input is for the VHF/UHF signals from the terrestrial antenna, which is not relevant to these claims.
and means in the first unit and second units for bi-directionally communicating control information between the second unit and the first unit.		Figure 11 illustrates two-way communication. Also, the accompanying text at page 19 (bottom) states that communication for channel selection is preferably two way.

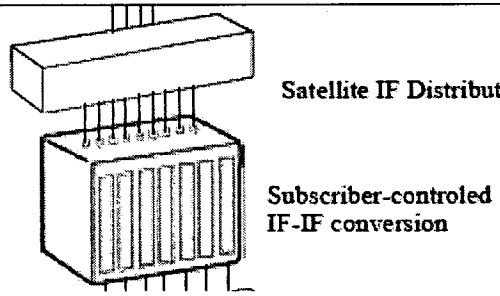
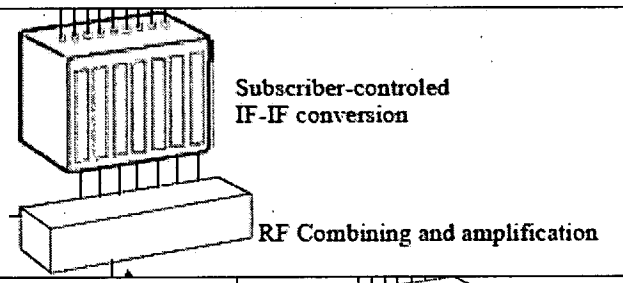
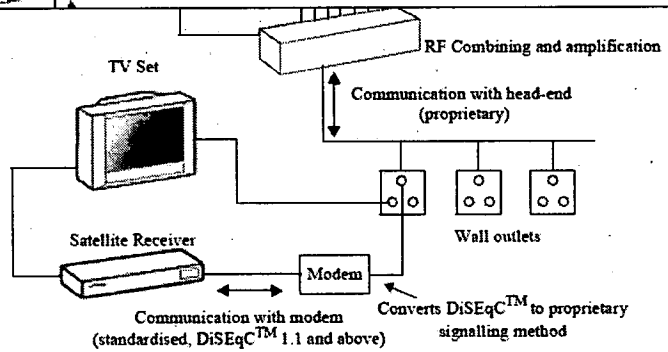
Claim 9	Eutelsat Installers Guide	Notes/Description
The signal distribution system of claim 8 wherein the control information comprises channel selection requests originating from the second unit and the control information comprises channel mapping information originating from the first unit.		The accompanying text at page 19 (bottom) states that the two-way communication is used for channel selection. Page 20, bottom, indicates that this information is sent from the IRD. Pages 29 and 38 teach that configuration information (channel mapping) is sent to the IRDs to allow automatic setup and monitoring.

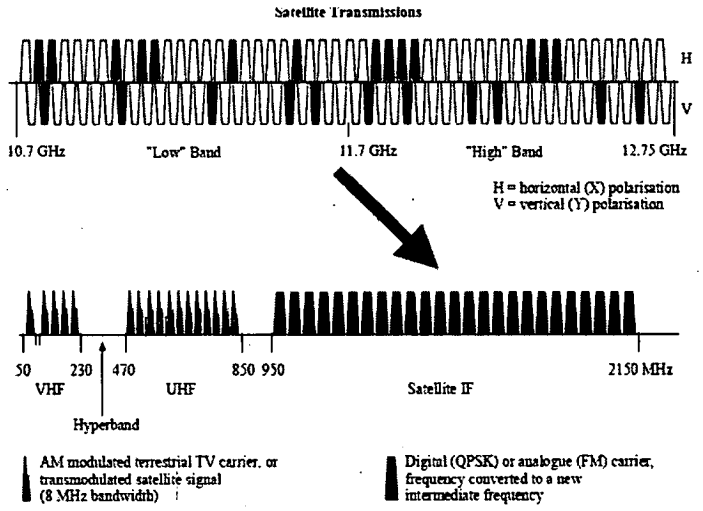
Claim 11	Eutelsat Installers Guide	Notes/Description
The signal distribution system of claim 8 wherein the first unit is a satellite outdoor unit and the second unit is a satellite integrated receiver decoder unit.	 Figure 11 : Architecture of a System with a Remote Controlled Head-End	Figure 11 illustrates a satellite antenna with switching and selecting equipment commonly placed outdoors, and a satellite receiver, which is referred to in the text at page 20 as an IRD (Integrated Receiver Decoder).

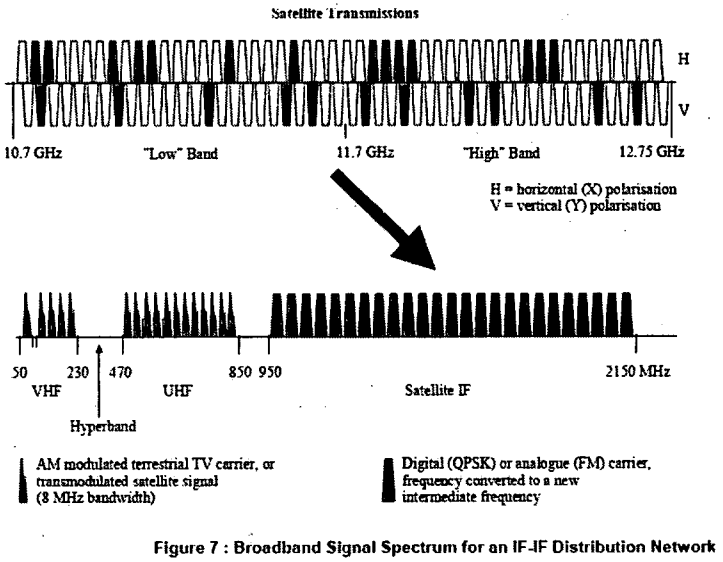
Claim 12	Eutelsat Installers Guide	Notes/Description
The signal distribution system of claim 11 wherein the communication medium consists of a single coaxial cable connected to the satellite outdoor unit.	**The resulting bus control system, known as DiSEqC™ (Digital Satellite Equipment Control), provides a means for communication between satellite receivers/IRDs and peripheral equipment, using only a single coaxial cable. DiSEqC™ is an open system that has been adopted as an international standard by CENELEC.**	Page 27 describes the communication medium as a "single coaxial cable."

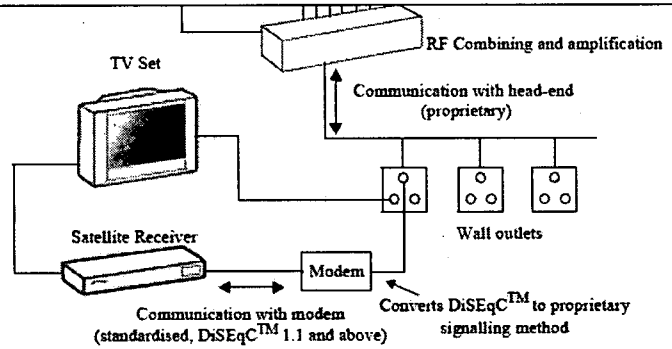
Claim 13	Eutelsat Installers Guide	Notes/Description
The signal distribution system of claim 12 wherein the means for communicating uses the same communication medium as the composite signal.		Figure 11 illustrates communication on the same medium.

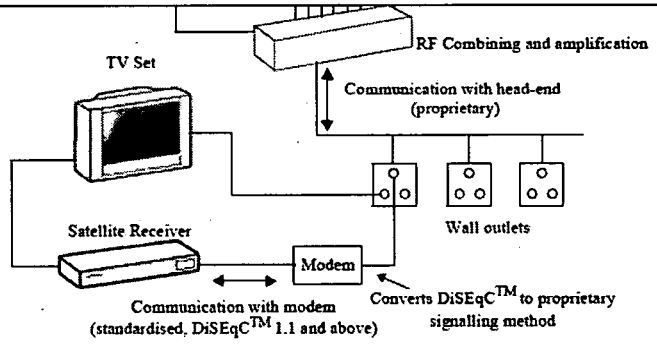
Claim 14	Eutelsat Installers Guide	Notes/Description
A method of communicating a plurality of transponder signals from a satellite outdoor unit (ODU) that receives a plurality of satellite broadband signals to an integrated receiver decoder (IRD) over a single cable connected to the ODU, the method comprising the steps of:	 Figure 11 : Architecture of a System with a Remote Controlled Head-End	Figure 11 of the Eutelsat Installers Guide illustrates a Quad LNB outputting a plurality (in this case, four) of LNB signals. Transponder signals extracted from the LNB output are distributed over the coaxial cable illustrated as coming from the RF Combiner. This composite output is distributed via a single cable to each of the wall outlets, which, as illustrated can be connected to a Satellite Receiver, or IRD.
communicating a transponder request signal to the ODU from the IRD;		As described at page 20, Figure 11 illustrates that the set-top box sends (IRD) sends a DiSEqC signal to the outdoor unit. Additionally, page 19, in the last paragraph states that this communication "so that remote channel selection can be carried out." A transponder request signal,

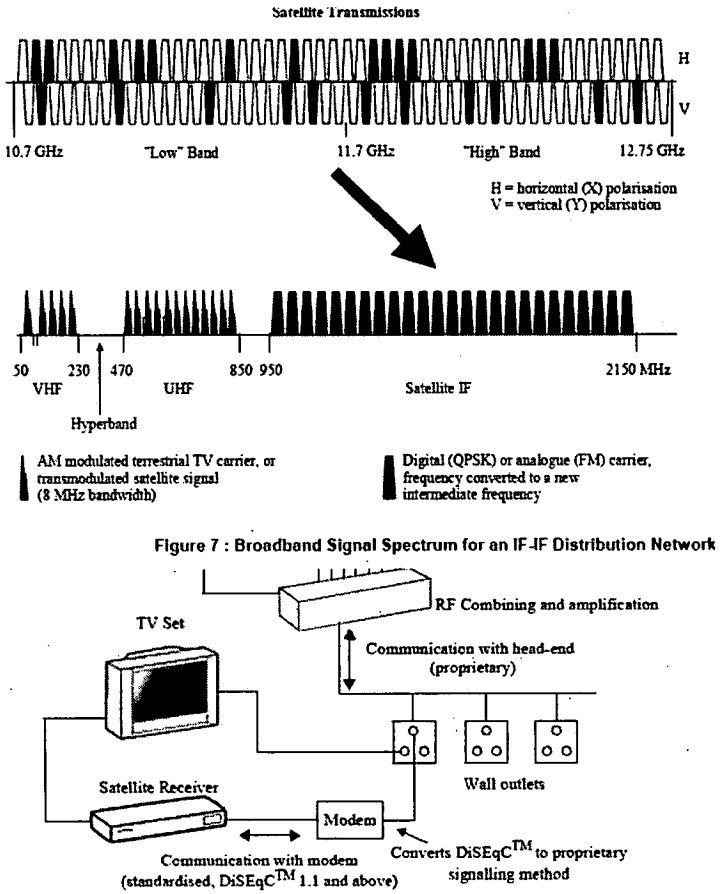
		requests a channel to be extracted or selected.
in the ODU, selecting a plurality of transponder signals extracted from the received satellite broadband signals, wherein the selecting is responsive to the transponder request signals;		The IF-IF converters select transponder signals (referred to as channels in both the '576 patent and in the Eutelsat Installers Guide). As stated immediately above the channel selection is based on information from the IRD .
combining selected transponder signals into a composite signal;		Figure 11 illustrates a signal combiner combines two RF signals to produce a composite signal
transmitting the composite signal over the single cable from the ODU to the IRDs,		Figure 11 illustrates that the composite signal is sent on a single cable from the combiner to the satellite receiver (IRD).

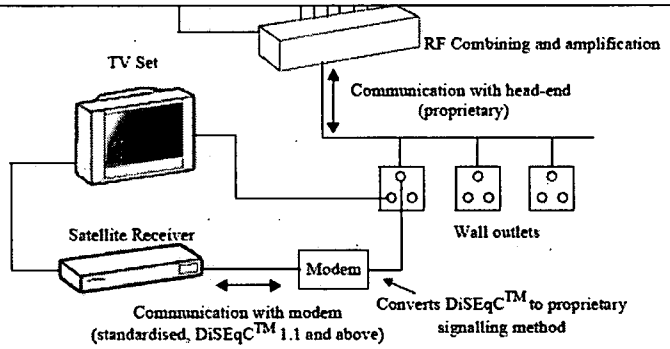
wherein the modulation of the transponder signal is not altered by the steps of selecting, combining, and transmitting.	 **Figure 7 : Broadband Signal Spectrum for an IF-IF Distribution Network**	Figure 7 illustrates that the modulation remains QPSK in the composite signal, and is therefore not altered.

Claim 16	Eutelsat Installers Guide	Notes/Description
The method of claim 14 wherein the step of combining comprises frequency translating the selected transponder channels to a variable frequency before combining.	 Figure 7 : Broadband Signal Spectrum for an IF-IF Distribution Network	Figure 7 illustrates that channels are frequency translated from their respective center frequencies to new center frequencies in the satellite IF distribution channel.

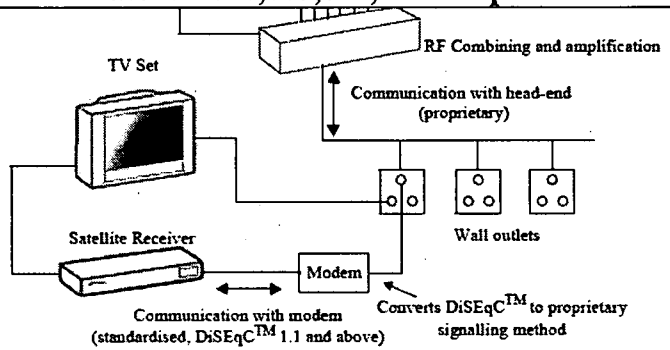
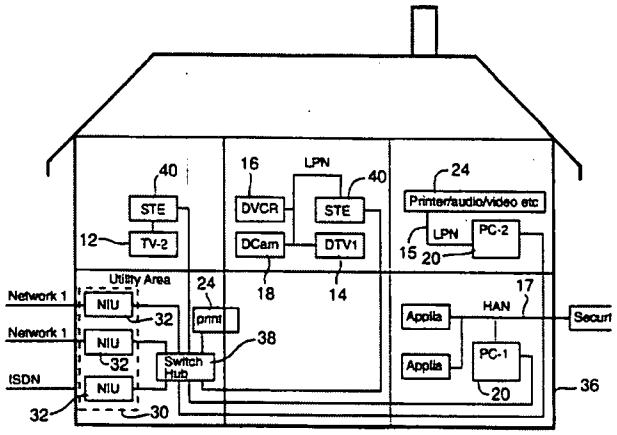
Claim 18	Eutelsat Installers Guide	Notes/Description
The method of claim 14 further comprising the step of splitting the composite signal inside a home and distributing to a plurality of IRDs.		Figure 11 illustrates the composite signal distributed and split to a plurality of wall outlets in a building. Each wall outlet can accommodate an IRD.

Claim 19	Eutelsat Installers Guide	Notes/Description
The method of claim 14 wherein the transponder request signal is transmitted over the cable from an IRD and all IRDs receive the same composite signal.		Page 20 describes the IRD as generating the commands for channel selection. Figure 11 illustrates the commands sent from the IRD over the same cable, and also illustrates a plurality of wall outlets, each of which can support an IRD

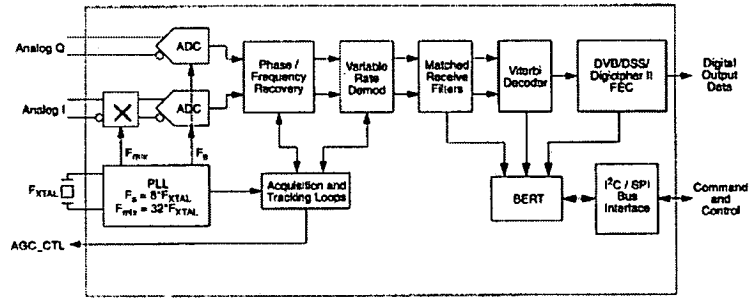
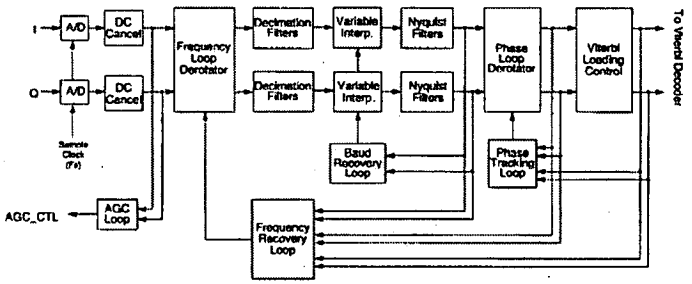
Claim 21	Eutelsat Installers Guide	Notes/Description
The method of claim 14 further comprising the steps of: frequency translating the selected transponder channels to a variable frequency before combining; and splitting the composite signal inside a home and distributing to a plurality of IRDs.	 Figure 7 : Broadband Signal Spectrum for an IF-IF Distribution Network	As discussed above with respect to claim 16, tuning to a variable frequency is taught by the reference (Figure 7). As discussed above with respect to claim 18, the reference teaches splitting and distributing to multiple IRDs (Figure 11).

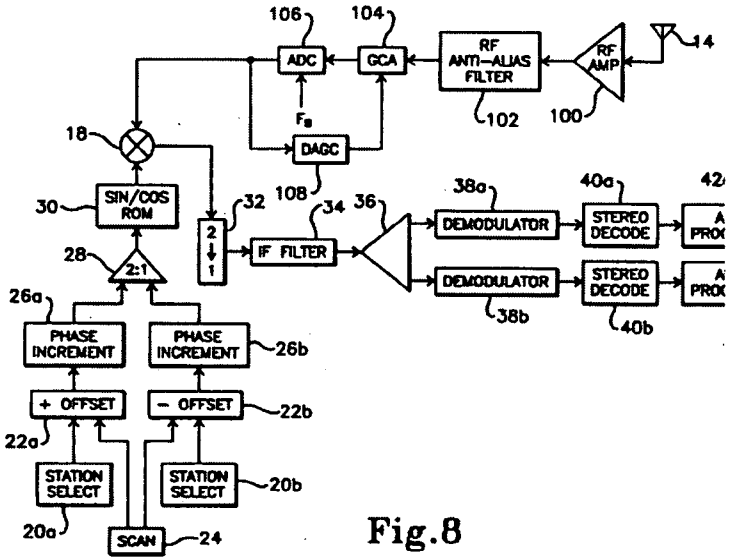
Claim 22	Eutelsat Installers Guide	Notes/Description
The method of claim 21 wherein the transponder request signal is transmitted over the cable from an IRD.		The DiSEqC signalling signal is sent over the same cable from the IRD.

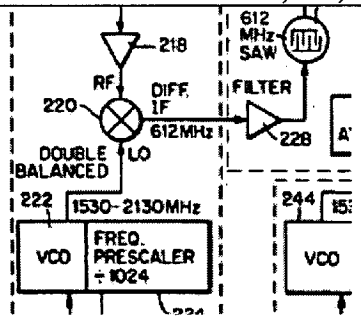
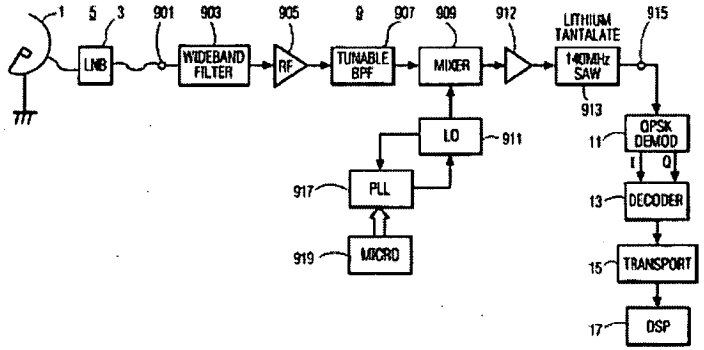
PART II: Applicability of the Eutelsat Installers Guide With Secondary References

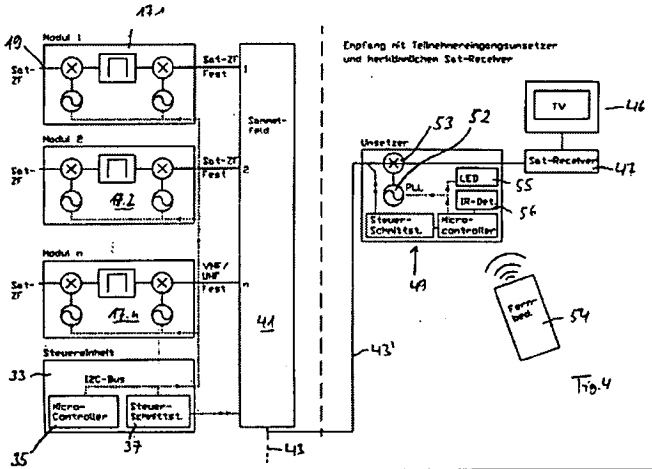
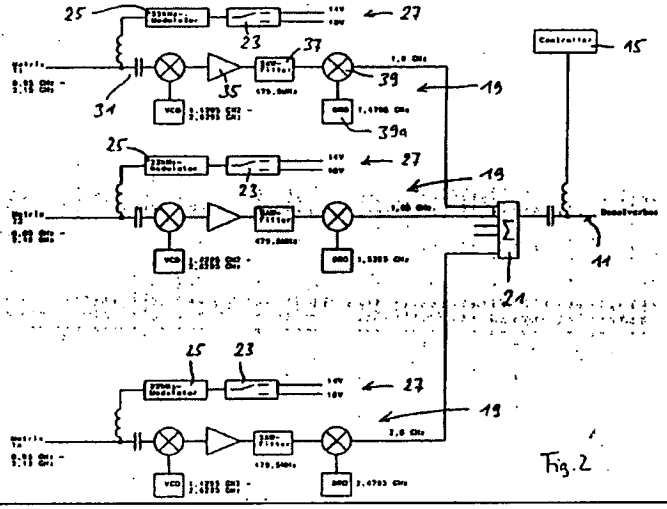
Claim 2	Eutelsat Installers Guide combined with United States Patent No. 6,005,861, to Humpleman	
The signal distribution system of claim 1 further comprising a plurality of IRDs and wherein the composite signal is transmitted on a single cable connected to the ODU and		Figure 11 illustrates a plurality of wall outlets, each of which can support an IRD. It also shows the composite signal being transmitted on a single cable where IRDs connected to wall outlets receive the composite signal.
all IRDs receive channels extracted from the composite signal.	FIG. 2 	Humpleman shows a network interface unit 32, or gateway, that extracts channels from the digital satellite TV composite signal, and routes extracted channels to the IRD (Figure 2).

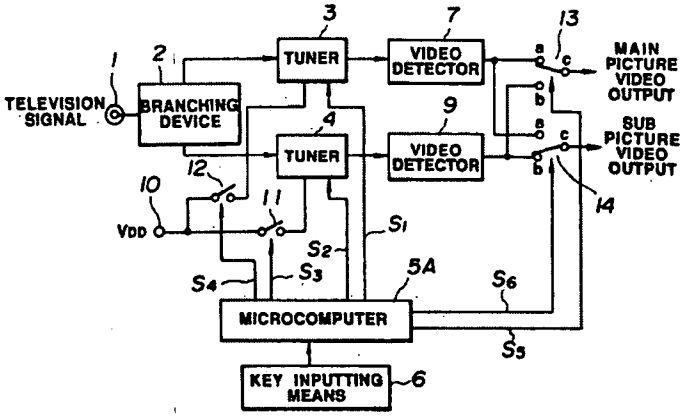
Claim 2, continued	The architecture of the present invention assumes that for some networks a first stage demultiplexing at the network interface unit **32** is necessary to stay within a definable bandwidth limit (one stream) rather than an arbitrary bandwidth set by the construction of the incoming stream (multiple streams). Making the assumption that MPEG-2 video is being used, there is a demultiplexing from a multiple program transport stream into a single program transport, as defined in the MPEG-2 specification. This is	At Column 2, lines 35-43, Humpleman discloses the channel extraction (demultiplexing) from the composite signal.

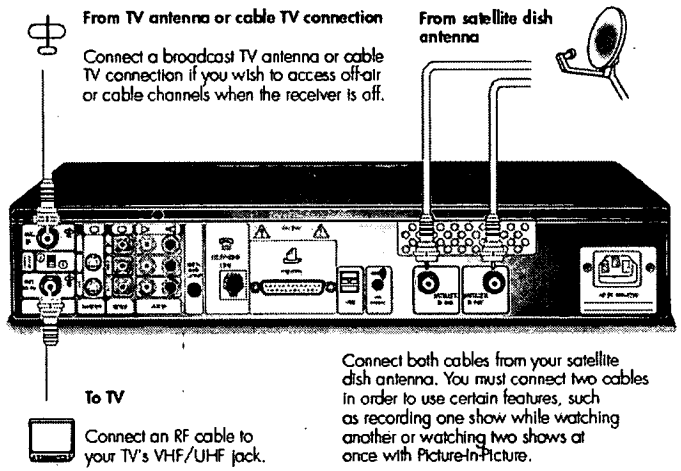
Claim 3	**Eutelsat Installers Guide combined with The Broadcom Digital Satellite Receiver Paper**	
The signal distribution system of claim 1 wherein the signal selector comprises an analog to digital converter and a digital filter.	 Fig. 3. Universal digital satellite receiver IC block diagram.  Fig. 8. BPSK/QPSK/OQPSK receiver.	The Broadcom Digital Satellite Receiver Paper teaches a receiver having an analog to digital converter and digital filters for tuning/signal selection. In its Introduction, the reference discloses the use of analog SAW filters to perform channel selection. At page 1639, the paper discusses the use of digital SAW filters in the digital receiver.

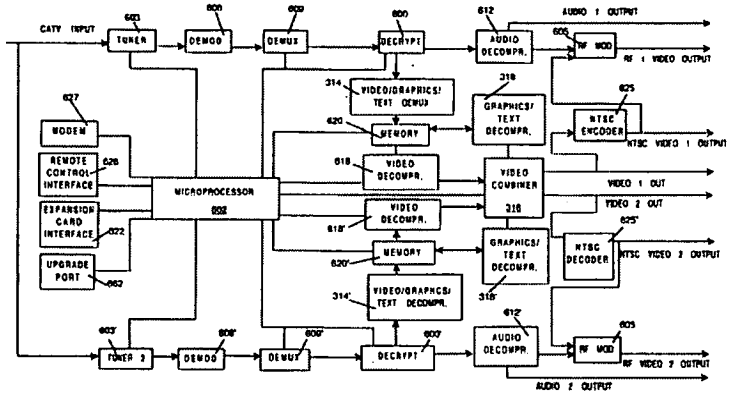
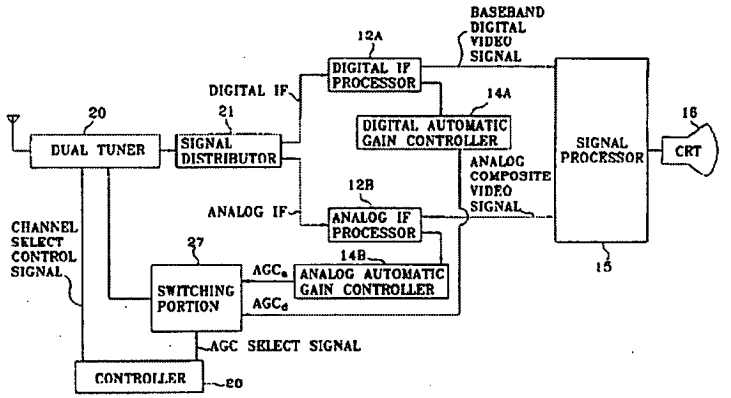
Claim 3	Eutelsat Installers Guide combined with United States Patent No. 5,278,837, to Kelley	
The signal distribution system of claim 1 wherein the signal selector comprises an analog to digital converter and a digital filter.	 Fig.8	Kelley teaches a digital receiver with an analog to digital converter 106 and a digital IF filter 34.

Claim 4	Eutelsat Installers Guide combined with United States Patent No. 5,073,930 to Green, et. al.	
The signal distribution system of claim 1 wherein the signal selector comprises a tuner.		Several References illustrate a tuner for signal selection. Green teaches a mixer and variable oscillator combined with a bandpass filter to tune and select a given channel. This portion of Figure 3 shows the tuner function in Green.
Claim 4	**Eutelsat Installers Guide combined with United States Patent No. 5,654,774 to, Pugel et. al.**	
The signal distribution system of claim 1 wherein the signal selector comprises a tuner.		At Col. 3, lines 18 – 24, the '774 patent discloses a tuner 9 for "selecting the particular RF signal corresponding to the desired channel from the plurality of RF signals received ..." Pugel illustrates the Tuner 9 receiving a broadband LNB output.

Claim 4	Eutelsat Installers Guide combined with European Patent Publication EP0757489	
		Figure 4 illustrates tuners connected to a satellite signal to select channels prior to combining them onto a composite signal.
Claim 4	**Eutelsat Installers Guide combined with European Patent Publication EP1009113**	
		Figure 2 shows a tuner at each of a plurality of satellite input signals each having a tuner (mixer and local oscillator) followed by a SAW filter to select channels prior to combining.

Claim 5	Eutelsat Installers Guide combined with United States Patent No. to 5,285,284	
The signal distribution system of claim 1 further comprising an integrated receiver decoder (IRD) connected to the coaxial cable with a plurality of tuners within the IRD, wherein each tuner within the IRD receives the composite signal and each tuner uses at least one transponder signal.		Figure 5 illustrates a television receiver having a picture-in-picture (PIP) function with two tuners **3** and **4**.

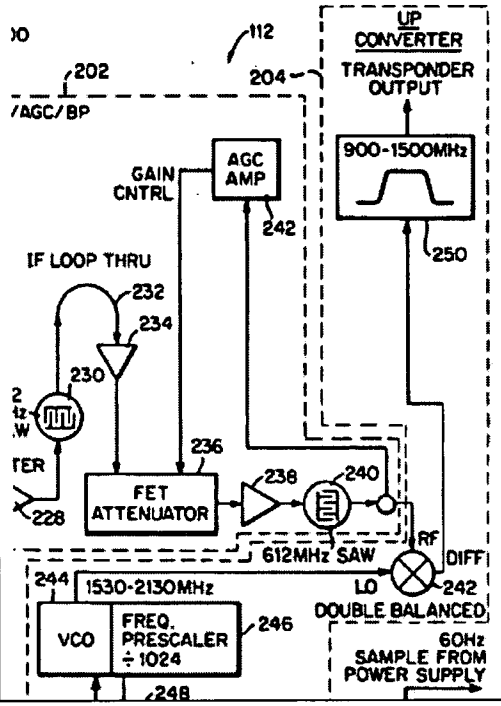
Claim 5	Eutelsat Installers Guide Combined with the RCA Setup Guide	
The signal distribution system of claim 1 further comprising an integrated receiver decoder (IRD) connected to the coaxial cable with a plurality of tuners within the IRD, wherein each tuner within the IRD receives the composite signal and each tuner uses at least one transponder signal	NOTE *You can watch TV if you connect only one cable between the satellite dish antenna and the receiver, but you must connect both cables to use features that require both of the receiver's tuners (viewing two shows at once with Picture-In-Picture or recording one show while watching another, for example).*  **From TV antenna or cable TV connection** Connect a broadcast TV antenna or cable TV connection if you wish to access off-air or cable channels when the receiver is off. **From satellite dish antenna** **To TV** Connect an RF cable to your TV's VHF/UHF jack. Connect both cables from your satellite dish antenna. You must connect two cables in order to use certain features, such as recording one show while watching another or watching two shows at once with Picture-In-Picture.	The RCA Setup Guide for a Satellite IRD describes dual tuner opreation for Picture-in-Picture and Watch-and-Record functions. Two signal inputs are also shown, one for each tuner.

Claim 5	Eutelsat Installers Guide combined with European Patent Publication Number EP0912059	
	 *Fig. 14*	This reference also discloses a set top box for television signals having two-tuner functionality. See Figure 14, and page 21, describing 2-tuner picture-in-picture functionality.
Claim 5	**Eutelsat Installers Guide combined with United States Patent No. 6,353,463, to Seo**	
		Another dual-tuner television reference. Figure 2 of the '463 patent illustrates a dual tuner **20** receiving the television signals.

Claim 7	Eutelsat Installers Guide combined with the Philips Wireless Remote Control Data Sheet	
The signal distribution system of claim 1 wherein transponder select information is transmitted over a wireless link.	**GENERAL DESCRIPTION** The UAA3202M is a fully integrated single-chip receiver, primarily intended for use in VHF and UHF systems employing direct Frequency Shift Keying (FSK) modulation. The UAA3202M incorporates a SAW stabilized local oscillator, balanced mixer, IF amplifier, limiter, Received Signal Strength Indicator (RSSI), RSSI comparator, FSK demodulator, data filter and data slicer. The device features a power-down mode in order to minimize the average receiver supply current. **Applications** • Keyless entry systems • Car alarm systems • Remote control systems • Security systems • Telemetry systems • Wireless data transmission • Domestic appliances.	the UAA3202M Frequency Shift Keying Receiver is for VHF and UHF wireless control. Described applications include remote control systems, telemetry systems and wireless data transmission (page 2).

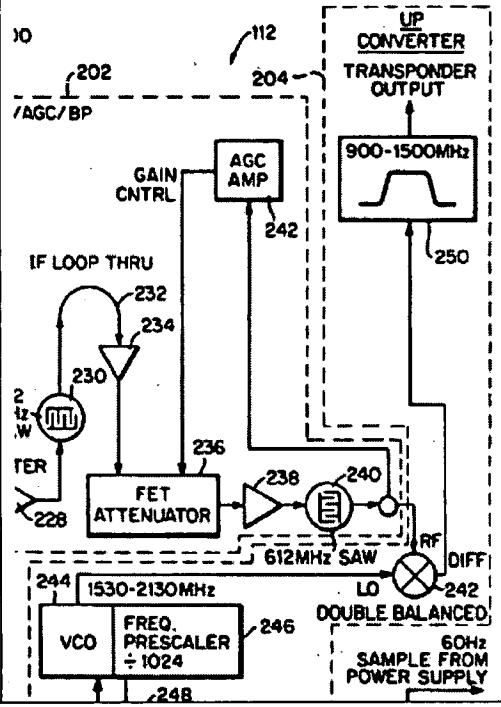
Claim 10	Eutelsat Installers Guide combined with United States Patent No. 5,073,930 to Green, et. al.	
The signal distribution system of claim 8, further comprising a means in the first unit for carrier offset correction.	of a 612 MHz. IF stage. Microcontroller 206 is capable of controlling the exact down-conversion frequency provided by down-converter 200 to correct for errors in the input signal center frequency (e.g., due to satellite transponder error and/or low noise block converter error). IF stage/AGC/bandpass filter block 202 filters	Green describes carrier offset correction for satellite signals in the transponder selection circuitry. Column 12, lines 40 – 45.

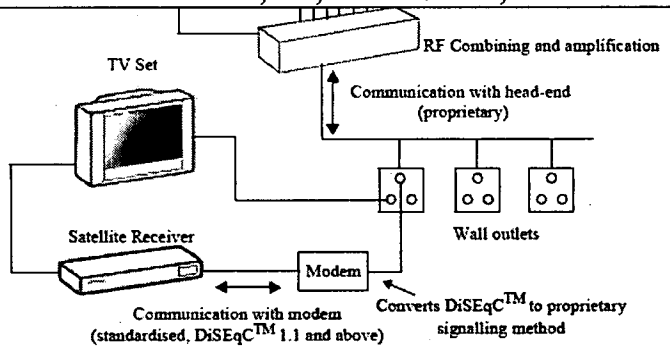
Claim 15	Eutelsat Installers Guide combined with the Broadcom Digital Satellite Receiver Paper	
The method of claim 14 wherein the ranging from 5% to 100% wider than the bandwidth of the transponder signal.	degradation (receiver + tuner) is well within the required DVB limit of 0.8 dB. The best performance occurs at 20 MBaud, approximately in the center of the 1–45-MBaud range. The performance degrades slightly at the two extremes of 1 and 45 MBaud. The degradation at 1 MBaud is primarily due to phase noise in the tuner and finite wordlength effects in the digital filters that recover the symbol timing from the highly oversampled input data (128-MHz sample rate versus 1-MBaud input signal) when adjacent channel interferers are present. The primary cause for the performance degradation at 45 MBaud is that the tuner's 55-MHz SAW filter cuts off some of the excess bandwidth of the input signal. (Note that a	Broadcom shows a filter having a bandwith of 55MHz in a system operating at sample rates of 1 – 45 MBaud. Page 1639, bottom.

Claim 16	Eutelsat Installers Guide combined with United States Patent No. 5,073,930 to Green, et. al.	
The method of claim 14 wherein the step of combining comprises frequency translating the selected transponder channels to a variable frequency before combining.	**244,246,248 within up converter circuit 204). Microcomputer 206 independently controls the local oscillator frequency output provided by VCO 244 to be within the range of 1530-2130 MHz. Mixer 242 heterodynes this local oscillator frequency output of IF strip 202 to provide a single transponder signal somewhere within the 900-1500 MHz band—with the exact center frequency of the output signal being a function of the local oscillator frequency produced by VCO 244. This**  	Green teaches translating selected transponder channels to a variable frequency within the spectrum of the composite signal, before combining. Fig. 3, and Column 14, lines 1-10.

Claim 17	Eutelsat Installers Guide combined with United States Patent No. 5,073,930 to Green, et. al.	
The method of claim 15 further comprising frequency translating the selected transponder channels to a predetermined frequency before combining.	50 Up converter 204 converts the selected signal back to a signal having a center frequency within the original 950-1450 MHz—and more specifically to have a center frequency exactly matching a standard center frequency of a given desired satellite transponder within 55 that band (as the transponder signal would have appeared directly from the antenna LNB). 60 verter 200. Thus, microcontroller 206 is capable of controlling down converter 200 to select any one of the input transponder signals, and then controls up converter 204 to convert that selected signal to any desired transponder output frequency. Selector 208 allows in-	Green also shows that the frequency translation can be to a predetermined frequency. Column 12, line 50 teaches translating to a predetermined frequency to match the transponder signal in the LNB output. Column 12, line 60 teaches converting to any desired placement in the composite signal. To properly place it, it must be predetermined.

Claim 20	Eutelsat Installers Guide combined with the Philips Wireless Remote Control Data Sheet	
The method of claim 14 wherein the transponder request signal is transmitted over a wireless link to the ODU.	**GENERAL DESCRIPTION** The UAA3202M is a fully integrated single-chip receiver, primarily intended for use in VHF and UHF systems employing direct Frequency Shift Keying (FSK) modulation. The UAA3202M incorporates a SAW stabilized local oscillator, balanced mixer, IF amplifier, limiter, Received Signal Strength Indicator (RSSI), RSSI comparator, FSK demodulator, data filter and data slicer. The device features a power-down mode in order to minimize the average receiver supply current. **Applications** • Keyless entry systems • Car alarm systems • Remote control systems • Security systems • Telemetry systems • Wireless data transmission • Domestic appliances.	the UAA3202M Frequency Shift Keying Receiver is for VHF and UHF wireless control. Described applications include remote control systems, telemetry systems and wireless data transmission (page 2).

Claim 21	Eutelsat Installers Guide combined with United States Patent No. 5,073,930 to Green, et. al.	
The method of claim 14 further comprising the steps of: frequency translating the selected transponder channels to a variable frequency before combining; and splitting the composite signal inside a home and distributing to a plurality of IRDs.	**244,246,248 within up converter circuit 204). Microcomputer 206 independently controls the local oscillator frequency output provided by VCO 244 to be within the range of 1530-2130 MHz. Mixer 242 heterodynes this local oscillator frequency output of IF strip 202 to provide a single transponder signal somewhere within the 900-1500 MHz band—with the exact center frequency of the output signal being a function of the local oscillator frequency produced by VCO 244. This**  	Green teaches translating selected transponder channels to a variable frequency within the spectrum of the composite signal, before combining. Fig. 3, and Column 14, lines 1-10. The functions of splitting and distributing are found in the primary Eutelsat reference at Figure 11.

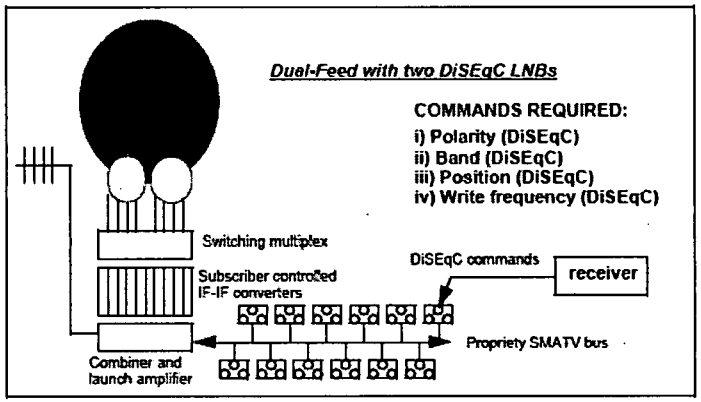
Claim 22	Eutelsat Installers Guide combined with United States Patent No. 5,073,930 to Green, et. al.	
The method of claim 21 wherein the transponder request signal is transmitted over the cable from an IRD.		The combination teaches claim 21, from which claim 22 depends. (See above). Figure 11 of the Eutelsat Installers Guide shows the request signal (DiSEqC) is transmitted over the cable from the IRD.

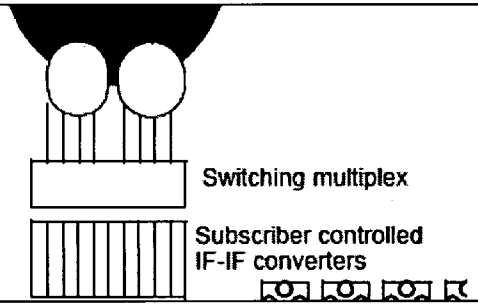
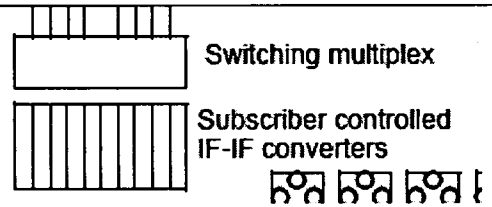
Claim 23	Eutelsat Installers Guide combined with United States Patent No. 5,073,930 to Green, et. al. and the Philips Wireless Remote Control Data Sheet	
The method of claim 21 wherein the transponder request signal is transmitted over a wireless link to the ODU.	**GENERAL DESCRIPTION** The UAA3202M is a fully integrated single-chip receiver, primarily intended for use in VHF and UHF systems employing direct Frequency Shift Keying (FSK) modulation. The UAA3202M incorporates a SAW stabilized local oscillator, balanced mixer, IF amplifier, limiter, Received Signal Strength Indicator (RSSI), RSSI comparator, FSK demodulator, data filter and data slicer. The device features a power-down mode in order to minimize the average receiver supply current. **Applications** • Keyless entry systems • Car alarm systems • Remote control systems • Security systems • Telemetry systems • Wireless data transmission • Domestic appliances.	The combination teaches claim 21, from which claim 22 depends. (See above). As stated above with respect to claim 20, the Philips data sheet teaches wireless remote signaling.

APPENDIX C

APPENDIX C

PART I: Applicability of the Eutelsat DiSEqC Specification to the Claims of the '576 patent

Claim 1	Eutelsat DiSEqC Specification	Notes/Description
A signal distribution system for distributing a plurality of low noise amplifier and block converter (LNB) signals from a satellite outdoor unit (ODU) over a coaxial cable to an integrated receiver decoder (IRD) comprising:	 Figure 19: Subscriber controlled SMATV Headend	Figure 19 illustrates Dual Quad LNBs, each outputting a plurality of LNB signals (in this case, four each). Transponder signals extracted from the LNB output are distributed over the coaxial cable illustrated as coming from the Signal Combiner. This composite output is distributed via a single cable to each of the wall outlets, which, as illustrated can be connected to a Satellite Receiver. Page 8 refers to the Satellite Receiver as an IRD.

a signal selector that receives a plurality of broadband LNB signals comprising a plurality of transponder signals,		Figure 19 illustrates the four broadband LNB output signals from each LNB supplied to a matrix switch for distribution to Subscriber-controlled IF-IF converters.
the signal selector is responsive to transponder select information transmitted by an IRD	**COMMANDS REQUIRED:** **i) Polarity (DiSEqC)** **ii) Band (DiSEqC)** **iii) Position (DiSEqC)** **iv) Write frequency (DiSEqC)**	Figure 19 illustrates that the IRD sends a DiSEqC signal to the switching equipment. The legend in Figure 19 further describes that one DiSEqC command is the Write Frequency command, described at page 8 as selecting the desired transponder signal (identified by its center frequency).
and selects a plurality of transponder signals from at least one broadband LNB signal based on the transponder select information;		The IF-IF converters select transponder signals (referred to as channels in both the '576 patent and in the Eutelsat DiSEqC Specification). As stated immediately above the channel selection is based on information from the IRD. Also, Section 4.2.4 at page 8 addresses "Remote Tuning" (remote channel selection) using DiSEqC commands to select the transponder

4.2.5. Transmission of the desired transponder frequency

The desired transponder frequency can be written in a packed BCD string form. the message is structured as follows:

FRAMING	ADDRESS	COMMAND	DATA	DATA	DATA

where:

FRAMING BYTE: E0h
Command from Master. No reply required.
First transmission

ADDRESS BYTE: 71h
Intelligent slave interface for Multi-Master Bus

COMMAND BYTE: 58h
Write channel frequency (BCD string)

DATA BYTES: Max. 3 bytes for the transponder frequency (GHz)

The high nibble of the first data byte contains the tens of GHz digit and the low nibble contains the GHz digit in BCD form. Subsequent bytes contain BCD nibbles in descending order until only trailing zeros remain.

For example 12.650 GHz would be transmitted in two bytes:

1	2	6	5	0	0
0001	0010	0110	0101	0000	0000

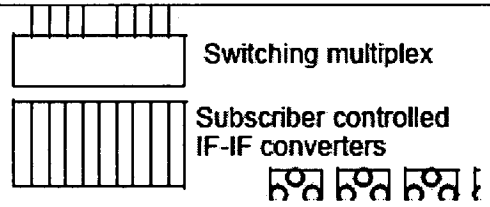
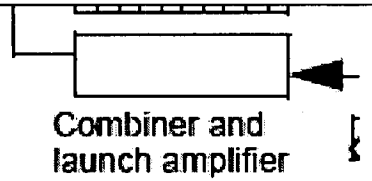
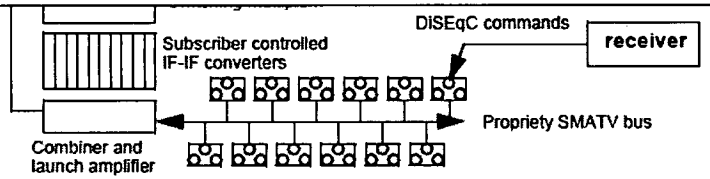
Name	Continuous commands	Tone Burst	DiSEqC commands	
Band (low/high)	0/22 kHz	-	"Write N0" 38h	20/24h
Polarity (ver/hor)	13/17 V	-		21/25h
Sat Position (A/B)	(0/22 kHz)	No mod/mod		22/26h
Option (A/B)	-	-		23/27h
Switch 1 (A/B)	-	-	"Write N1" 39h	28/2Ch
Switch 2 (A/B)	-	-		29/2Dh
Switch 3 (A/B)	-	-		2A/2Eh
Switch 4 (A/B)	-	-		2B/2Fh
Write channel frequency	-	-		58h

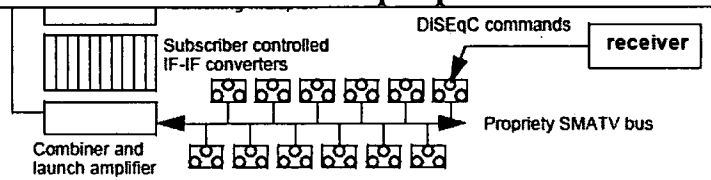
Table 5: DiSEqC Level 1.1 commands

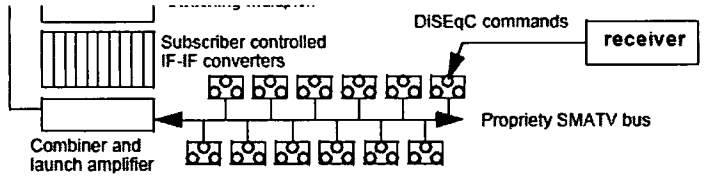
frequency desired by the IRD.

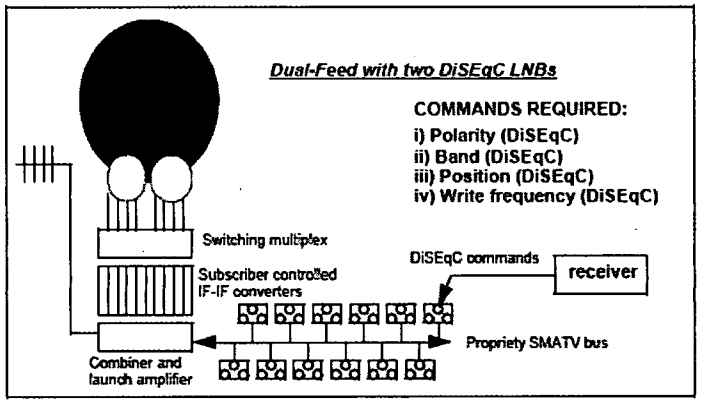
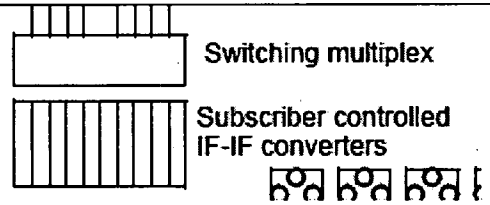
Additionally, Section 4.2.5 provides the command structure that includes Command Byte 58h, in which the channel frequency is identified.

Still further, Table 5, at page 10 describes the DiSEqC commands, that include commands for hi and lo band selection, polarity selection, A/B switch selection, and, most importantly, write channel frequency to select the transponder frequency.

a frequency translator coupled to the signal selector that is capable of shifting the selected transponder signals to new carrier frequencies to produce RF signals;		The IF-IF converters frequency translate the IF signals from their original position in their respective broadband LNB signals to their new position for placement in the composite signal.
and a signal combiner coupled to at least one frequency translator capable of combining at least two RF signals to produce a composite signal;		Figure 19 illustrates that a signal combiner combines the IF signals The fact that terrestrial signals can also be combined (or not) is irrelevant.
wherein the modulation of the composite signal is the same as the modulation of the broadband LNB signals		as illustrated in Figure 19, there is no transmodulation of any of the incoming satellite signals. As such one of ordinary skill in the art would have understood that without transmodulation, the modulation of the composite signal is the same as that of the broadband LNB signals.
and wherein the composite signal is transmitted on the coaxial cable; whereby the composite signal is transmitted to the IRD		Figure 19 illustrates that the composite signal is sent on a single cable from the combiner to the satellite receiver (IRD). Page 8 references using existing cable distribution systems, which, at the time, were coaxial.

Claim 2	Eutelsat DiSEqC Specification	Notes/Description
The signal distribution system of claim 1 further comprising a plurality of IRDs and wherein the composite signal is transmitted on a single cable connected to the ODU and all IRDs receive channels extracted from the composite signal.		Figure 19 illustrates a plurality of wall outlets, each of which can support an IRD as exemplified by the IRD connected to the first wall outlet. As stated above with respect to claim 1, the composite signal is illustrated as being transmitted on a single cable. All IRDs connected to a wall outlet on the 'tree' can receive the composite signal.

Claim 6	Eutelsat DiSEqC Specification	Notes/Description
The signal distribution system of claim 1 wherein transponder select information is transmitted over the same cable as the composite signal.		Figure 19 illustrates that the transponder select information (i.e., DiSEqC channel selection) is sent over the same cable as the composite signal.

Claim 8	Eutelsat DiSEqC Specification	Notes/Description
A signal distribution system for distributing signals comprising a plurality of channels from a plurality of sources between a first unit and a second unit over a communication medium comprising:	 Figure 19: Subscriber controlled SMATV Headend	Figure 19 illustrates a signal distribution system, for satellite television signals. As described above, the broadband satellite signals each contain a plurality of individual transponder signals, or channels. Extracted or selected channels from the downconverted broadband LNB output are sent from the outdoor unit to the IRD over a communication medium (coaxial cable).
means in the first unit responsive to information transmitted by the second unit for extracting selected channels from each of the plurality of sources		The IF-IF converters select transponder signals (referred to as channels in both the '576 patent and in the Eutelsat DiSEqC Specification). As stated immediately above the channel selection is based on information from the IRD. Also, Section 4.2.4 at page 8 addresses "Remote Tuning" (remote channel selection) using DiSEqC commands to select the transponder frequency desired by the IRD. Additionally, Section 4.2.5 provides

4.2.5. Transmission of the desired transponder frequency

The desired transponder frequency can be written in a packed BCD string form, the message is structured as follows:

FRAMING	ADDRESS	COMMAND	DATA	DATA	DATA

where:

FRAMING BYTE: E0h
Command from Master. No reply required.
First transmission

ADDRESS BYTE: 71h
Intelligent slave interface for Multi-Master Bus

COMMAND BYTE: 58h
Write channel frequency (BCD string)

DATA BYTES: Max. 3 bytes for the transponder frequency (GHz)

The high nibble of the first data byte contains the tens of GHz digit and the low nibble contains the GHz digit in BCD form. Subsequent bytes contain BCD nibbles in descending order until only trailing zeros remain.

For example 12.650 GHz would be transmitted in two bytes:

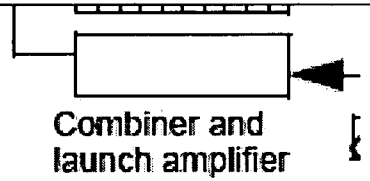
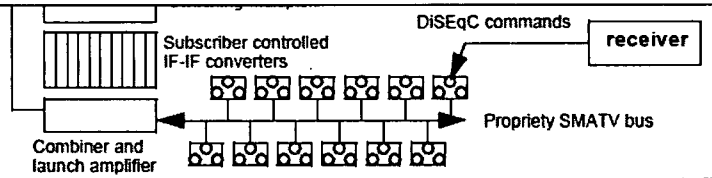
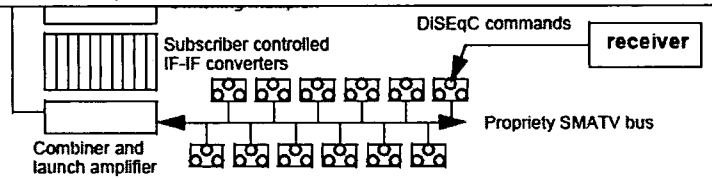
1	2	6	5	0	0
0001	0010	0110	0101	0000	0000

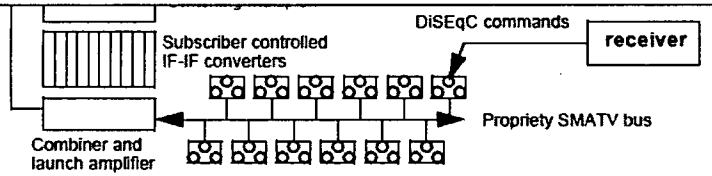
Name	Continuous commands	Tone Burst	DiSEqC commands	
Band (low/high)	0/22 kHz	-	"Write N0" 38h	20/24h
Polarity (ver/hor)	13/17 V	-		21/25h
Sat Position (A/B)	(0/22 kHz)	No mod/mod		22/26h
Option (A/B)	-	-		23/27h
Switch 1 (A/B)	-	-	"Write N1" 39h	28/2Ch
Switch 2 (A/B)	-	-		29/2Dh
Switch 3 (A/B)	-	-		2A/2Eh
Switch 4 (A/B)	-	-		2B/2Fh
Write channel frequency	-	-		58h

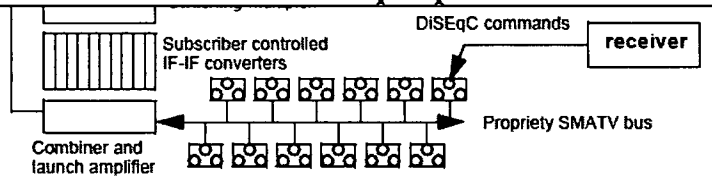
Table 5: DiSEqC Level 1.1 commands

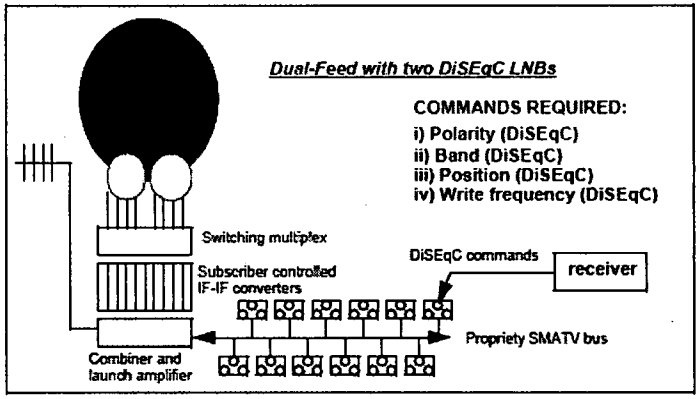
the command structure that includes Command Byte 58h, in which the channel frequency is identified.

Still further, Table 5, at page 10 describes the DiSEqC commands, that include commands for hi and lo band selection, polarity selection, A/B switch selection, and, most importantly, write channel frequency to select the transponder frequency.

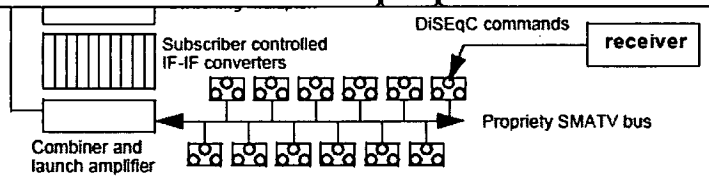
and combining the selected channels into a composite signal		Figure 19 illustrates that a signal combiner combines the IF signals The fact that terrestrial signals can also be combined (or not) is irrelevant.
without demodulating channels and without changing the modulation of the channels		As illustrated in Figure 19, there is no transmodulation of any of the incoming satellite signals. As illustrated in Figure 19, the signal is sent to a set top box, or IRD. IRDs are known to receive a modulated signal and perform the Receive function (including demodulation) themselves. As such, the channels are not demodulated.
and transmitting the composite signal over the medium;		Figure 19 illustrates that the composite signal is sent on a coaxial cable from the combiner to the satellite receiver (IRD).
and means in the second unit for receiving the composite signal and demodulating and decoding at least one channel;		The Satellite receiver, or IRD, tunes to a channel in the composite signal and demodulates and decodes that channel so that it can be displayed on the TV Set.

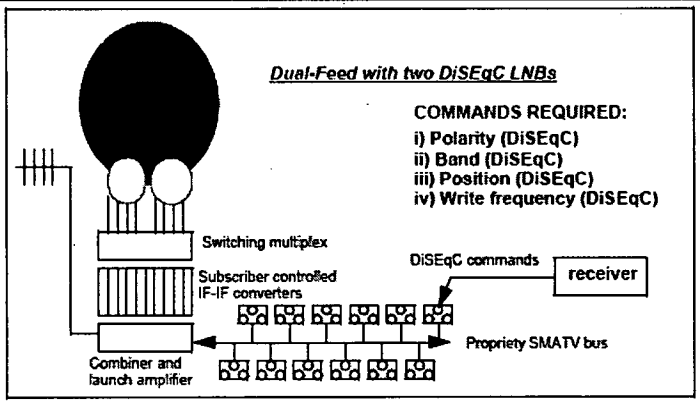
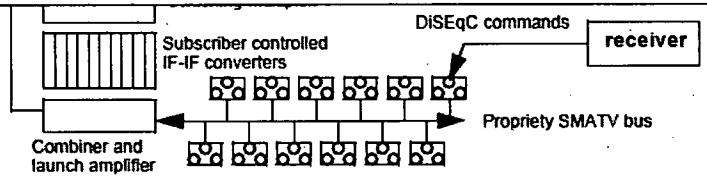
and means in the first unit and second units for bi-directionally communicating control information between the second unit and the first unit.		Figure 19 illustrates one-way communication. However, at page 11, first paragraph, full two-way, or bi-directional signaling is taught.

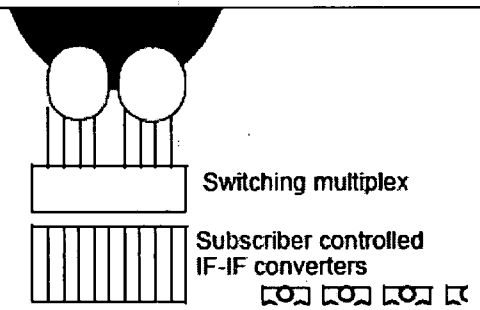
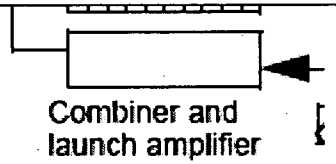
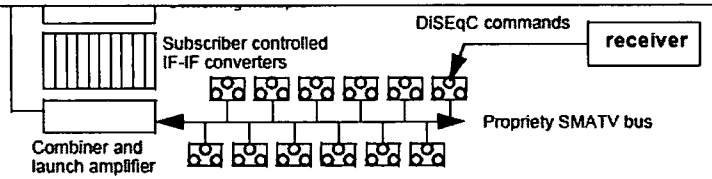
Claim 9	Eutelsat DiSEqC Specification	Notes/Description
The signal distribution system of claim 8 wherein the control information comprises channel selection requests originating from the second unit and the control information comprises channel mapping information originating from the first unit.		As stated above, Eutelsat DiSEqC Specification teaches that write frequency commands are channel selection requests sent from the IRD to the selection units to select a desired channel (transponder signal). Page 4 describes channel mapping, or configuration information, that can be available with two-way signaling.

Claim 11	Eutelsat DiSEqC Specification	Notes/Description
The signal distribution system of claim 8 wherein the first unit is a satellite outdoor unit and the second unit is a satellite integrated receiver decoder unit.	 Figure 19: Subscriber controlled SMATV Headend	Figure 19 illustrates a satellite antenna with switching and selecting equipment commonly placed outdoors, and a satellite receiver, which is referred to in the text at page to as an IRD (Integrated Receiver Decoder).

Claim 12	Eutelsat DiSEqC Specification	Notes/Description
The signal distribution system of claim 11 wherein the communication medium consists of a single coaxial cable connected to the satellite outdoor unit.	2. Remote tuning for subscriber controlled SMATV headends for single cable IF distribution systems	Figure 19 illustrates a single cable distribution. Page 8 of the Eutelsat DiSEqC Specification references utilizing the existing **single** cable tree distribution. Also, page 6 refers to Enhanced DiSEqC (fully described in the document) as enabling remote tuning for **single** cable IF distribution systems.

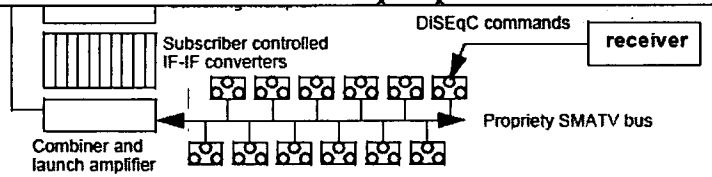
Claim 13	Eutelsat DiSEqC Specification	Notes/Description
The signal distribution system of claim 12 wherein the means for communicating uses the same communication medium as the composite signal.		Figure 19 illustrates communication on the same medium.

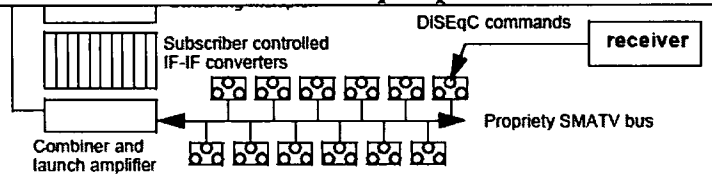
Claim 14	Eutelsat DiSEqC Specification	Notes/Description
A method of communicating a plurality of transponder signals from a satellite outdoor unit (ODU) that receives a plurality of satellite broadband signals to an integrated receiver decoder (IRD) over a single cable connected to the ODU, the method comprising the steps of:	 Figure 19: Subscriber controlled SMATV Headend	Figure 19 illustrates two Quad LNBs, each outputting a plurality of LNB signals (in this case, four each). Transponder signals extracted from the LNB output are distributed over the coaxial cable illustrated as coming from the Signal Combiner. This composite output is distributed via a single cable to each of the wall outlets, which, as illustrated can be connected to a Satellite Receiver, or IRD.
communicating a transponder request signal to the ODU from the IRD;		Figure 19 illustrates that the (IRD) sends a DiSEqC signal to the outdoor unit. A transponder request signal, is referred to as a write channel request, to request a transponder

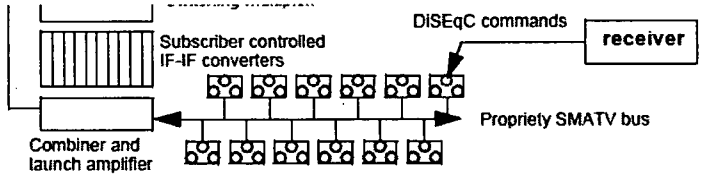
	COMMANDS REQUIRED: **i) Polarity (DiSEqC)** **ii) Band (DiSEqC)** **iii) Position (DiSEqC)** **iv) Write frequency (DiSEqC)**	channel.
in the ODU, selecting a plurality of transponder signals extracted from the received satellite broadband signals, wherein the selecting is responsive to the transponder request signals;		The switch selects LNB outputs and the IF-IF converters select transponder signals (referred to as channels in both the '576 patent and in the Eutelsat DiSEqC Specification). As stated immediately above the channel selection is based on DiSEqC information from the IRD.
combining selected transponder signals into a composite signal;		Figure 19 illustrates a signal combiner combines two RF signals to produce a composite signal
transmitting the composite signal over the single cable from the ODU to the IRDs,		Figure 19 illustrates that the composite signal is sent on a single cable from the combiner to the satellite receiver (IRD). Page 8 references utilizing the existing **single** cable tree distribution. Also, page 6 refers to Enhanced DiSEqC (fully described in the document) as enabling remote

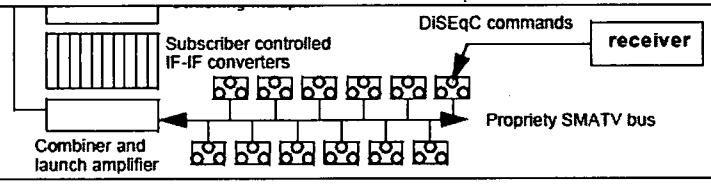
		tuning for **single** cable IF distribution systems.
wherein the modulation of the transponder signal is not altered by the steps of selecting, combining, and transmitting.		ADD FROM 19 – SIMPLE STATEMENT There is no discussion in the reference that discusses altering the modulation of the signal by selecting, combining and transmitting.

Claim 16	Eutelsat Installers Guide	Notes/Description
The method of claim 14 wherein the step of combining comprises frequency translating the selected transponder channels to a variable frequency before combining.		The reference teaches that channels are frequency translated from their respective center frequencies to new center frequencies for placement in the composite signal. One of ordinary skill in the art would have understood that such placement could be variable to allow proper placement in the composite signal.

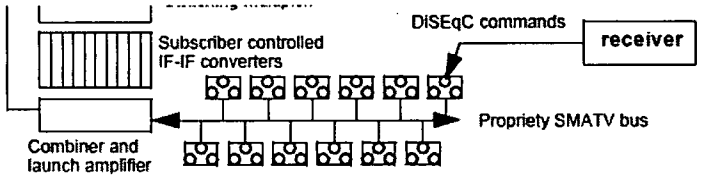
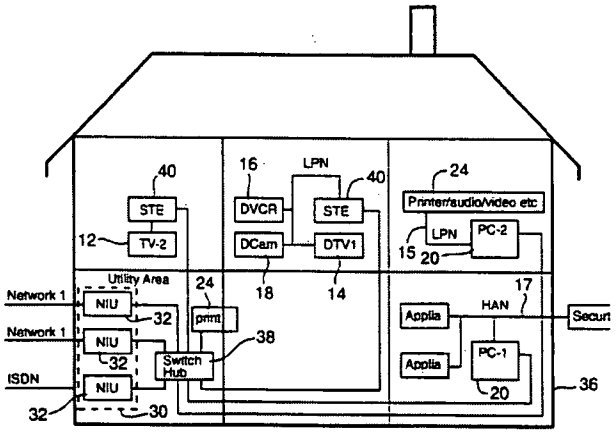
Claim 18	Eutelsat DiSEqC Specification	Notes/Description
The method of claim 14 further comprising the step of splitting the composite signal inside a home and distributing to a plurality of IRDs.		Figure 19 illustrates that the composite signal is split to several wall units each capable of supporting an IRD.

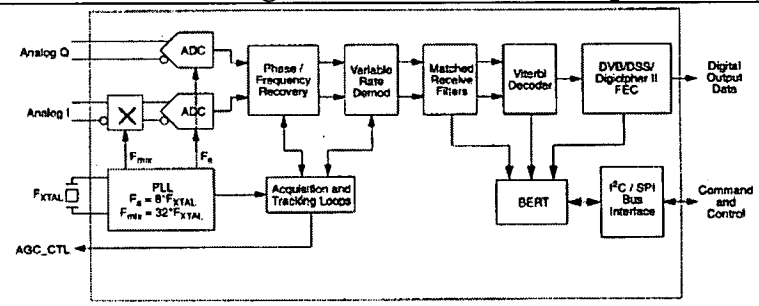
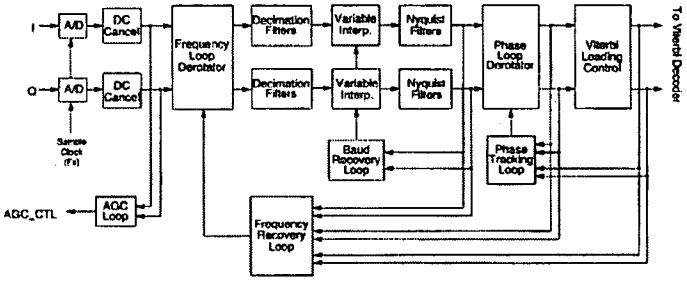
Claim 19	Eutelsat DiSEqC Specification	Notes/Description
The method of claim 14 wherein the transponder request signal is transmitted over the cable from an IRD and all IRDs receive the same composite signal.		Figure 19 illustrates the commands sent from the IRD over the same cable, and a plurality of wall outlets. The single cable is split at the wall outlets so that all IRDs receive the same composite signal.

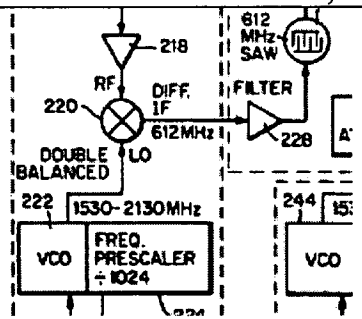
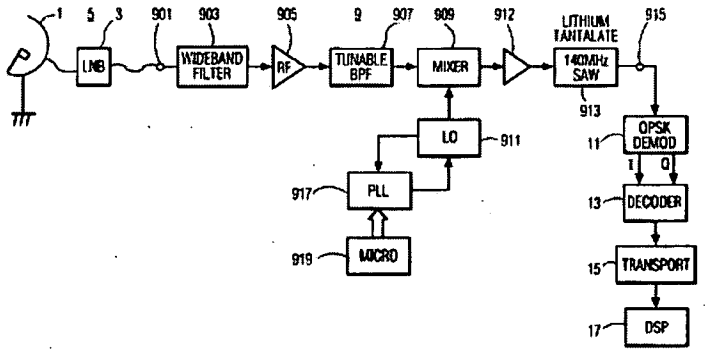
Claim 21	Eutelsat Installers Guide	Notes/Description
The method of claim 14 further comprising the steps of: frequency translating the selected transponder channels to a variable frequency before combining; and splitting the composite signal inside a home and distributing to a plurality of IRDs.		As discussed above with respect to claim 16, tuning to a variable frequency is taught by the reference. As discussed above with respect to claim 18, the reference teaches splitting and distributing to multiple IRDs (Figure 11).

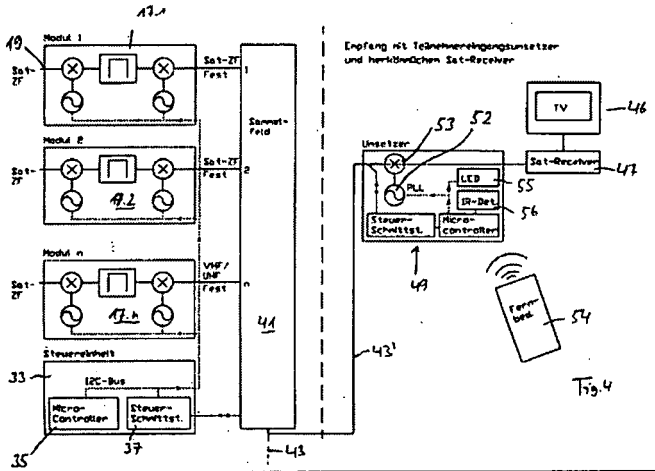
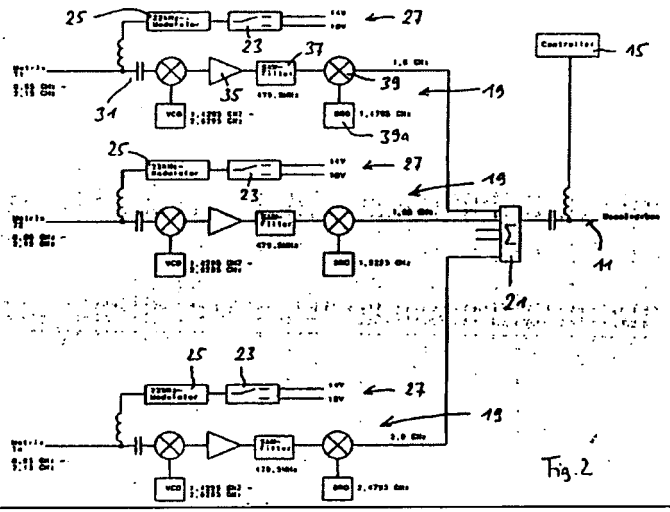
Claim 22	Eutelsat Installers Guide	Notes/Description
The method of claim 21 wherein the transponder request signal is transmitted over the cable from an IRD.		The DiSEqC signalling signal is sent over the same cable from the IRD.

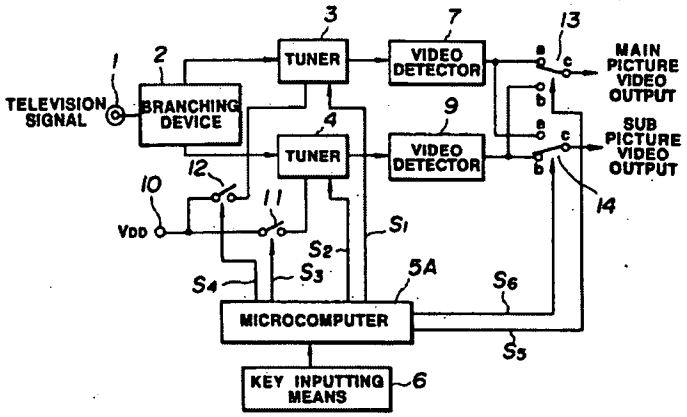
PART II: Applicability of the Eutelsat DiSEqC Specification With Secondary References

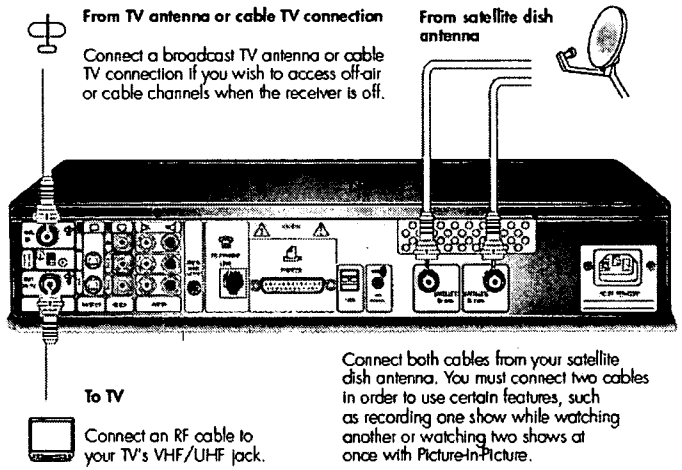
Claim 2	Eutelsat DiSEqC Specification combined with United States Patent No. 6,005,861, to Humpleman	
The signal distribution system of claim 1 further comprising a plurality of IRDs and wherein the composite signal is transmitted on a single cable connected to the ODU and		Figure 19 illustrates a plurality of wall outlets, each of which can support an IRD. It also shows the composite signal being transmitted on a single cable where IRDs connected to wall outlets receive the composite signal.
all IRDs receive channels extracted from the composite signal.	FIG. 2  The architecture of the present invention assumes that for some networks a first stage demultiplexing at the network interface unit **32** is necessary to stay within a definable bandwidth limit (one stream) rather than an arbitrary bandwidth set by the construction of the incoming stream (multiple streams). Making the assumption that MPEG-2 video is being used, there is a demultiplexing from a multiple program transport stream into a single program transport, as defined in the MPEG-2 specification. This is	Humpleman shows a network interface unit 32, or gateway, that extracts channels from the digital satellite TV composite signal, and routes extracted channels to the IRD (Figure 2).
Claim 2, continued		At Column 2, lines 35-43, Humpleman discloses the channel extraction (demultiplexing) from the composite signal.

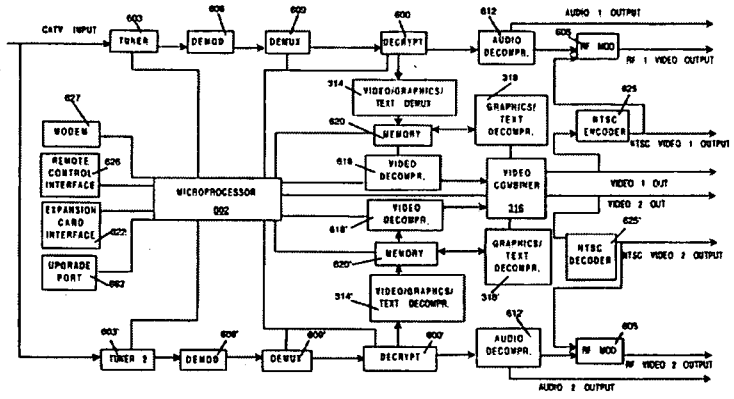
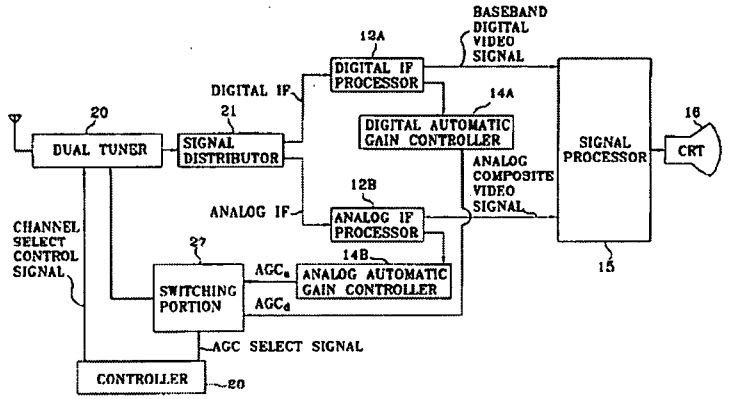
Claim 3	Eutelsat DiSEqC Specification combined with The Broadcom Digital Satellite Receiver Paper	
The signal distribution system of claim 1 wherein the signal selector comprises an analog to digital converter and a digital filter.	 Fig. 3. Universal digital satellite receiver IC block diagram.  Fig. 8. BPSK/QPSK/OQPSK receiver.	The Broadcom Digital Satellite Receiver Paper teaches a receiver having an analog to digital converter and digital filters for tuning/signal selection. In its Introduction, the reference discloses the use of analog SAW filters to perform channel selection. At page 1639, the paper discusses the use of digital SAW filters in the digital receiver.

Claim 4	Eutelsat DiSEqC Specification combined with United States Patent No. 5,073,930 to Green, et. al.	
The signal distribution system of claim 1 wherein the signal selector comprises a tuner.		Several References illustrate a tuner for signal selection. Green teaches a mixer and variable oscillator combined with a bandpass filter to tune and select a given channel. This portion of Figure 3 shows the tuner function in Green.
Claim 4	**Eutelsat DiSEqC Specification combined with United States Patent No. 5,654,774 to, Pugel et. al.**	
The signal distribution system of claim 1 wherein the signal selector comprises a tuner.		At Col. 3, lines 18 – 24, the '774 patent discloses a tuner 9 for "selecting the particular RF signal corresponding to the desired channel from the plurality of RF signals received ..." Pugel illustrates the Tuner 9 receiving a broadband LNB output.

Claim 4	Eutelsat DiSEqC Specification combined with European Patent Publication EP0757489	
		Figure 4 illustrates tuners connected to a satellite signal to select channels prior to combining them onto a composite signal.
Claim 4	**Eutelsat DiSEqC Specification combined with European Patent Publication EP1009113**	
		Figure 2 shows a tuner at each of a plurality of satellite input signals each having a tuner (mixer and local oscillator) followed by a SAW filter to select channels prior to combining.

Claim 5	Eutelsat DiSEqC Specification combined with United States Patent No. to 5,285,284	
The signal distribution system of claim 1 further comprising an integrated receiver decoder (IRD) connected to the coaxial cable with a plurality of tuners within the IRD, wherein each tuner within the IRD receives the composite signal and each tuner uses at least one transponder signal.		Figure 5 illustrates a television receiver having a picture-in-picture (PIP) function with two tuners **3** and **4**.

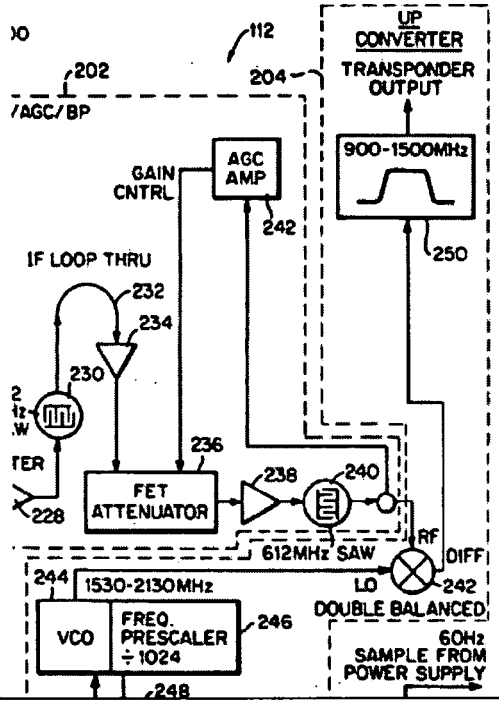
Claim 5	Eutelsat DiSEqC Specification combined with the RCA Setup Guide	
The signal distribution system of claim 1 further comprising an integrated receiver decoder (IRD) connected to the coaxial cable with a plurality of tuners within the IRD, wherein each tuner within the IRD receives the composite signal and each tuner uses at least one transponder signal	[redacted] *You can watch TV if you connect only one cable between the satellite dish antenna and the receiver, but you must connect both cables to use features that require both of the receiver's tuners (viewing two shows at once with Picture-In-Picture or recording one show while watching another, for example).*  **From TV antenna or cable TV connection** Connect a broadcast TV antenna or cable TV connection if you wish to access off-air or cable channels when the receiver is off. **From satellite dish antenna** **To TV** Connect an RF cable to your TV's VHF/UHF jack. Connect both cables from your satellite dish antenna. You must connect two cables in order to use certain features, such as recording one show while watching another or watching two shows at once with Picture-In-Picture.	The RCA Setup Guide for a Satellite IRD describes dual tuner opreation for Picture-in-Picture and Watch-and-Record functions. Two signal inputs are also shown, one for each tuner.

Claim 5	Eutelsat DiSEqC Specification combined with European Patent Publication Number EP0912059	
	 *Fig. 14*	This reference also discloses a set top box for television signals having two-tuner functionality. See Figure 14, and page 21, describing 2-tuner picture-in-picture functionality.
Claim 5	**Eutelsat DiSEqC Specification combined with United States Patent No. 6,353,463, to Seo**	
		Another dual-tuner television reference. Figure 2 of the '463 patent illustrates a dual tuner **20** receiving the television signals.

Claim 7	Eutelsat DiSEqC Specification combined with the Philips Wireless Remote Control Data Sheet	
The signal distribution system of claim 1 wherein transponder select information is transmitted over a wireless link.	**GENERAL DESCRIPTION** The UAA3202M is a fully integrated single-chip receiver, primarily intended for use in VHF and UHF systems employing direct Frequency Shift Keying (FSK) modulation. The UAA3202M incorporates a SAW stabilized local oscillator, balanced mixer, IF amplifier, limiter, Received Signal Strength Indicator (RSSI), RSSI comparator, FSK demodulator, data filter and data slicer. The device features a power-down mode in order to minimize the average receiver supply current. **Applications** • Keyless entry systems • Car alarm systems • Remote control systems • Security systems • Telemetry systems • Wireless data transmission • Domestic appliances.	the UAA3202M Frequency Shift Keying Receiver is for VHF and UHF wireless control. Described applications include remote control systems, telemetry systems and wireless data transmission (page 2).

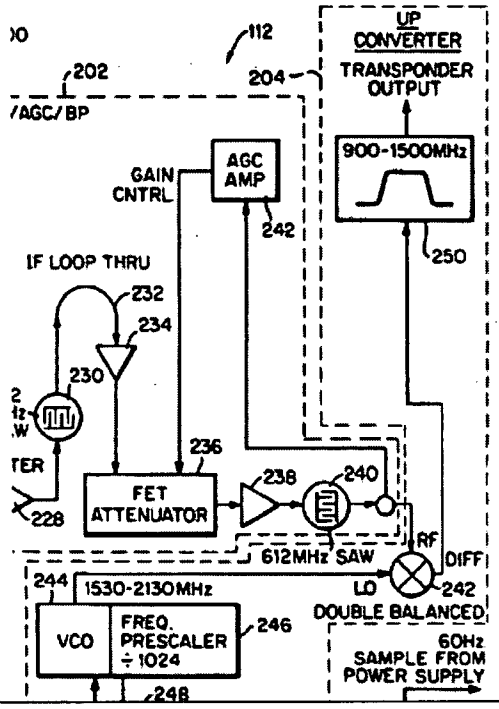
Claim 10	Eutelsat DiSEqC Specification combined with United States Patent No. 5,073,930 to Green, et. al.	
The signal distribution system of claim 8, further comprising a means in the first unit for carrier offset correction.	of a 612 MHz. IF stage. Microcontroller 206 is capable of controlling the exact down-conversion frequency provided by down-converter 200 to correct for errors in the input signal center frequency (e.g., due to satellite transponder error and/or low noise block converter error). IF stage/AGC/bandpass filter block 202 filters	Green describes carrier offset correction for satellite signals in the transponder selection circuitry. Column 12, lines 40 – 45.

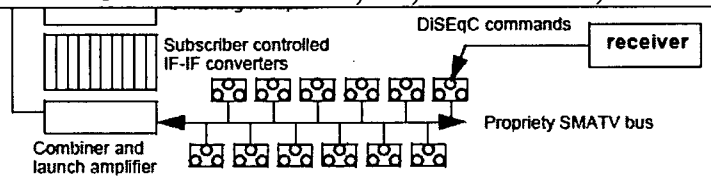
Claim 15	Eutelsat DiSEqC Specification combined with the Broadcom Digital Satellite Receiver Paper	
The method of claim 14 wherein the ranging from 5% to 100% wider than the bandwidth of the transponder signal.	degradation (receiver + tuner) is well within the required DVB limit of 0.8 dB. The best performance occurs at 20 MBaud, approximately in the center of the 1–45-MBaud range. The performance degrades slightly at the two extremes of 1 and 45 MBaud. The degradation at 1 MBaud is primarily due to phase noise in the tuner and finite wordlength effects in the digital filters that recover the symbol timing from the highly oversampled input data (128-MHz sample rate versus 1-MBaud input signal) when adjacent channel interferers are present. The primary cause for the performance degradation at 45 MBaud is that the tuner's 55-MHz SAW filter cuts off some of the excess bandwidth of the input signal. (Note that a	Broadcom shows a filter having a bandwith of 55MHz in a system operating at sample rates of 1 – 45 MBaud. Page 1639, bottom.

Claim 16	Eutelsat DiSEqC Specification combined with United States Patent No. 5,073,930 to Green, et. al.	
The method of claim 14 wherein the step of combining comprises frequency translating the selected transponder channels to a variable frequency before combining.	**244,246,248** within up converter circuit **204**). Microcomputer **206** independently controls the local oscillator frequency output provided by VCO **244** to be within the range of 1530-2130 MHz. Mixer **242** heterodynes this local oscillator frequency output of IF strip **202** to provide a single transponder signal somewhere within the 900-1500 MHz band—with the exact center frequency of the output signal being a function of the local oscillator frequency produced by VCO **244**. This 	Green teaches translating selected transponder channels to a variable frequency within the spectrum of the composite signal, before combining. Fig. 3, and Column 14, lines 1-10.

Claim 17	Eutelsat DiSEqC Specification combined with United States Patent No. 5,073,930 to Green, et. al.	
The method of claim 15 further comprising frequency translating the selected transponder channels to a predetermined frequency before combining.	Up converter **204** converts the selected signal back to a signal having a center frequency within the original 950-1450 MHz—and more specifically to have a center frequency exactly matching a standard center frequency of a given desired satellite transponder within that band (as the transponder signal would have appeared directly from the antenna LNB). verter **200**. Thus, microcontroller **206** is capable of controlling down converter **200** to select any one of the input transponder signals, and then controls up converter **204** to convert that selected signal to any desired transponder output frequency. Selector **208** allows in-	Green also shows that the frequency translation can be to a predetermined frequency. Column 12, line 50 teaches translating to a predetermined frequency to match the transponder signal in the LNB output. Column 12, line 60 teaches converting to any desired placement in the composite signal. To properly place it, it must be predetermined.

Claim 20	Eutelsat DiSEqC Specification combined with the Philips Wireless Remote Control Data Sheet	
The method of claim 14 wherein the transponder request signal is transmitted over a wireless link to the ODU.	**GENERAL DESCRIPTION** The UAA3202M is a fully integrated single-chip receiver, primarily intended for use in VHF and UHF systems employing direct Frequency Shift Keying (FSK) modulation. The UAA3202M incorporates a SAW stabilized local oscillator, balanced mixer, IF amplifier, limiter, Received Signal Strength Indicator (RSSI), RSSI comparator, FSK demodulator, data filter and data slicer. The device features a power-down mode in order to minimize the average receiver supply current. **Applications** • Keyless entry systems • Car alarm systems • Remote control systems • Security systems • Telemetry systems • Wireless data transmission • Domestic appliances.	the UAA3202M Frequency Shift Keying Receiver is for VHF and UHF wireless control. Described applications include remote control systems, telemetry systems and wireless data transmission (page 2).

Claim 21	Eutelsat DiSEqC Specification combined with United States Patent No. 5,073,930 to Green, et. al.	
The method of claim 14 further comprising the steps of: frequency translating the selected transponder channels to a variable frequency before combining; and splitting the composite signal inside a home and distributing to a plurality of IRDs.	**244,246,248 within up converter circuit 204). Microcomputer 206 independently controls the local oscillator frequency output provided by VCO 244 to be within the range of 1530-2130 MHz. Mixer 242 heterodynes this local oscillator frequency output of IF strip 202 to provide a single transponder signal somewhere within the 900-1500 MHz band—with the exact center frequency of the output signal being a function of the local oscillator frequency produced by VCO 244. This**  	Green teaches translating selected transponder channels to a variable frequency within the spectrum of the composite signal, before combining. Fig. 3, and Column 14, lines 1-10. The functions of splitting and distributing are found in the primary Eutelsat reference at Figure 19.

Claim 22	Eutelsat DiSEqC Specification combined with United States Patent No. 5,073,930 to Green, et. al.	
The method of claim 21 wherein the transponder request signal is transmitted over the cable from an IRD.		The combination teaches claim 21, from which claim 22 depends. (See above). Figure 19 of the Eutelsat DiSEqC Specification shows the request signal (DiSEqC) is transmitted over the cable from the IRD.

Claim 23	Eutelsat DiSEqC Specification combined with United States Patent No. 5,073,930 to Green, et. al. and the Philips Wireless Remote Control Data Sheet	
The method of claim 21 wherein the transponder request signal is transmitted over a wireless link to the ODU.	**GENERAL DESCRIPTION** The UAA3202M is a fully integrated single-chip receiver, primarily intended for use in VHF and UHF systems employing direct Frequency Shift Keying (FSK) modulation. The UAA3202M incorporates a SAW stabilized local oscillator, balanced mixer, IF amplifier, limiter, Received Signal Strength Indicator (RSSI), RSSI comparator, FSK demodulator, data filter and data slicer. The device features a power-down mode in order to minimize the average receiver supply current. **Applications** • Keyless entry systems • Car alarm systems • Remote control systems • Security systems • Telemetry systems • Wireless data transmission • Domestic appliances.	The combination teaches claim 21, from which claim 22 depends. (See above). As stated above with respect to claim 20, the Philips data sheet teaches wireless remote signaling.

EXHIBIT B

EUTELSAT

Organisation européenne de télécommunications par satellite
European Telecommunications Satellite Organization
70, rue Balard — 75502 PARIS Cedex 15 — France

Technical Guide



INFORMATION FOR INSTALLERS OF HOT BIRD™ DVB-S SYSTEMS VERSION 1.0

June 7, 1999

This document is provided for information purposes. Whilst every effort has been made to provide accurate information, no responsibility is taken for errors or omissions. EUTELSAT reserves the right to change this information without notice.

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1. Introduction

This document provides recommendations for the use and installation of equipment for the reception and distribution of EUTELSAT DVB-S transmissions from the HOT BIRD™ satellite system at 13°E.

The technical characteristics of the HOT BIRD™ satellites are given in *Annex A* to this document. The annex includes information on the satellite themselves, the frequency plan, the satellite coverages and the azimuth and elevation angles to the 13° East orbital position.

Additional information is provided herein on the operational configuration of the individual transponders. This should be read in conjunction with the most up-to-date details of the digital TV and radio transmissions available from EUTELSAT on request (in the "TV and Radio Line-Up"). *(See section "Contact details").* This includes details of the transmission frequency. Alternatively, the information can be downloaded from the EUTELSAT Web site (http://www.eutelsat.com).

2. DVB-S Transmissions

2.1. Characteristics of the Satellite Delivery Network

Annex A provides the technical characteristics (frequency plans and generic coverages) of the HOT BIRD™ satellite system located at the 13° East orbital position. It also includes charts of azimuth angle, elevation angle and polarisation alignment angle to aid in the antenna installation process.

The technical characteristics of other EUTELSAT satellite networks (e.g. at 7°E) are available from EUTELSAT on request. A EUTELSAT contact point is given in *section 6. on page 47.*

2.2. Characteristics of DVB-S Carriers

2.2.1. Satellite Access Modes (MCPC and SCPC)

Broadcast links via EUTELSAT's HOT BIRD™ system can be provided in several ways:

- Transmission of a high rate (typically 38 Mbit/s) multiplex, comprising a number of different digital television programmes (typically four to eight standard definition programmes). This mode of operation is commonly referred to as Multiple Channel (Programme) Per Carrier (MCPC). Such transmissions usually use a dedicated transponder (i.e. single carrier transponder access).
- Transmission of a medium rate (typically around 4 to 8 Mbit/s) multiplex, usually comprising a single digital television programme (but not necessarily so). This mode of operation is commonly referred to as Single Channel (Programme) Per Carrier (SCPC). Such transmissions use part of the satellite transponder's bandwidth and power. In other words, the transponder is accessed in a multi-carrier mode. In this case the transponder resources are shared amongst several users (uplink carriers).
- Transmission via a Skyplex™ uplink (for certain HOT BIRD™ transponders only).

As far as reception is concerned, Skyplex transmissions are indistinguishable from MCPC transmissions with a symbol rate of 27.5 Msymbol/s and can be treated as such.

SCPC access can provide a number of advantages to the broadcaster, such as the potential to reduce satellite transponder and transmit earth station costs and the capability for independent uplink operation. Consequently, it is frequently used for contribution applications and for distribution to cable head-ends.

However, SCPC access does not use the satellite power and bandwidth resources in the most efficient way. MCPC access, which is significantly more power-efficient, is usually used for broadcast services. Indeed, EUTELSAT recommends to broadcasters and service providers that MCPC access is used in direct-to-home applications.

The modulation, coding and multiplexing structures of MCPC and SCPC carriers are identical and are as specified in the DVB-S standard.

However, SCPC and MCPC transmissions differ in the following ways:

- They employ different transmission (symbol) rates.
- They have different radiated power levels (EIRPs).
- They may employ different degrees of Forward Error Correction (FEC).

- They demand different levels of frequency accuracy, frequency stability and phase noise performance of reception equipment.
- They provide different "channel hopping" response times.

Each of the above characteristics is discussed briefly in the following sections.

2.2.2. Symbol Rates

MCPC transmissions can have a symbol rate that typically range from 20 to 30 Msymbol/s, depending upon the bandwidth that is available for transmission. A symbol rate of 27.5 Msymbol/s is compatible with a 33 MHz satellite transponder bandwidth and is most commonly used. A symbol rate of 30 Msymbol/s is compatible with a 36 MHz transponder bandwidth.

SCPC transmissions can have a symbol rate as low as 3 Msymbol/s, depending upon the amount of information carried (e.g. one or more digital TV programmes). The upper limit on the symbol rate extends beyond the lower limit for MCPC, which means that equipment capable of receiving both SCPC and MCPC carriers would need to be able to process symbol rates over the full range of 3 to 30 Msymbol/s.

2.2.3. Radiated Power Levels

MCPC transmissions essentially employ all of the available satellite transponder power with little or no transponder "backoff"[1].

SCPC transmissions share the satellite transponder with other SCPC transmissions and consequently the EIRP assigned to each carrier is significantly less than the transponder's maximum EIRP capability. The backoff per carrier is typically at least 5 dB and is frequently much higher, depending upon the number of SCPC transmissions that are sharing the transponder. Consequently, for a given satellite coverage (EIRP), a larger antenna may be required to receive an SCPC transmission than is required to receive a MCPC transmission. It is for this reason that MCPC access is preferred for DTH applications.

2.2.4. Forward Error Correction

MCPC and SCPC transmissions both employ the full range of FEC rates specified in the DVB-S standard (1/2, 2/3, 3/4, 5/6 and 7/8).

1. *Operation of the satellite high power amplifier below its maximum output level in order to reduce the adverse effects of channel nonlinearities on the transmission quality.*

MCPC transmissions frequently employ an FEC rate of 3/4 but are not constrained to do so.

SCPC signals are transmitted with lower power and consequently they often employ a higher FEC rates (2/3 or 1/2) in order to minimise the size of the antenna needed for service reception.

2.2.5. Frequency Stability and Phase Noise Considerations

The frequency stability and phase noise performance of outdoor reception systems designed for FM TV services may be adequate for the reception of MCPC digital TV transmissions. Consequently, outdoor units originally installed for FM TV reception may be adapted to receive DVB-S MCPC transmissions by the addition of a suitable IRD. This is possible because digital transmissions at the high symbol rates used by MCPC carriers are relatively insensitive to frequency instability and phase noise. However, use of a "digital-ready" LNB will guarantee reception of all MCPC transmissions.

At lower transmission rates, such as those used for SCPC services, the frequency stability and phase noise performance of some outdoor units (LNBs) may be inadequate. In this case, users may experience difficulty with automatic tuning and initial acquisition of SCPC broadcasts, requiring the replacement of the existing LNB with a digital-ready device offering better performance.

When choosing a digital-ready LNB for SCPC reception, the most important parameters are the initial frequency accuracy and the temperature stability. Devices should be selected for the best initial frequency precision and the best temperature stability ($< \pm 1$ to 2 MHz over the operating temperature range).

2.2.6. Channel Hopping Considerations

The response time when channel hopping can be acceptably short with MCPC access, so long as the service information is delivered at an adequate rate. The maximum delay is likely to occur when switching from multiplex to multiplex, which requires re-tuning of the receiver to the new carrier frequency.

With SCPC access, response times can be significantly worse and as high as four to five seconds. This is partly because the data transmission rate is much lower than for MCPC transmissions, leading to a lower rate of service information transfer for the same degree of overhead (percentage of capacity allocated to the service information). Switching between different multiplexes, and hence receiver re-tuning, will also occur more frequently, since the SCPC transmissions will generally carry only one or very few digital TV programmes.

3. Reception System Architectures

3.1. General

In this section an overview is given of possible reception system architectures. In general, these fall into two categories: individual reception systems and collective reception systems.

Individual reception systems will be referred to as "DTH" systems. Collective reception systems are often referred to as "Satellite Master Antenna Television" (SMATV) systems.

The purpose of this section is to identify the different possible reception system architectures and to discuss the various advantages and disadvantages of each solution. This information is provided in order to help installers choose a suitable system architecture, taking into account the environment in which it is to operate.

In particular, it is recommended that installers consider the use of DiSEqC™-compatible equipment to ensure that newly installed reception systems have maximum configuration flexibility, regardless of their architecture.

3.2. Orbital Location(s)

Although EUTELSAT provides many television services, and other services, from a number of different orbital positions, entertainment television services are concentrated at the 13° E orbital position (the "HOT BIRD™" position).

As a minimum, direct-to-home (DTH) and satellite master antenna television (SMATV) reception systems should be capable of receiving from this orbital position.

However, given that television services of interest to the general public exist at other orbital positions, and to provide the consumer with the maximum of programme choice, EUTELSAT encourages the installation of DTH and SMATV reception systems that allow simultaneous reception from two or more orbital positions.

3.3. Individual Reception Systems

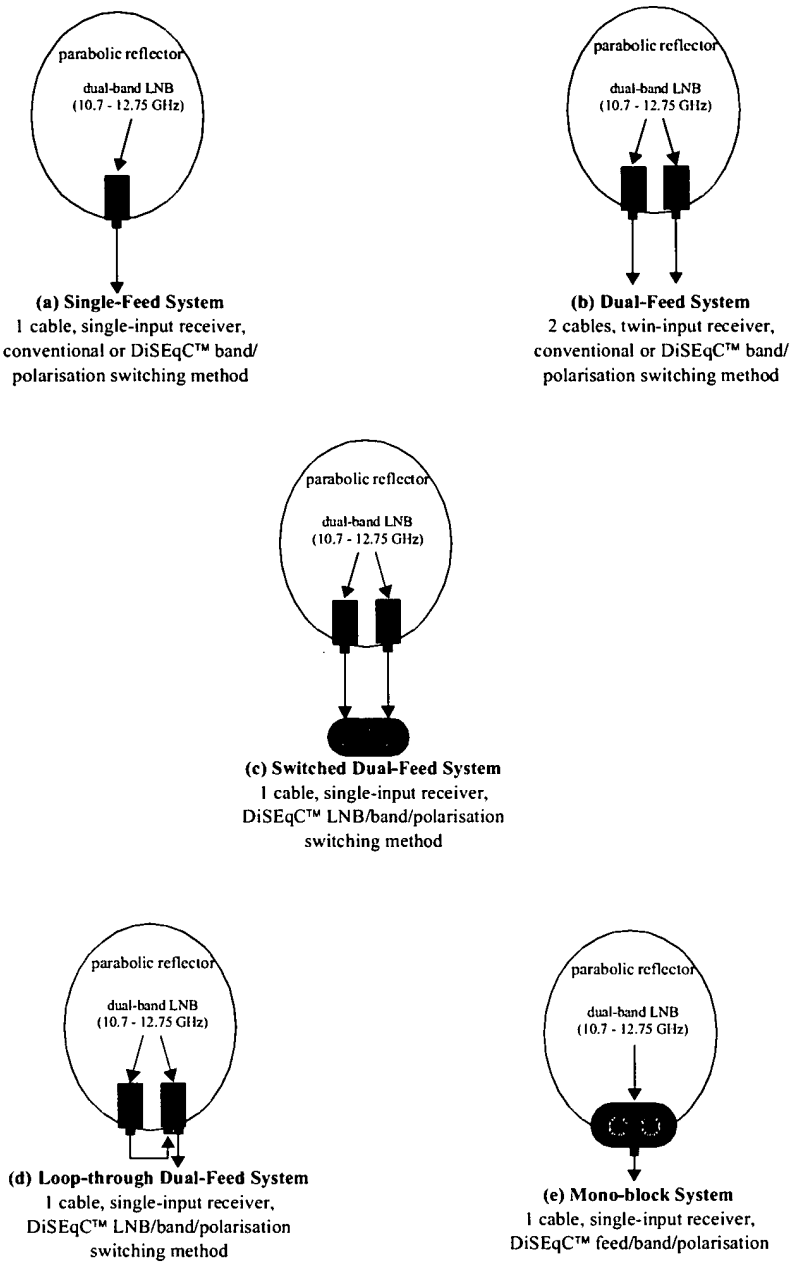


Figure 1 : DTH Receive System Architectures

Five DTH reception architectures are shown in *Figure 1.*

Figure 1(a) is a single-feed system for reception only from the EUTELSAT system at 13° East. It utilises a single "universal" LNB to receive all signals in the range of 10.7 tp 12.75 GHz on any one of the two linear polarisations. Frequency band switching and polarisation switching is performed within the LNB.

Figure 1(b), *Figure 1(c)*, *Figure 1(d)* and *Figure 1(e)* are systems for reception from two orbital positions via a dual-feed assembly. Single antenna architectures such as these are recommended for DTH systems receiving from two orbital positions in order to avoid the cost and environmental impact associated with installing two separate antenna subsystems. Systems with a single mechanically steerable antenna would also suit this purpose, with a longer response time when switching between orbital positions. The architectures of *Figure 1(b)*, *Figure 1(c)*, *Figure 1(d)* and *Figure 1(e)* differ in their cabling and signalling requirements for the connection between the IRD and the antenna subsystem.

In *Figure 1(b)* two dual-band LNBs share a common reflector. The system is intended for simultaneous reception from the EUTELSAT system at 13° East and a second orbital location close by (typically within ±6°). Frequency band switching and polarisation switching is performed independently within the LNB for each orbital position. Two cables are required for connection to the IRD (indoor unit) which must be equipped with two LNB inputs that can be independently controlled.

Figure 1(c) is an alternative dual-feed architecture, which additionally allows switching between the two LNBs (orbital positions) to be performed at the antenna under the control of the IRD. Only one cable is required for the interconnection between the antenna subsystem and the IRD and the latter need only be equipped with a single LNB input.

Figure 1(d) is another dual-feed architecture which is logically similar to the method of *Figure 1(c)*, but uses internal switching in one of the LNBs to provide an LNB loop-through facility. It is functionally equivalent to the architecture of *Figure 1(c)* and also requires a single cable for interconnecting the antenna subsystem and the IRD. Switching within the LNB eliminates the need to provide a separate switch box, leading to potential cost and weight savings and reducing the number of connections that require waterproofing.

Figure 1(e) shows a mono-block universal LNB for reception from two satellites spaced six degrees apart. Reception is possible across the full frequency band of 10.7 to 12.75 GHz and on both polarisations from each orbital position. Such devices are simpler to install than equivalent systems employing two physically separate LNBs to achieve the same purpose (as shown in *Figure 1(b)*, *Figure 1(c)* and *Figure 1(d)*). They are designed to allow existing antennas receiving from a single satellite position to be easily upgraded for reception from two orbital positions. A single cable is required for the interconnection between the LNB and the IRD. Further information on this type of LNB and its use, including a list of mono-block LNB manufacturers, is available on request from EUTELSAT *(See section "Contact details").*

In general, it is desirable to minimise the number of connections to be made at the outdoor unit in order to reduce the possibility of equipment failure due to faulty cabling or water ingress. Of the four dual-feed architectures identified in *Figure 1*, the mono-block LNB is the best solution in this respect, because it requires only a single connection to be made and waterproofed at the LNB.

All architectures of *Figure 1* require signalling from the IRD so that the appropriate frequency band and polarisation can be selected at the antenna subsystem. Depending upon the architecture, this can be done using either conventional tone signalling methods or by means of a compatible communications protocol called DiSEqC™. The use of DiSEqC™-compatible equipment is recommended. The subject of DiSEqC™ is dealt with in *section 3.5.*

Figure 1(e) is the preferred solution for dual-feed reception systems for environmental, cost and practical reasons (under the assumption that simultaneous reception from both orbital locations is not required).

3.4. Collective Reception Systems

3.4.1. POSSIBLE ARCHITECTURES

Collective reception systems are installed for a number of reasons. A relatively simple system could be intended just to provide multiple reception points within a home, allowing independent programme selection at each reception point. More extensive systems could serve a block of apartments, where limited line of sight, local regulations or physical limitations on the number of antennas that can be installed preclude the installation of multiple individual reception systems. The cost to the viewer is potentially lower with collective reception systems, since the cost of equipment is shared amongst all users. Service availability will also be enhanced with a single, relatively large antenna for collective reception with respect to a typical DTH installation, where for aesthetic and practical reasons the antenna is often kept as small as possible.

Collective reception systems can be implemented in a number of different ways. These include:

- FM/QPSK to AM re-modulation.
- Switched IF systems.
- IF-IF conversion.
- IF-RF-IF conversion.
- Remote controlled head-ends.
- QPSK to QAM re-modulation.

Each of these technical solutions is discussed briefly in the following sections. DVB-S IRDs could be employed in the many of these architectures.

3.4.1.a FM/QPSK to AM Re-Modulation

This is a traditional technique for distributing clear (unscrambled) analogue channels. The FM (analogue) or QPSK (digital) satellite signal is demodulated and the recovered baseband signal is used to amplitude modulate a new carrier in the frequency bands used for terrestrial television services (i.e. the VHF/UHF bands). The recovered baseband signal is not processed in any way prior to re-modulation. Signal distribution is via a single cable to individual TV sets equipped with a conventional VHF/UHF tuner. Such distribution systems are typically limited to 20 to 30 channels, depending upon the system bandwidth. This total includes all terrestrial channels received by conventional means.

Figure 2 is an illustration of the spectrum of the broadband signal that is distributed to the individual TV sets. The "hyperband", which is located between the UHF and VHF frequency bands, is not usually used in distribution networks of this type.

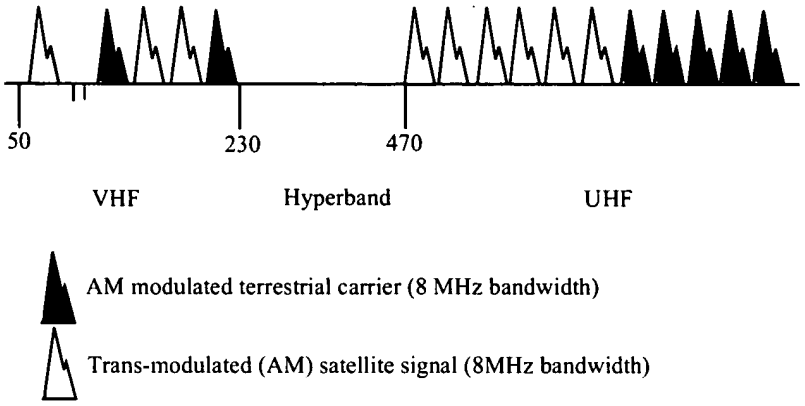


Figure 2 : Broadband Signal Spectrum for a FM/QPSK-AM Distribution Network

Figure 3 is an illustration of the distribution system architecture. Networks of this type require one satellite receiver and one AM modulator per (satellite) channel at the "head-end" of the distribution network. These two functions are often combined in a "transmodulator". A "quad" LNB is employed to simultaneously provide signals received on both polarisations (X and Y) and in both satellite frequency bands (the 10.7 - 11.7 GHz "low" band and the 11.7 - 12.75 GHz "high" band)

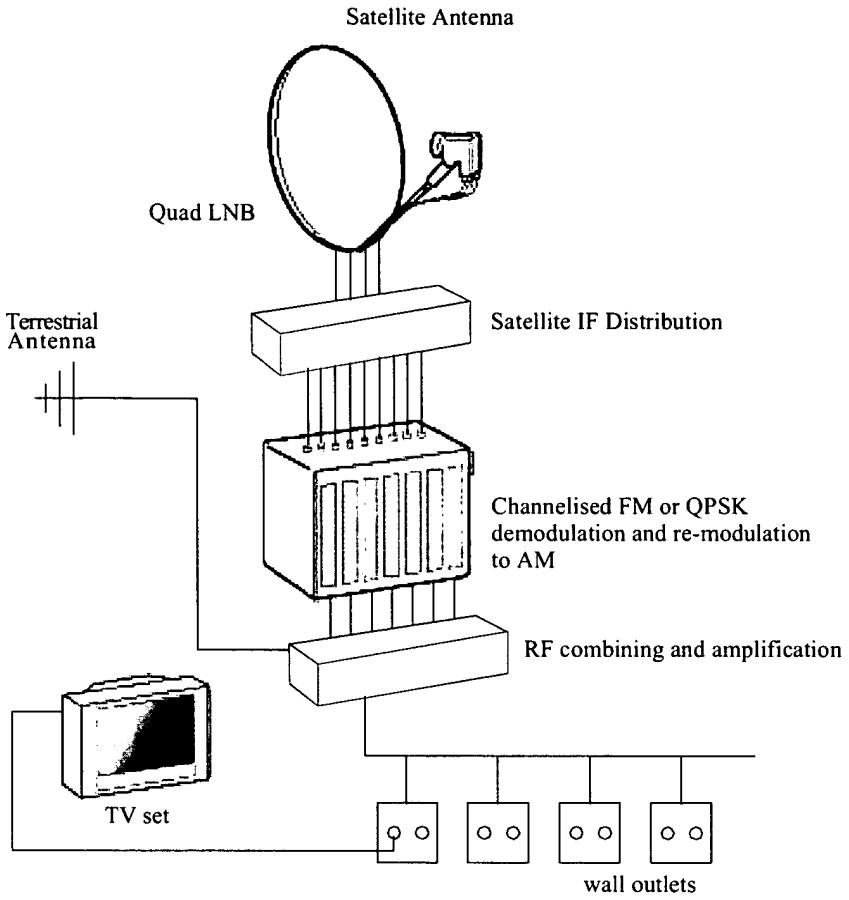


Figure 3 : FM/QPSK-AM Distribution Network Architecture

Existing distribution networks could be adapted to accommodate digital television transmissions by replacing individual FM TV receivers with digital IRDs at the head-end. However, given the potentially large number of services that can be delivered by digital means, the capacity of the distribution system would soon be exceeded. Conventional means (i.e. teletext) would also need to be relied upon for data services and some service information may be irrelevant to the end user. For example, tuning information for the satellite delivery network would have no meaning in the context of a collective reception in the VHF/UHF bands.

With collective reception systems of this type the digital services will appear to be essentially the same as analogue services, with none of the additional benefits of fully digital delivery methods (enhanced programme choice, advanced programme guides and new interactive services, for example).

3.4.1.b Switched IF Systems

Switched IF systems distribute the satellite Intermediate Frequency (IF) signal supplied by the LNB directly to each user. They require multiple cables each having sufficient bandwidth to deliver both the full satellite IF range (950 – 2150 MHz) and the terrestrial frequency range (50 – 850 MHz). The number of cables depends upon the number of orbital positions, polarisations and frequency bands to be supported.

The system architecture for a single user is illustrated in *Figure 4*. In this example reception is from a single orbital position. As before, a quad LNB is used to deliver signals received on both polarisations (X and Y) and in both frequency bands (lower and upper).

Each user is equipped with a "multi-switch" that provides a number of outlets. The purpose of the switch is to select the correct polarisation and frequency band for the programme of interest. In other words, it switches between the signals delivered by the four outputs of the quad LNB. Polarisation/band switching for one outlet is independent of the switching for other outlets. Terrestrial signals are added to the IF signal delivered by the satellite and are distributed via the same cable network.

The domestic distribution network is flexible in that it supports a variety of different equipment (satellite FM TV receivers, digital satellite IRDs and conventional television sets), each having the capability for independent programme selection. As far as the user is concerned, the system is equivalent to having a dedicated DTH reception system. Switched IF distribution systems thus create a "virtual" antenna for each user. One difference with DTH installations is that the satellite IRD may require an equaliser to compensate for distortions introduced by the distribution network. The equaliser compensates for the fact that the attenuation of the network is not constant across the frequency band used to distribute the TV signals. This variation in attenuation (gain) is often referred to as the "gain slope". The equaliser is sometimes built into the cable distribution amplifiers.

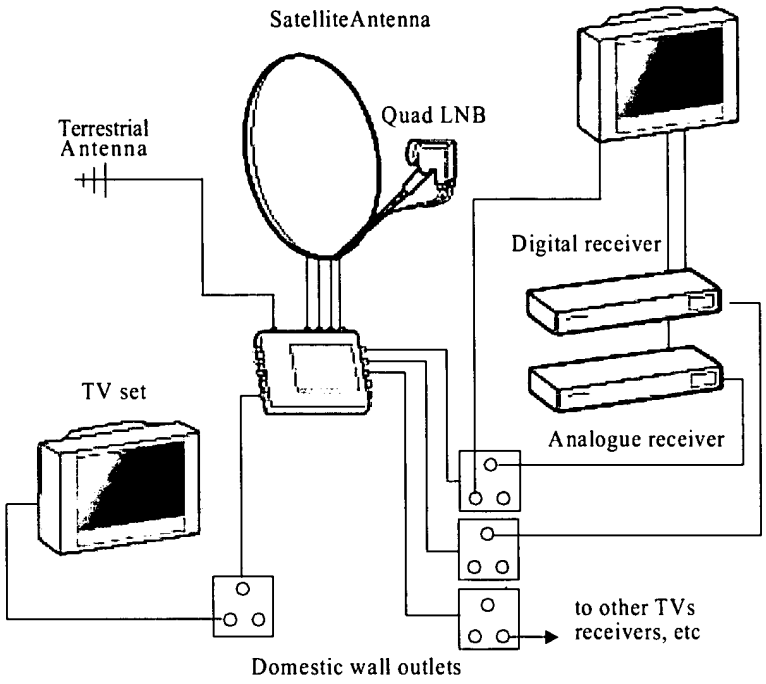


Figure 4 : Switched IF Distribution System – Domestic Architecture

This distribution method has the important advantage that it conveys all the digital information that is available in the DVB-S multiplex directly to each user's IRD. The IRD is identical to that used in DTH systems and the user is provided with all the services that a DTH viewer would enjoy. Furthermore, the system is transparent to any system used for conditional access (pay TV).

Figure 5 shows the general architecture of a switched IF distribution system, again for reception from a single orbital position. A backbone comprising five cables, four carrying the satellite IF signals and one carrying the terrestrial signals, feeds each of the multi-switches connected in cascade. Each switch provides a through path for the input signals to feed the following switch in the cascade.

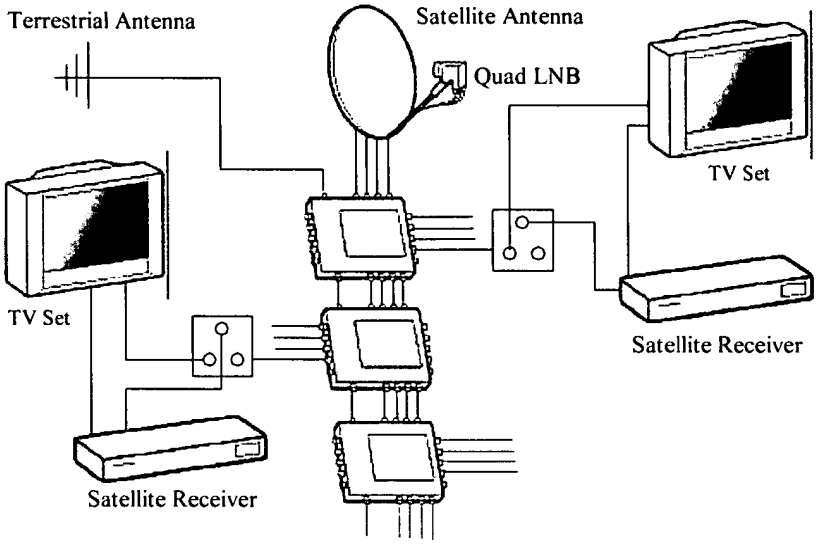


Figure 5 : Switched IF Distribution Network - General Architecture

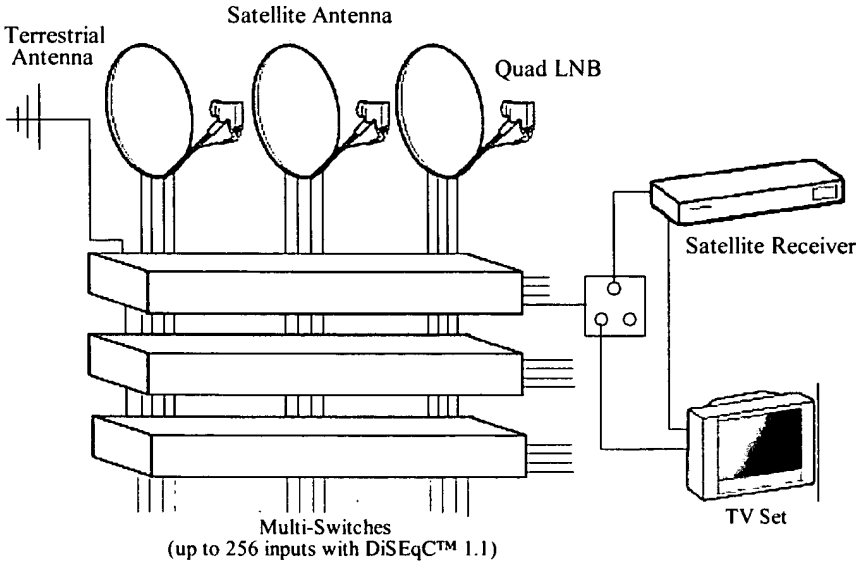


Figure 6 : Multi-Satellite Switched IF Distribution System

This architecture can be extended to support more than one orbital position, as indicated in *Figure 6*. The backbone now contains additional cables, the total number depending upon the number of orbital positions to be supported. The multi-switches must also provide a greater number of inputs to provide full flexibility to each user.

3.4.1.c IF-to-IF Conversion

IF-to-IF conversion systems distribute a limited number of satellite transmissions (analogue or digital) chosen from all those delivered by the satellite antenna. They "re-build" the satellite IF spectrum so that it is suitable for distribution via a single cable. It is a flexible system but can only support up to thirty channels (transponders). This limitation is less of a problem for digital transmissions than for analogue transmissions because of the multi-channel nature of DVB-S signals.

Figure 7 illustrates the broadband signal spectrum that is distributed on the single cable and the way that the satellite IF signal is assembled from all of the available satellite transmissions. The satellite IF signal can be distributed along with signals occupying the terrestrial frequency bands. The latter could comprise any mixture of traditional AM signals, transmodulated satellite signals or even digital terrestrial signals.

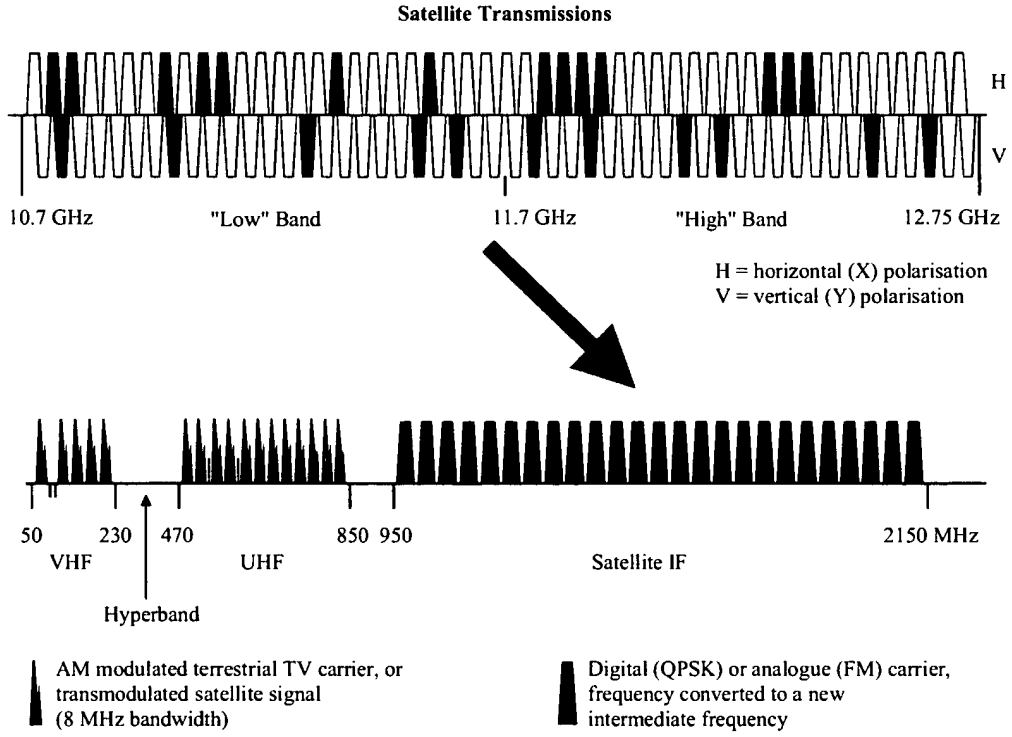


Figure 7 : Broadband Signal Spectrum for an IF-IF Distribution Network

The distribution network architecture is illustrated in *Figure 8*. Each user is equipped with a satellite receiver (analogue or digital) and can use a conventional television set to receive the terrestrial signals. The distribution network must operate up to a frequency to 2150 MHz. Once again, digital IRDs may benefit from the use of an equaliser to compensate for distortions introduced by the distribution network.

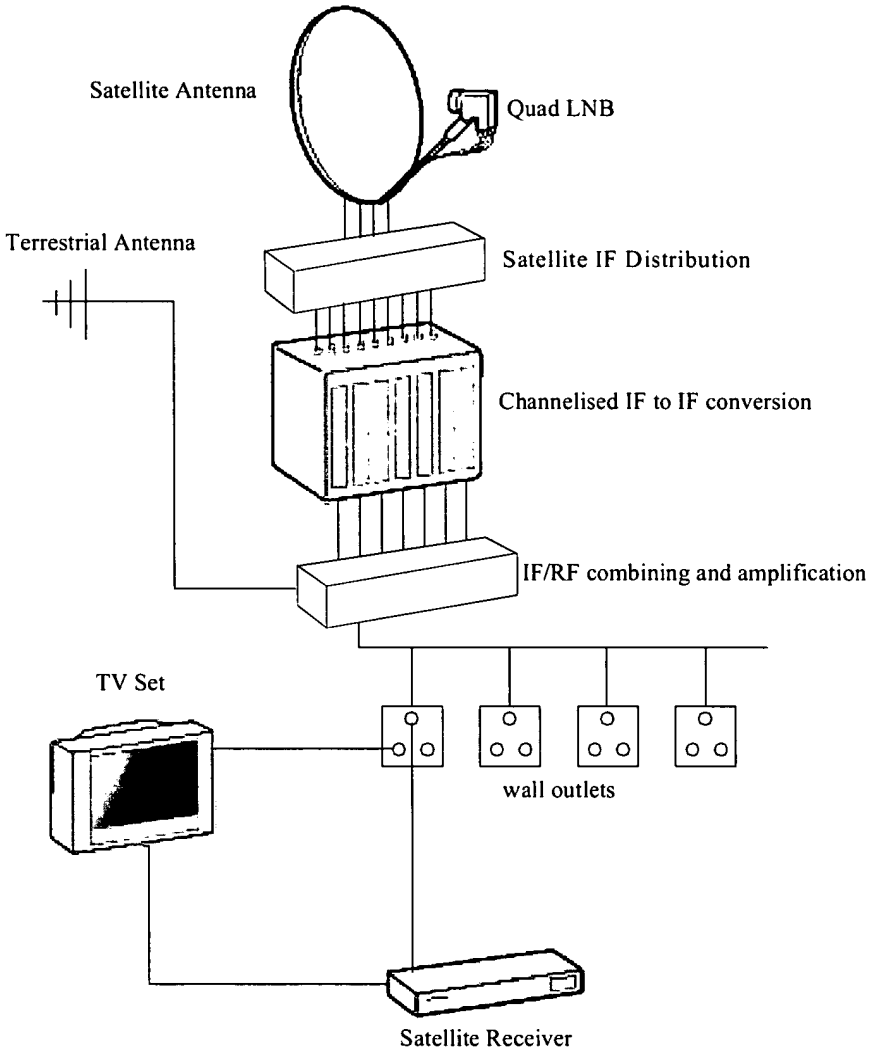


Figure 8 : Architecture of an IF-IF Distribution Network

As is the case for switched IF distribution systems, IF-IF conversion systems are essentially transparent to the signals that they carry. However, there is one important difference for digital satellite television signals. Because the IF signals are simply shifted in frequency, some of the service information delivered to the user will be inappropriate for the delivery network. In particular, tuning information, which is provided to allow IRDs to tune to the correct intermediate frequency for a particular multiplex when receiving directly from the satellite, will be incorrect. Digital IRDs connected to IF-IF distribution networks may therefore not be able to tune automatically and may require a degree of manual intervention by the user.

3.4.1.d IF-to-RF-to-IF Conversion

As the name implies, distribution networks employing IF-RF-IF conversion are based on the IF-IF conversion approach with an additional frequency conversion to the "RF" band for distribution via the cable network. In this context, the term "RF" refers to the VHF/UHF frequencies used for terrestrial signal distribution.

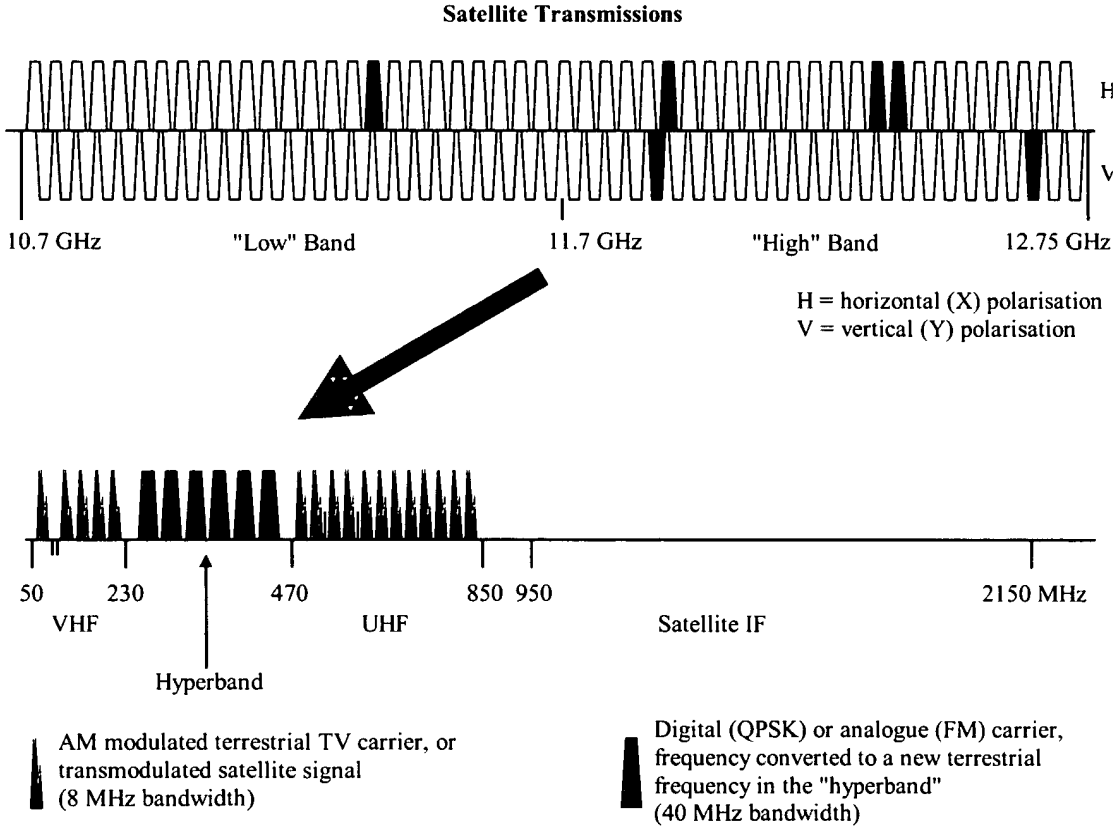


Figure 9 : Broadband Signal Spectrum for an IF-RF-IF Distribution System

Figure 8 illustrates the broadband spectrum distributed in the single cable network. The desired satellite transmissions (analogue or digital) are selected from those supplied by the satellite delivery network and are converted to a frequency in the VHF band, the UHF band or the so-called "hyperband". The selected satellite signals are distributed to the wall outlets at this frequency, along with the terrestrial signals that occupy the UHF and VHF bands.

Figure 10 shows the architecture of an IF-RF-IF distribution system.

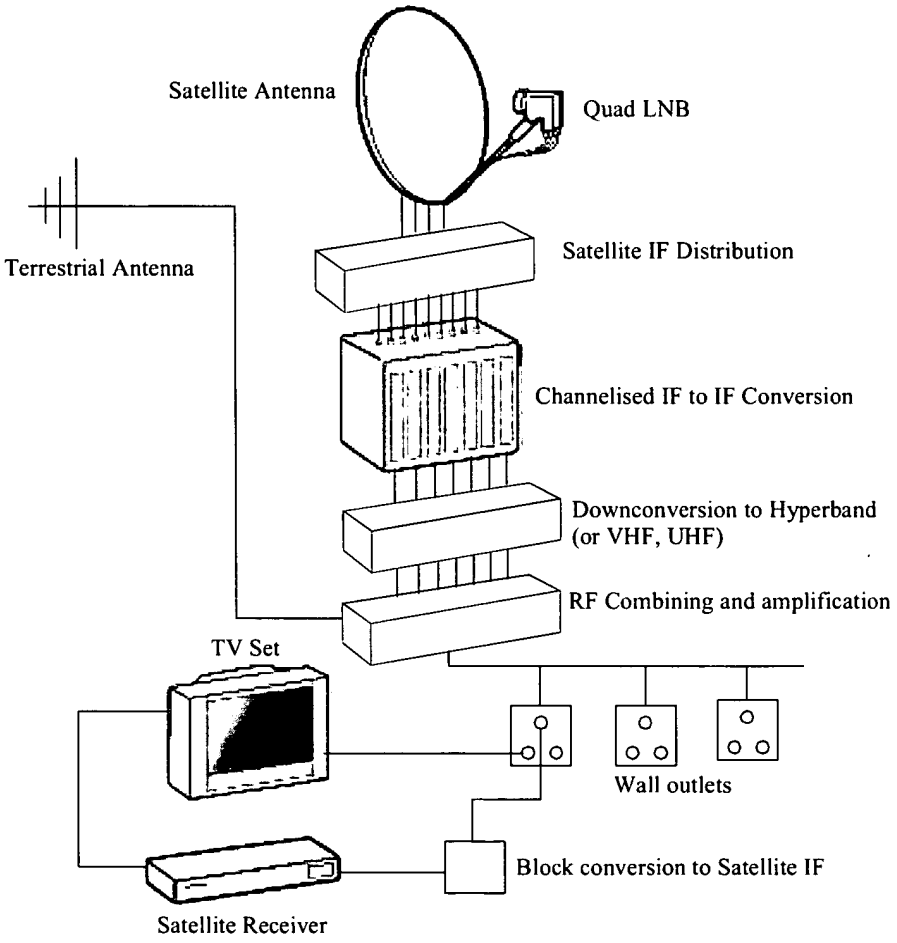


Figure 10 : Architecture of an IF-RF-IF Distribution System

The selected satellite transmissions are converted to a new intermediate frequency and are then downconverted to a frequency in the hyperband (or even in the UHF or VHF band). At the wall outlet the signal is fed to a block upconverter which shifts the (satellite) signals back into the satellite IF range so that they can be received using a standard satellite receiver. The user thus requires a block upconverter in addition to a satellite receiver. Again, the satellite IRD may benefit from the use of an equaliser to compensate for distortions introduced by the distribution network.

The advantage of this system is that it is compatible with terrestrial distribution systems that do not provide sufficient bandwidth to support satellite IF distribution (i.e. systems that were designed and specified for frequencies up to 850 MHz only). Its principal disadvantage is that it can distribute only a very limited number of satellite signals (typically between 4 and 8) in the available bandwidth.

Furthermore, since it is unlikely that the satellite signals will be restored to their original IF frequencies, digital IRD tuning problems may also be encountered with this type of distribution system.

3.4.1.e Remote-Controlled Head-Ends

IF-IF distribution systems are limited by the bandwidth of the single cable used for signal distribution. Consequently, not all users may be able to access all of the channels that interest them, since some channels may be in multiplexes that cannot be accommodated by the distribution system.

Unlimited channel choice is possible if the user's terminal can remotely tune to the required channel (multiplex) at the head-end. This implies that each terminal is allocated a fixed distribution frequency (fixed IF) and controls its own dedicated IF-IF converter located at the cable head-end. Because of the fixed frequency allocation, this limits the number of users to around thirty for a single cable. However, all users have the capability to independently access all multiplexes that are delivered by the satellite system.

The system architecture is shown in *Figure 11*. It is similar to that shown in *Figure 8* for an IF-IF distribution network, except that there must be communication, preferably two-way, between each terminal and the head-end so that remote channel selection can be carried out.

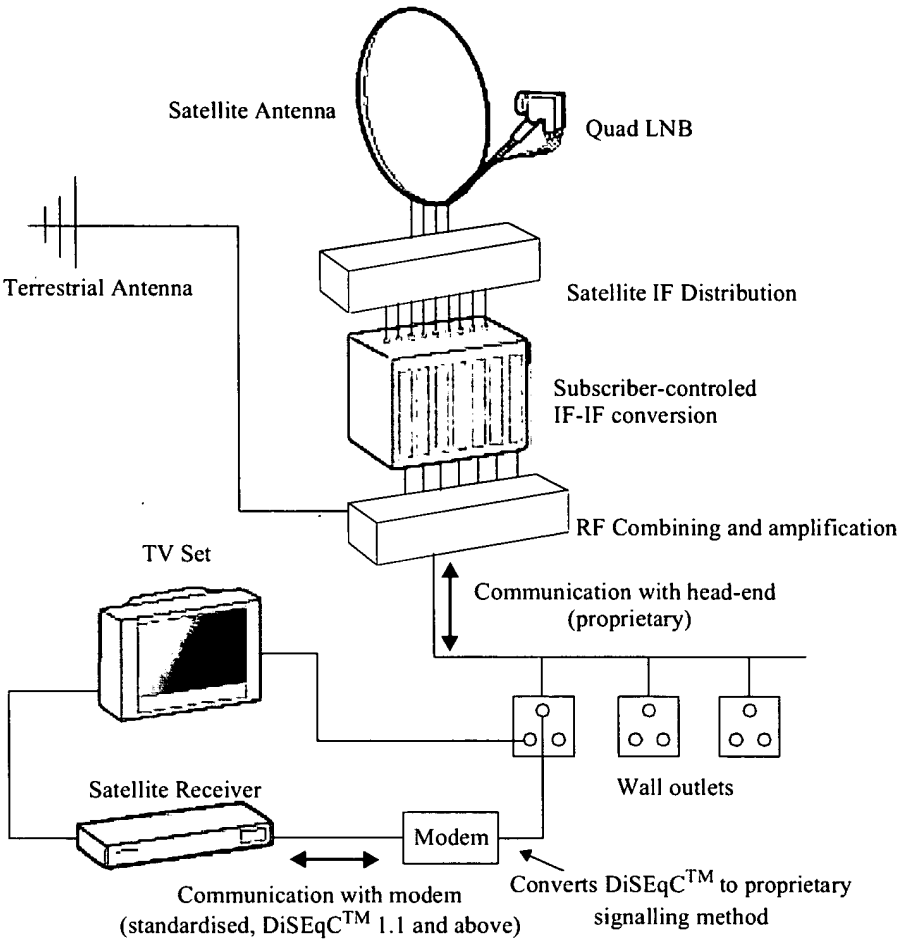


Figure 11 : Architecture of a System with a Remote Controlled Head-End

The communication system used to transmit information from the wall outlet to the head-end is usually proprietary. However, the system for communicating between the wall outlet and the IRD is standardised (*section 3.5.3.*). Each user is equipped with a modem that converts the standardised DiSEqC™ commands generated by the IRD into the proprietary signalling format (usually a frequency-shifted version of the 22 kHz DiSEqC™ signal).

3.4.1.f QPSK to QAM Re-Modulation

This is the digital equivalent of analogue distribution networks based on FM to AM conversion. Digital satellite signals are "transmodulated" from QPSK to 16-, 32- or 64-QAM at the head-end, which significantly increases spectral efficiency. The technique was originally developed for larger cable TV (CATV) networks but has also been adopted for use in SMATV systems. It is an all-digital method and is consequently not suitable for distribution of analogue TV.

Figure 12 illustrates the broadband signal spectrum for this network architecture. Note that it is compatible with distribution networks whose bandwidth access and would need to employ equalisation to compensate for distortions introduced by the distribution network.

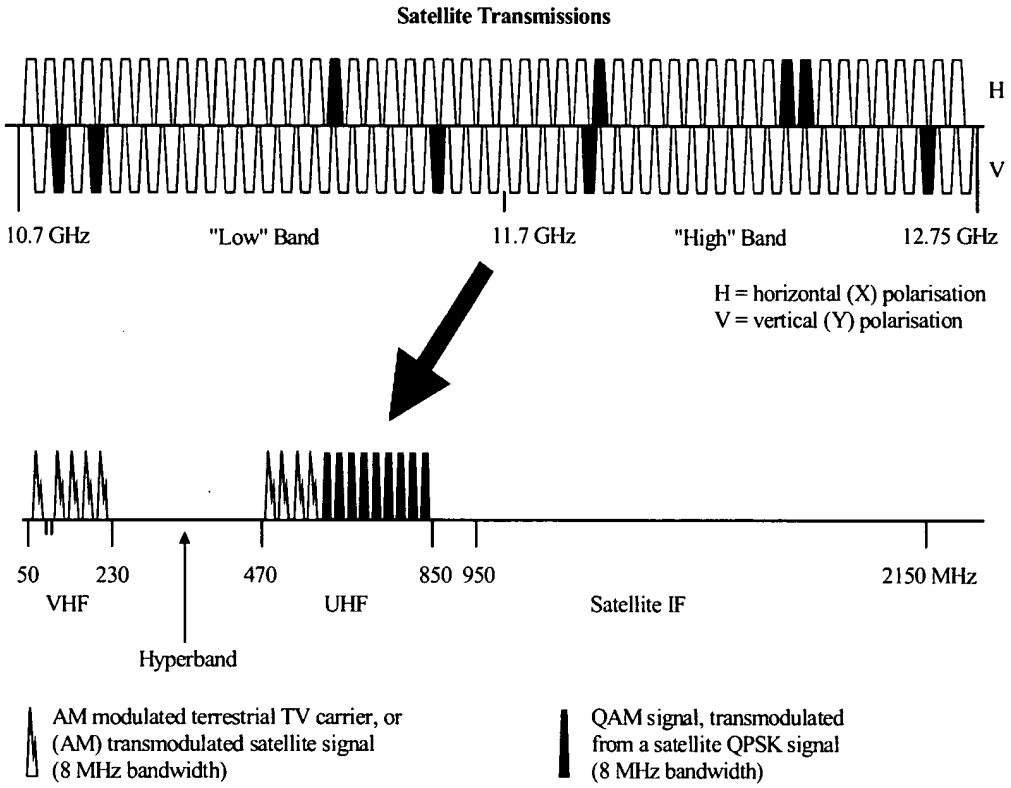


Figure 12 : Broadband Signal Spectrum for a QPSK to QAM System

In the future, there is the possibility to have a remotely tuned transmodulator at the head end. The user would have a fixed frequency in the VHF/ Hyperband/UHF band, all types of digital signals (satellite QPSK, terrestrial COFDM & CATV QAM) would be converted to a QAM signal in the local network. Each user would occupy approximately 8 MHz, so if all the bandwidth were free (50-850 MHz) 100 users could be supported on one cable with no restriction on the source of the digital programming. Of course with this combined transmodulation and frequency conversion, there are complex issues regarding the SI which are still being addressed by the industry.

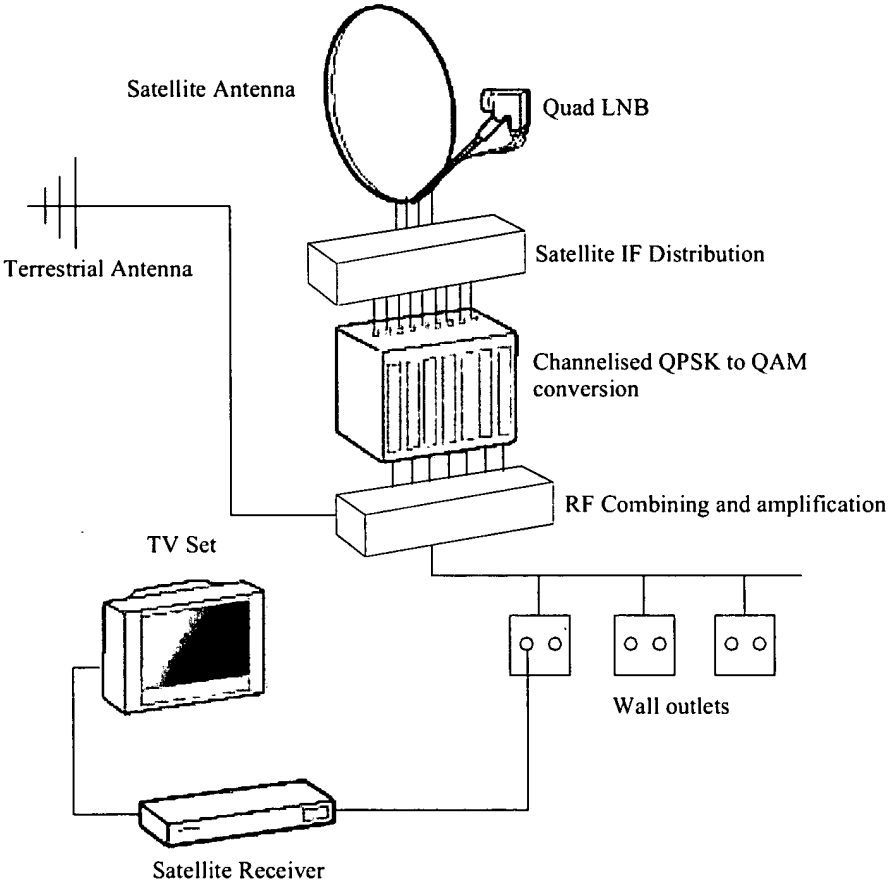


Figure 13 : Architecture of a QPSK-QAM Re-Modulation System

3.4.2. SMATV Configurations Standardised by ETSI

ETSI has standardised a number of architectures for collective reception systems. These are described in EN 300 473.

System A is based on transmodulation from QPSK to 16-, 32- or 64-QAM and is thus equivalent to the architecture described in Section 0. It is referred to as "SMATV-DTM" and is based on the standard for cable networks given in EN 300 429. Two variants are described.

The first variant employs full transmodulation at the cable head-end, with Reed-Solomon (RS) decoding applied to correct for burst errors introduced by the satellite link followed by RS encoding to correct errors introduced by the distribution network. The second variant eliminates this RS decoding/ encoding function in order to simplify the transmodulator. In this case, RS decoding is applied only in the IRD and thus corrects the errors introduced by the satellite link as well as those introduced by the distribution network. Because of this cascading of errors, it is only suitable for systems having a high satellite link margin.

System B is based on the direct distribution of satellite IF signals. It also has two variants: "SMATV-IF" and "SMATV-S".

SMATV-IF is applicable to the "switched IF", "IF-IF conversion" and "remote controlled head-end" architectures as previously described in *section 3.4.1.b*, *section 3.4.1.c* and *section 3.4.1.d* respectively. SMATV-S is equivalent to the "IF-RF-IF conversion" architecture described in *section 3.4.1.e*.

3.4.3. Interaction Channels in SMATV Systems

ETSI has published guidelines for implementing "interaction" channels in SMATV distribution systems via two-way satellite links.

Interaction is accommodated in the distribution network by allocating portions of the spectrum to "forward" and "return" channels (70 to 130 MHz for the forward channel and 15 to 35 MHz for the return channel). Each channel accommodates a 3 Mbit/s QPSK carrier that is shared by all users. SMATV networks can be thus adapted to provide interactive services with a return path via satellite.

The reader is referred to the relevant ETSI document, TR 101 201, for further information.

3.4.4. Satellite IF Distribution Network Characteristics

SMATV networks that are based on the distribution of satellite IF signals should be capable of delivering signals over the frequency range 47 MHz – 2150 MHz to allow for the distribution of terrestrial AM/VSB transmissions in addition to analogue or digital satellite transmissions. All passive distribution components (splitters, cables, taps, etc.) should be designed for this frequency range and should allow the passage of control signals from each receiver to the appropriate matrix switch *(See section 3.5.3.)*.

The matrix switches should provide the possibility of combining the satellite IF signals with signals received on the terrestrial frequencies (47 – 862 MHz). The input and output isolations of such switches should be at least 26 dB.

3.4.5. Optimum Network Configuration

The optimum network architecture for collective reception systems depends on many factors. Among these are:

- The type of services that are required.
- The type of building that will accommodate the system (old or new, large or small).
- The number of homes to be connected.
- Whether or not there is and existing distribution network.
- The condition and capability of such networks.

Detailed consideration of such issues will ultimately determine the optimum architecture. However, it is possible to make some general observations.

Firstly, distribution systems should be transparent to Conditional Access (CA) systems that are used to implement, for example, pay-TV services. They should also be transparent, as far as possible, to the service information that is transmitted in the DVB-S multiplexes (such as, for example, tuning information). This is not possible with QPSK-QAM transmodulation, for example, unless the signals from the satellite are de-multiplexed to allow the service information to be adapted to the new distribution network.

Secondly, low cost is important if users are to obtain cost savings or at least cost parity with DTH reception systems. Systems that require signals to be de-multiplexed are generally very expensive and consequently are often unsuitable for SMATV applications. Transmodulation from QPSK to QAM also requires the availability of QAM terminals at a reasonable price.

Based on these observations, only architectures that rely on IF distribution of QPSK signals appear satisfactory today. Of these, switched IF architectures, which employ a multi-cable "backbone", are usually only suitable for new buildings because of problems of physical access in existing buildings. Single cable solutions are more attractive in the latter, although there is a significant cost associated with upgrading a network designed for the distribution of terrestrial signals only to provide the bandwidth necessary to accommodate satellite IF signals (from 47 MHz up to 2150 MHz).

EUTELSAT recommends the use of switched IF architectures *(See section 3.4.1.b)* wherever possible for maximum programme choice, network flexibility and transparency.

In addition, a progressive approach is suggested for systems employing a single cable for signal distribution.

Systems of this type should utilise the entire terrestrial frequency band (i.e. up to 850 MHz) before they are extended to 2150 MHz. Use of this band can be maximised by distributing clear AM analogue channels in the VHF/UHF bands and a limited number (5 or 6) of (satellite) QPSK signals in the hyperband. This is the "IF-RF-IF conversion" architecture of *section 3.4.1.e.*

Further QPSK signals (30 or more) can be accommodated by extending the network to 2150 MHz and using IF-IF conversion techniques (the "IF-IF conversion" architecture of *section 3.4.1.c*).

Finally, if more QPSK signals are required in future, then the network could be reconfigured by allocating a frequency to each user and performing remote tuning at the head-end. This is the "remote controlled head-end" architecture of *section 3.4.1.e*, which is limited to around 30 users for a single cable.

3.5. Reception System Control Capabilities

3.5.1. Signalling Methods

3.5.1.a Conventional Signalling Method

Receiving systems, regardless of their architecture, need to be able to operate over the full frequency range of 10.7 - 12.75 GHz and on both linear polarisations in order to be physically capable of receiving all of the services available from the 13°E orbital position (or other orbital positions).

The simplest form of receive architecture consists of an antenna equipped with a single feed (LNB) and connected by a single cable to an IRD (i.e. the DTH reception architecture of *Figure 1(a)*). In this architecture the single LNB needs to be capable of working over the full frequency range and on both polarisations.

The bandwidth employed by the satellite broadcasting system is too large to be directly implemented in the LNB. Conventional practice is to receive in one of two frequency bands: in the "low" frequency band (10.7 – 11.7 GHz) or in the "high" frequency band (11.7 – 12.75 GHz). The LNB is switched to receive in the frequency band that is appropriate for the desired satellite channel.

The LNB also receives on one of two linear polarisations: horizontal (X) or vertical (Y). The LNB is switched to receive in the polarisation that is appropriate for the desired satellite channel.

Consequently, the simplest reception architecture requires four signalling states to be communicated from the IRD to the antenna subsystem:

- Low band, horizontal polarisation.
- Low band, vertical polarisation.
- High band, horizontal polarisation.
- High band, vertical polarisation.

The conventional solution is to use continuous-tone signalling and variation of the LNB power supply voltage for this purpose. The cable that conveys the received satellite signals to the IRD also carries these control signals.

Note that some dual-feed systems that operate in a single frequency band (usually the "low" band) use the signalling tone for switching between orbital positions.

3.5.1.b The Need for an Advanced Signalling Method

The tone/voltage signalling method is adequate for systems that require four or less signalling states.

However, many systems require more signalling states. The simplest example of this is a dual-feed DTH system that receives from two different orbital positions. In this case the appropriate feed (LNB) needs to be selected, as well as the frequency band and polarisation. Additional signalling states are therefore required.

The number of additional states depends upon the complexity of the receive system. In general, SMATV systems require more complex signalling than DTH systems.

It is also desirable to have two-way communication, so that the IRD can obtain feedback on the settings of remotely configured equipment, and a means for proprietary signalling between the outdoor and indoor units.

3.5.1.c The DiSEqC™ System

EUTELSAT has developed a switching method that is fully compliant with, and indeed greatly exceeds, the requirements of dual satellite DTH reception.

The resulting bus control system, known as DiSEqC™ (**Di**gital **S**atellite **Eq**uipment **C**ontrol), provides a means for communication between satellite receivers/IRDs and peripheral equipment, using only a single coaxial cable. DiSEqC™ is an open system that has been adopted as an international standard by CENELEC.

The relevant specifications for the DiSEqC™ communication protocol are available on request from EUTELSAT, or from EUTELSAT's Web site (http://www.eutelsat.com).

A number of stages of DiSEqC™ implementation have been proposed, known generically as one-way and two-way DiSEqC™. This has been done to allow the standard to be introduced in an evolutionary manner.

The DiSEqC™ system uses the satellite receiver (IRD) as a single master terminal controlling a number of remote devices such as LNBs.

One-way DiSEqC™ (DiSEqC™ 1.0) is a preparative, or intermediate, standard. It allows for the switching and control of compatible units such as LNBs, switches and positioners, without confirmation from the remote slave devices.

Two-way DiSEqC™ (DiSEqC™ 2.0/2.1) further enhances the standard by allowing remote units to report their possible and actual configurations. Combined with appropriate control software in the receiver, DiSEqC™ 2.0 will greatly assist in simplifying the set-up and configuration of complex reception systems.

The DiSEqC™ standard is also compatible with existing tone and voltage switching techniques, thereby allowing for a simple upgrade path. Indeed, as an initial implementation, a DiSEqC™ Tone Burst standard has been defined which provides the minimum signalling necessary for dual-feed reception systems.

Since the DiSEqC™ system is relatively simple to implement, and in view of the potential it offers for sophisticated and intelligent reception systems, EUTELSAT recommends that installers employ equipment that is compatible with the DiSEqC™ 2.0 standard, or higher, as soon as possible. If an evolutionary path is required, then interim solutions should be based on the DiSEqC™ 1.0 standard.

3.5.2. Individual Reception Systems

Reference is made in this section to the five DTH receive system architectures shown previously in *Figure 1, page 6.*

In architectures (a) and (b) of *Figure 1*, either conventional tone/voltage signalling or the DiSEqC™ communication protocol could be used to control the band and polarisation switching. In architecture (b) the signalling would be performed on both cables so that each of the two LNBs could be configured in the appropriate manner.

As a minimum, receive system architectures (c), (d) and (e) require the use of the one-way DiSEqC™ tone signalling standard with conventional band/ polarisation switching, in order to provide adequate signalling states for control of the LNBs. Implementation of DiSEqC™ 2.0 or higher with suitable LNBs is, however, preferred.

3.5.3. Collective Reception Systems

A number of system architectures have been identified previously in *section 3.4.1.* Some of these involve the use of a satellite IRD in the subscriber's home, namely:

1. Switched IF systems.
2. IF-IF conversion.
3. IF-RF-IF conversion.
4. Remote controlled head-ends.

Systems (2) and (3) rely on a pre-allocation of satellite channels to IF frequencies. Consequently, no signalling is necessary between the IRD and the various elements of the distribution system, which are illustrated in *Figure 8* and *Figure 10* respectively.

System (1) requires communication from the IRD to the multi-switch that delivers its programmes. If the SMATV system is designed to receive from a single orbital location, as illustrated previously in *Figure 5*, then conventional tone/voltage signalling or DiSEqC™ may be employed. However, if it is designed to receive from two or more orbital positions, as illustrated in *Figure 6*, then more than four switching states are required and DiSEqC™ should be used.

System (4), as illustrated in *Figure 11*, also requires communication between the IRD and equipment contained in the distribution network. In this case DiSEqC™ should be used for communication between the IRD and the wall outlet. Communication between the wall outlets and the head-end can be implemented using DiSEqC™ or an equivalent proprietary signalling method. In the event that a proprietary signalling method is used, a modem will be required to perform the conversion from DiSEqC™ to the proprietary format, as indicated in *Figure 11.*

The advantages of two-way DiSEqC™ are particularly apparent in SMATV distribution networks, where the number of devices and switching states to control may be large. DiSEqC™ also allows the receiver to automatically detect that it is operating in a SMATV system and to adjust its configuration accordingly.

4. Reception Equipment

4.1. General Requirements

DVB-S reception systems should comply with the appropriate ETSI standards and implementation guidelines. These include, but are not limited to:

- ETR 154 (implementation guidelines for the use of the MPEG-2 Systems, Video and Audio standards).
- EN 300 421 (framing structure, channel coding and modulation for satellite services).
- EN 300 468 and ETR 211 (specification for service information in DVB systems and related implementation guidelines).
- EN 50221 (common interface specification for conditional access).
- EN 50256 (characteristics of DVB receivers).
- EN 50201 (interfaces for DVB-IRDs).

Installers should check with their equipment suppliers the extent of compatibility with the above standards.

Installers are invited to consider using equipment that is also compatible with EUTELSAT's recommendations as given in the following subsections.

4.2. Carrier Types

It is recommended that, as a minimum, all receive installations should be capable of receiving MCPC transmissions from the 13° East orbital position. The performance of most analogue DTH antenna systems (outdoor units) is usually adequate for digital MCPC programme reception.

To widen programme choice, installers may wish to choose equipment that is compatible with SCPC transmissions. In this event, EUTELSAT recommends that the issues of frequency stability/phase noise performance and channel hopping response time, as outlined previously in *section 2.2.5.* and *section 2.2.6.*, be given due consideration.

4.3. Antenna Subsystem

The antenna subsystem, or outdoor unit, comprises the antenna, one or more low noise block downconverters (LNBs), polarisers and external component(s), if any, associated with LNB switching.

EUTELSAT-compatible DTH and SMATV reception systems, unless otherwise indicated, should comply with the requirements given in the relevant ETSI standard, which is ETS 300 784.

It is recommended that all reception equipment be capable of operation over the whole of the 10.7 – 12.75 GHz frequency band.

The recommended characteristics for the antenna are based on ETS 300 784 and are summarised in *Table 1.* These apply to both single-feed and multi-feed antenna assemblies[2], excluding the feedhorn(s). A recommended G/T figure is given for the purposes of defining an acceptable dish/LNB combination.

As a design objective, the minimum cross-polar discrimination of the receive antenna at the nominal boresight of the HOT BIRD™ pointing position, and down to the -1 dB contour, shall be 27 dB for DTH systems and 30 dB for SMATV systems. As a minimum, performances of 22 dB for a DTH system and 25 dB for a SMATV system shall be met for both orthogonal polarisations with ±1° polarisation misalignment of the LNB, but exclusive of pointing error.

EUTELSAT recommends that the DTH co-polar and cross-polar design objectives match those for SMATV systems given in *Figure 14*, particularly in the $2.8° \leq \emptyset \leq 7°$ angular range.

2. *In multi-feed systems the requirements apply for the feed used to receive from the HOT BIRD™ satellite system.*

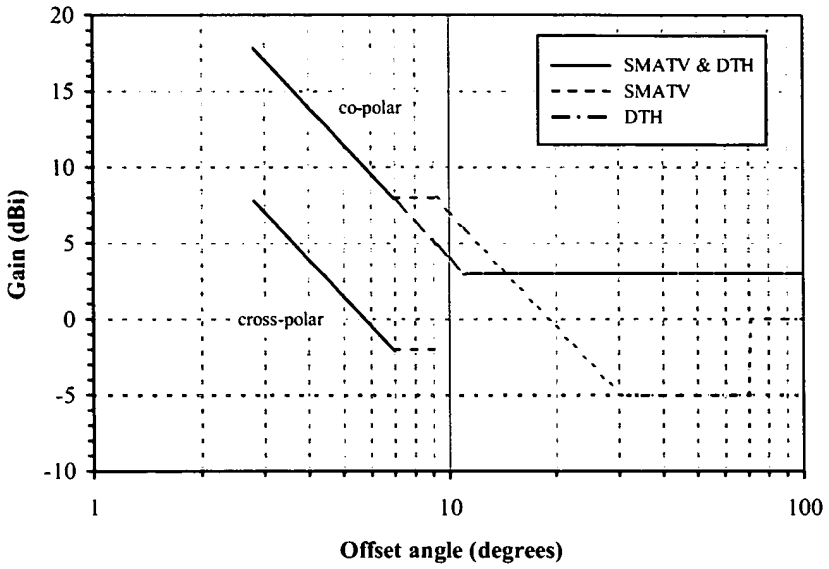
The recommended characteristics for the low noise block downconverter (LNB) are given in *Table 2*. Spurious outputs generated by the LNB should be limited to the level illustrated in *Figure 15*.

Parameter	DTH	SMATV
ETSI equipment classification:	Type B	Type A
Receive frequency range:	10.70 - 12.75 GHz	10.70 - 12.75 GHz
Minimum G/T[a] for over the receive frequency range (clear sky, 30° elevation): dBK^{-1}	$63 - EIRP + 20.\log_{10}\left(\frac{f}{10.7}\right)$	$66 - EIRP + 20.\log_{10}\left(\frac{f}{10.7}\right)$
Receive polarisation:	Dual-linear, orthogonal	Dual-linear, orthogonal
Off-axis co-polar gain:	*see Figure 14*	*see Figure 14*
Minimum on-axis cross-polar discrimination[b]: () indicates design objective	≥ 22 dB (27 dB)	≥ 25 dB (30 dB)
Off-axis cross-polar gain:	see *Figure 14*	see *Figure 14*
Antenna subsystem pointing accuracy: degrees (Φ = main beam minimum half power beamwidth)	≤ 0.1 x Φ	≤ 0.1 x Φ
Polarisation alignment capability continuous adjustment range: accuracy:	 180° ± 1°	 180° ± 1°

Table 1: Characteristics of the Antenna Subsystem

a. *"EIRP" is the satellite EIRP/carrier in dBW at the receive location and "f" is the downlink frequency in GHz. For DTH, the indicated G/T value should typically provide a small downlink margin (approximately 3 dB) to protect against propagation impairments and interference. The dimensioning has been performed for commonly used transmission parameters (MCPC, symbol rate = 27.5 Msymbol/s, FEC rate = 3/4). Manufacturers should check that these parameters apply for their target market. A minimum antenna diameter of 60 cm is recommended for DTH applications to restrict the effects of interference from other satellite systems. A minimum diameter of 80 cm is recommended for SMATV or dual-feed DTH systems.*

b. *Applicable everywhere within the main beam in the direction of the satellite down to the -1 dB gain contour of the receive antenna.*



Equipment Type[a]	Co-polar		Cross-polar	
	Gain	Offset Angle	Gain	Offset Angle
SMATV[b]	29 - 25 log(ϕ)	2.8° ≤ ϕ ≤ 7°		
	+8	7° < ϕ ≤ 9.2°	19 - 25 log(ϕ)	2.8° ≤ ϕ ≤ 7°
	32 - 25 log(ϕ)	9.2° < ϕ ≤ 30°	-2	7° < ϕ ≤ 9.2°
	-5	30° < ϕ ≤ 70°		
	0	70° < ϕ		
DTH	29 - 25 log(ϕ)	2.8° ≤ ϕ ≤ 11°	19 - 25 log(ϕ)	2.8° ≤ ϕ ≤ 7°
	+3	11° < ϕ		

a. Figures are quoted for linear polarisation and FSS frequency bands. A relaxation in performance is proposed in ETS 300 784 for the BSS band. However, given the wide-band nature of the TVRO, the quoted performance figures will be the most stringent for TVRO antenna design.

b. As a design objective, the antenna discrimination, defined as the difference between the on-axis gain and the gain at an angular offset, φ, should be at least 28 dB for φ ≥ 2.8°

Figure 14 : Off-Axis Antenna Gain Pattern

Parameter	Value
RF frequency range:	10.70 - 12.75 GHz
lower band: local oscillator frequency[a]:	10.70 - 11.70 GHz 9.75 GHz ± 5 MHz
upper band: local oscillator frequency[a]:	11.70 - 12.75 GHz 10.6 GHz ± 5 MHz
IF frequency range (minimum):	950 - 2150 MHz
Small signal gain over RF frequency range	40dB ≤ Gain ≤ 65dB
max. amplitude variation over IF frequency range:	1.5 dB (within any 27 MHz bandwidth) 2.0 dB (within any 36 MHz bandwidth) 5.0 dB (over entire IF range - SMATV) 8.0 dB (over entire IF range - DTH)
max. group delay variation over IF band:	20 ns (within any 36 MHz bandwidth)
multi-carrier intermodulation ratio:[b]	≥ 35 dB.
local oscillator intermodulation products at LNB output: (in the frequency band 950 - 2150 MHz) [c]	< -60 dBc
local oscillator phase noise: (see Figure 15)	-50 dBc (1 kHz) -75 dBc (10 kHz) -95 dBc (100 kHz)
spurious components at LNB output: (in frequency band f_c ± 120 kHz: *see Figure 15*)	-60 dBc
LNB isolation[d]	> 26 dB
LNB input RF interface: (optional, if waveguide is employed):	PBR 120 (rectangular), or C120 (circular) with gasket groove
Antenna feed RF interface: (optional, if waveguide is employed):	UBR 120 (rectangular), or C120 (circular) without gasket groove
Output IF connector:	IEC 169-24 type F, female
IF output characteristic impedance:	75 Ω
Output return loss: LNB output return loss: this is the recommended value in the ETSI BSS and FSS specifications. (over the frequency range 950 - 2150 MHz)	≥ 8 dB
recommended switching control signals:	DiSEqC™ 2.0 [e]
dc supply voltage: (assuming conventional switching method)	+11.5 to +19 V
maximum current: [f] (assuming conventional switching method)	250 mA (single-band) 300 mA (dual-band)

Table 2: Characteristics of the Low Noise Block Downconverter

a. The conversion frequency deviation accounts for temperature, supply voltage, initial setting accuracy and ageing. The variation due to temperature and supply voltage alone shall not exceed ± 3 MHz.

b. The ratio of the minimum output level of the carriers, when loaded with 2 equal carriers at the 1 dB gain compression point, to the largest in-band intermodulation product.
c. Applicable for dual-band LNBs only.
d. Application to dual LNB and mono-block systems utlising DiSEqC™ switching, where both LNBs are simultaneously powered on any one polarisation each.
e. The DiSEqC™ system is recommended for band and polarity switching and has expansion capability to include satellite position and (if necessary) SMATV-type multiple LNB switching. Specifications are available from EUTELSAT upon request. Method is provisionally recommended in Annex B would allow the use of a single voltage (12V) to power the LNB with reduced current consumption and power dissipation.
f. The use of DiSEqC™ switching will reduce the current consumption requirements for the LNB.

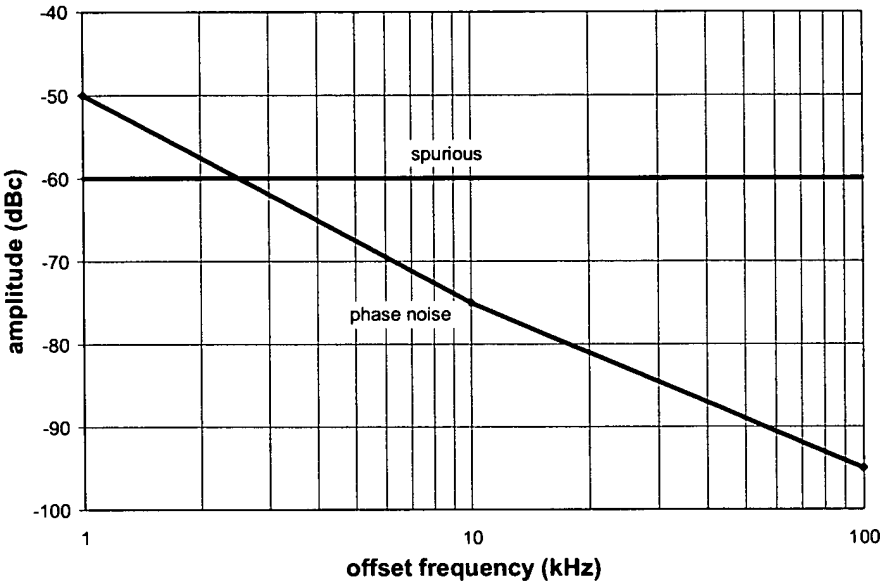


Figure 15 : LNB LO Phase Noise and Spurious Components

4.4. Integrated Receiver-Decoder

4.4.1. General

The IRD behaviour should be consistent with the recommendations given in ETR 154.

Digital IRDs should comply with the framing structure, channel coding and modulation requirements of EN 300 421.

4.4.2. Symbol Rates

All reception equipment should be capable of operating over the full range of symbol rates identified previously in *section 2.2.2.* for MCPC transmissions (i.e. 20 to 30 Msymbol/s).

Equipment with optional SCPC capability should be designed to operate over an extended range of 3 to 30 Msymbol/s.

4.4.3. FEC Rates

All receivers should be capable of operating over the full range of FEC rates specified by the DVB-S standard (i.e. 1/2, 2/3, 3/4, 5/6 and 7/8).

In addition, it is recommended that a facility be provided to automatically detect the FEC rate and to configure the receiver for proper reception without the need for user intervention.

4.4.4. Equalisation

Installers may wish to consider the use of receivers equipped with an equaliser for improved performance in SMATV IF distribution systems. Information on the typical channel response for an SMATV network and the potential performance gain can be found in EN 300 473.

4.4.5. Firmware

In order to guard against obsolescence of reception equipment, installers should consider the use of IRDs whose firmware can be updated over the air.

4.4.6. Number of Transport Streams and Services

The IRD should be capable of accommodating at least 100 transport streams (DVB carriers) and at least 1000 services (programmes).

4.4.7. EUTELSAT Network Information

Each DVB carrier conveys "service information" (SI) that allows the IRD to properly decode the services it carries. It is possible for a DVB carrier to convey information on services provided by other carriers, although this is not mandatory and cannot be guaranteed in all cases.

It is EUTELSAT's intention to provide a common access channel that will convey service information for the whole of the EUTELSAT satellite network. This network-wide service information will be derived from the various services delivered by the EUTELSAT space segment.

IRDs that are intended for reception from the EUTELSAT space segment should include a facility to automatically tune to this channel during set-up and should use the information conveyed by this channel for IRD configuration. This will ensure that the information presented to the viewer is up-to-date and complete for the whole of the EUTELSAT space segment.

Work is ongoing on the definition of this information delivery system. Details will be made available in a separate document once this work has been completed.

4.4.8. Conditional Access

It is recognised that programme encryption is one area where implementation decisions by broadcasters may not be made solely on the basis of conformance with other broadcasting groups. Hence EUTELSAT makes no specific recommendations on the conditional access system to be employed.

EUTELSAT does, however, recommend that broadcasters/service providers consider the use of CA systems that support the DVB Common Interface (EN 50221). Practically, this means that CA systems that are available on a PCMCIA module may be used to upgrade existing IRDs that make use of the common interface. Different conditional access systems are accommodated through the insertion of an appropriate conditional access module (PCMCIA card).

EUTELSAT recommends that installer's consider the use of such IRDs in order to ensure that reception systems are as "open" as possible and provide the maximum of flexibility and programme choice to the user.

4.4.9. Teletext

Installers should be aware that DVB provides a mechanism to convey teletext information within the transport stream (DVB carrier).

DVB IRDs should transcode the teletext data into the vertical blanking interval (VBI) of the analogue video output so that it is compatible with the teletext decoders of existing TV receivers. Teletext delivered in this form is also compatible with UHF distribution networks (e.g. to support multiple receivers in the home).

Installers should verify that IRDs support this facility if their customers are concerned about teletext availability and/or compatibility with conventional distribution networks.

4.4.10. Physical Interfaces

The IRD shall comply with the EN 50201 standard.

4.4.10.a IF Connections

The recommended characteristics for the IF interface (with the LNB) are given in *Table 3.*

It is recommended that a loop-through facility be provided so that the digital IRD can be connected in cascade with an existing analogue satellite receiver. This is illustrated in *Figure 16.*

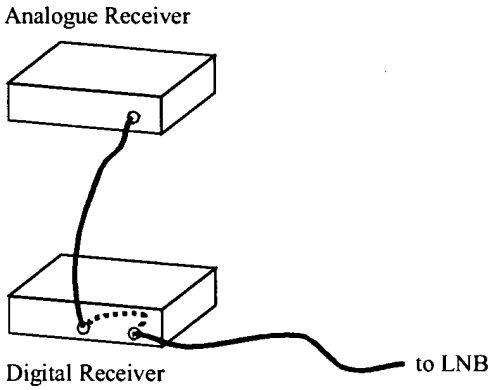


Figure 16 : IF Loop-Through Facility

When the digital IRD is powered on it should take control of the LNB. When it is powered off control should revert to the analogue IRD.

Parameter	Value
Input frequency range:	950 - 2150 MHz (minimum)
Number of LNB inputs:	1
Number of LNB outputs:	1 (looped-through to input)
Input connector:	IEC 169-24, type F, female
Characteristic impedance:	75 Ω
Input return loss (over input frequency range):	≥ 8 dB
Nominal (-3 dB) bandwidth:	Adaptable, depending upon bit rate
LNB isolation [a]	> 26 dB
LNB Switching Control signals:	DiSEqC™ Level 2.0 or higher
Maximum AFC pull-in range:	± 5 MHz
Maximum group delay variation over the IF frequency range:	20 ns (within any 36 MHz bandwidth)

Table 3: IF Interface Characteristic

a. Applicable to dual input receivers where both LNBs are simultaneously powered.

4.4.10.b Control of Peripheral Devices

It is recommended that the DiSEqC™ 2.0 or higher be implemented in the IRD.

When used with DiSEqC™-enabled peripheral devices, such as LNBs, this will facilitate automatic equipment set-up, adjustment and monitoring. It will also ensure compatibility with modern SMATV networks that employ DiSEqC™ signalling.

Note that DiSEqC™ signalling can be configured to emulate conventional tone/voltage switching signals, thus ensuring compatibility with non-DiSEqC™ devices.

4.4.10.c Conditional Access Interface

(See section 4.4.8.)

4.4.10.d VHF/UHF CONNECTIONS

The IRD should provide a VHF/UHF output for compatibility with in-home VHF/UHF distribution systems and VCR and television equipment that is not equipped with video and audio baseband inputs. This output would carry the demodulated, decoded and re-modulated video, audio and teletext information of the selected digital programme.

If provided, it should be possible to combine normal VHF/UHF terrestrial signals with the re-modulated signal generated by the digital IRD. The IRD would thus provide a VHF/UHF input for the terrestrial signals and a VHF/UHF output for the combination of these signals and the signal generated by the IRD.

It should be possible to adjust the frequency of the VHF/UHF signal generated by the digital IRD so that it may be accommodated in existing VHF/UHF distribution networks *(See section 3.4.1.a)*.

4.4.10.e Baseband Connections

All IRDs should include at least two Peritelevision (SCART) connectors for connection to a TV and a VCR.

Additional Peritelevision connectors may be useful for interconnection with other equipment such as analogue satellite receivers.

Note that there are two common types of SCART arrangement, one with composite and RGB input/output and one with composite and luminance/chrominance (S-Video) input/output. The inclusion of luminance/chrominance in the Peritelevision connector increases the flexibility in routing when several pieces of equipment are connected together.

Peritelevision connectors may include an audio-video link control protocol such as, for example, the Programme Delivery Control system specified in ETS 300 231. This may be used to generate VCR/TV control signals based on the IRD's interpretation of the SI contained in the digital multiplex. A typical application would be automatic programme recording based on the event information contained in the SI (programme start and stop times).

An S-Video (S-VHS / Hi-8) connector may be provided in order to supply a high quality[3] luminance/chrominance pair to a VCR, a television set or other equipment. Its implementation is optional.

4.4.10.f Analogue Audio Outputs

As a minimum, Left and Right phono sockets should be provided for audio connection to a hi-fi.

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3. *Reduced luminance/chrominance cross-talk and increased luminance bandwidth.*

4.4.10.g Digital Interfaces

As a minimum, receivers should implement an RS232-compliant serial port or a parallel port (IEEE 1284) in the IRD. The purpose of this digital interface is to facilitate the transfer of data conveyed in a DVB multiplex to a PC (for example, software downloading).

Manufacturers may wish to also consider the use of high performance interfaces such as IEEE 1394.

4.4.10.h Telephone Connection

A "return channel" from the IRD to the broadcaster/service provider is commonly implemented via the public telephone network. Alternative solutions are possible, as discussed previously in Section 3.4.3.

Receivers containing an integral modem should incorporate an RJ11 socket with a suitable local-end connector on an adapter cable to connect the modem to the user's telephone line. All modem equipment should correspond to the requirements of the telecommunications licensing authority of the country in which the equipment is to be used. The modem should implement line sensing to avoid use of the interaction channel when the line is in an off-hook or busy state.

Implementation of a return channel via the telephone network is optional. If this facility is provided it should conform to ETS 300 801.

5. Installation Guidelines

5.1. DVB Transmission Frequencies

It is EUTELSAT policy to use the downlink frequency band 10.70 - 12.75 GHz for either analogue (FM) or digital TV services.

The HOT BIRD™ satellites are equipped with both "narrowband" and "wideband" satellite transponders. The narrowband transponders have a nominal bandwidth of either 33 MHz or 36 MHz. Wideband transponders have a nominal bandwidth of 72 MHz, 46.5 MHz or 49.5 MHz.

Both narrowband and wideband transponders may be used in different service configurations. As a consequence of this service flexibility, the centre frequency of a DVB transmission may differ from the nominal centre frequency of the transponder given in *Annex A*

Broadly speaking, digital TV carriers can also be classified as either "narrowband" or "wideband".

The majority of wideband carriers have a transmitted symbol rate of 27.5 Msymbol/s, which is well matched to a nominal transponder bandwidth of 33 MHz. These carriers usually convey multiple digital TV programmes and are transmitted via a dedicated transponder. Consequently, they are allocated the full transponder power and are thus optimised for individual reception with a small (e.g. 60 cm) antenna. As discussed previously in *section 2.2.1.*, these carriers are usually referred to as MCPC[4] transmissions.

Some MCPC carriers have a symbol rate lower than 27.5 Msymbol/s (e.g. 20 Msymbol/s).

Narrowband carriers typically have a transmitted symbol rate of between 3.8 and 6.1 Msymbol/s. They share the transponder with other carriers and are allocated only a fraction of the transponder power. A larger receive antenna is required and consequently narrowband carriers are less suitable for individual reception. These carriers are usually referred to as SCPC[5] transmissions, since they typically convey a single digital television programme.

Table 4 indicates the typical range of digital TV carrier frequency offsets that could be encountered in the HOT BIRD™ satellite system. The frequency offset is expressed relative to the centre frequency of the transponder used to broadcast the carrier and depends upon the transponder bandwidth. The range shown for narrowband carriers is for the smallest bandwidth carrier (i.e. 3.8 Msymbol/s). The transponder centre frequencies are given in Table 3of *Annex A*.

Nominal Transponder Bandwidth (MHz)	Narrowband (SCPC) Carriers (3.8 - 6.1 Msymbol/s)	Wideband (MCPC) Carriers (27.5 Msymbol/s)
33	0 to ±14.2	0
36	0 to ±15.7	0 to ±1.5
46.5	0 to ±21.0	0 to ±6.75
49.5	0 to ±22.5	0 to ±8.25
72	0 to ±33.7	0 to ±19.5

Table 4: Digital Television Carrier Frequency Offsets

4. *Multiple Channel (TV programme) Per Carrier.*
5. *Single Channel (TV programme) Per Carrier.*

5.2. Carrier EIRP

Up-to-date details of the digital TV and radio transmissions from EUTELSAT satellites are available on request from EUTELSAT (in the "TV and Radio Line-Up"). This includes details of the transmission frequency. Alternatively, the information can be downloaded from the EUTELSAT Web site (http:// www. eutelsat.com)

The HOT BIRD™ satellite coverages are illustrated in *Figure 2* to *Figure 5* of *Annex A*. There are four types of coverage: SuperWidebeam (*Annex A, Figure 2*), Superbeam (*Annex A, Figure 3*), Widebeam (*Annex A, Figure 4*) and Steerable (*Annex A, Figure 5*).

The "TV and Radio Line-Up" mentioned previously indicates the coverage that is currently in operation for each transponder.

Each coverage comprises a number of "saturated" EIRP contours[6].

The saturated EIRP value will usually apply for a "standard" wideband MCPC digital TV carrier transmitted via a dedicated transponder. The term "standard" in this context refers to a single 27.5 MSymbol/s transmission in a 33 MHz or a 36 MHz transponder.

However, the power allocated to some digital TV transmissions will be less than this saturated value. This is especially true for narrowband SCPC transmissions that share the transponder with other carriers. In this case, the power of the carrier can be obtained by subtracting its "backoff" from the saturated EIRP value.

For example, if the receive earth station were situated on the 53 dBW Superbeam saturated EIRP contour and the carrier's backoff value were 2 dB, then the carrier EIRP would be 53 - 2 = 51 dBW.

Up-to-date carrier backoff values are available on request from EUTELSAT.

5.3. Guidelines on TVRO Antenna Diameters

Since the HOT BIRD™ satellites are used to broadcast both analogue and digital TV programmes, there are two types of terminal that can be defined for use in the HOT BIRD™ system.

- DVB-only (digital-only) reception systems.
- DVB (digital) and analogue reception systems.

These are generally referred to as television receive-only (TVRO) terminals.

6. *The power radiated by the transponder when it is operated at its maximum output power level (with its on-board high power amplifier operated at "saturation").*

The size of the dish that is required to receive DVB television programmes from the HOT BIRD™ satellites is dependent upon the services to be acquired, the coverage associated with the transponder, the operational mode of the transponder and the geographical location of the TVRO. For the majority of installations, a 60-cm antenna is generally adequate for direct reception of services from 13°E.

In some situations the size of the dish may also be constrained by the need to reject transmissions from orbital locations adjacent to the 13°E position, where the orbital spacing is nominally 3°. In such cases a dish diameter of 80 cm will provide increased protection of the services delivered by the HOT BIRD™ satellites. The use of a slightly larger dish is particularly recommended for dual-feed DTH systems.

For reference purposes, *Table 5* provides an indication of the minimum antenna diameter for good-quality, direct-to-home reception of television programmes. Note that the EIRP is that calculated from the saturated EIRP, given in *Figure 2* to *Figure 5* of *Annex A*, and the backoff value for the carrier in question.

Clearly, the minimum TVRO antenna diameter will be determined by the service with the lowest carrier EIRP amongst all of the services of interest.

The final decision on antenna size should be based on local experience, taking into account the specific equipment used, as well as the required margin above threshold.

Satellite (Carrier) EIRP	TVRO Antenna Diameter [a]
53 dBW	45 cm [b]
52 dBW	55 cm [b]
51 dBW	60 cm [b]
49 dBW	70 cm [b]
47 dBW	90 cm
45 dBW	120 cm
43 dBW	150 cm
41 dBW	180 cm
39 dBW	210 cm

Table 5: Antenna Diameter for Reception from the HOT BIRD™ Satellites

a. Figures applicable for DTH reception of analogue and digital services. Larger antennas are recommended for cable and community reception

b. Reception is possible with this antenna diameter, but a smaller antenna may be affected by interference from channels using the same frequencies at neighbouring satellite positions (3° spacing). This is particularly true for channels in the frequency ranges 10.95 - 11.2 GHz. 11.45 - 11.7 GHz and 12.5 - 12.75 GHz.

The appropriate minimum TVRO antenna diameter for dual-feed reception systems will generally be higher than that given in Table 5 for the same performance. For example, for a TV service transmitted with an EIRP of 49 dBW, the minimum recommended antenna diameter for a dual-feed receiving system is 80 cm.

For community reception systems (SMATV) it is recommended that the antenna diameter is larger than the above values to provide an additional margin for losses in the cable distribution system[7].

5.4. Dish Alignment

It is strongly recommended that all antennas are precisely pointed to obtain the maximum receive signal strength and to avoid potential interference from adjacent satellites. DVB reception will degrade extremely quickly once the threshold bit error rate (BER) has been reached.

Antenna installation should be carried out using frequency-selective signal strength measurement for analogue transmissions and BER measurement for digital transmissions (e.g. using a hand-held BER meter).

The alignment should be carried out using the weakest digital emission (the one with the lowest carrier EIRP).

Annex A gives charts of azimuth angle, elevation angle and polarisation angle to assist in dish alignment.

The azimuth angle is measured in the local horizontal plane and is positive in a clockwise direction from true north. A dish pointed due east would therefore have an azimuth angle of 90 degrees.

Note that local magnetic north may deviate from true north at the receive location. Consequently, if a magnetic compass is used for azimuth alignment, the dish may not be properly pointed in azimuth. The azimuth angle can be corrected by the value of local magnetic deviation if this is known. Fine azimuth adjustment should always be done using the BER indicator mentioned previously.

Elevation angle is measured in the local vertical plane that contains the satellite and is expressed relative to the local horizontal. An antenna pointed at the local horizon would thus have an elevation angle of zero degrees.

7. *A value of 2 dB is often considered sufficient margin, although this figure is implementation dependent. This is equivalent to a 25% increase in the TVRO antenna diameter.*

Most TVRO antennas have an offset-fed configuration[8]. In this case, antenna adjustment "by eye" based on direct measurement of the elevation angle will be incorrect. The adjustment should be made using the elevation alignment scale on the antenna's mounting bracket. Once again, fine elevation alignment should be made using a BER indicator to optimise dish pointing.

The polarisation angle is measured with respect to the local vertical. A positive value means rotation in a clockwise sense when looking in the direction of the satellite. A value of +5° would mean that the satellite's vertical (Y) polarisation plane is rotated by five degrees in a clockwise direction (when looking towards the satellite) with respect to the local vertical.

Polarisation alignment is made by rotating the LNB in its clamping bracket. The adjustment can usually be made using a scale provided on the LNB and/ or its mounting bracket.

In some cases, vertical alignment of the LNB corresponds to a polarisation offset of zero degrees. However, some LNBs have a fixed polarisation offset built-in and consequently vertical alignment of the LNB does not correspond to a polarisation offset angle of zero degrees. Care should therefore be taken when aligning the LNB to ensure that the correct polarisation adjustment is made. The manufacturer's documentation and recommendations should be referred to in all cases.

Good polarisation alignment is important to ensure that transmissions on one polarisation (e.g. horizontal, or X) do not interfere with transmissions from the same satellite on the other polarisation (e.g. vertical, or Y).

Polarisation alignment based on signal strength or BER measurement is difficult because the measurement is not very sensitive to polarisation alignment angle. An alternative is to align the LNB for minimum cross-polar (interfering) signal strength.

To illustrate this approach, assume that the polarisation alignment is being made for a vertically polarised channel. The IRD is first tuned to the frequency of a *horizontally* polarised channel and the LNB is rotated by approximately 90° (i.e. to correspond approximately to horizontal polarisation) until reception is possible. Once the signal has been acquired, the LNB is slowly rotated towards the nominal position for vertical polarisation until the signal is lost. This position is noted on the LNB's angular scale. The process is then repeated with the LNB initially rotated by 90° in the opposite direction and the second position corresponding to signal loss is noted. The optimum polarisation adjustment for vertically polarised carriers is then made by rotating the LNB to a position half way between the two readings.

8. *The feed position is offset from the natural focal point of the parabolic reflector. When the antenna is viewed face on, so that the reflector appears as an ellipse, the feed position is below the centre of the ellipse.*

5.5. Connectors

Always use good quality F-connectors, making sure they are correctly matched to the size (diameter) of the cable. Usually, crimped type connectors are more reliable, as long as the correct crimping tool is employed.

Poor connections are the main source of installation faults, always remember to adequately waterproof all externals connections as soon as the installation is operating correctly.

For digital signals, poor connections can often lead to high VSWR and poor or unreliable reception.

In addition, it is vital that the earthing is well make to maintain the shielding properties (isolation from interference) and also to provide an adequate dc path for the LNB power.

5.6. Consideration for SMATV installations

Below are some practical points to bear in mind:

- use a sufficiently large antenna for the size of system you are planning;
- in IF systems, never use 90° F-connectors or F-F connectors (to extend cable) in the main trunk or backbone. A small loss of signal here, due to increased VSWR, can be very difficult to recover in other parts of the network;
- make sure that the output of the LNB is as flat as possible across the frequency band, particularly at the highest frequencies above 2GHz. In fact, all components should ideally be rated well above the 2,150 MHz limit that is required for satisfactory distribution of the highest frequencies;
- only use amplification as required and do not overload the inputs to multi switches or tuners;
- do not over equalise, tuners are designed to accept a flat or falling frequency response. If there is a positive frequency slope (i.e. the higher frequency signals have a higher level) then this may upset the sensitivity of the tuner and cause reception problems.

6. Contact details

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France
Fax: + 33 1 53 98 40 23

Note: All documents are available on the EUTELSAT web site:

http://www.eutelsat.com/docs/tech

If you are not already receiving regular mailings, please remember to complete the registration form name "Technical Information Service" on the web site.

EXHIBIT C

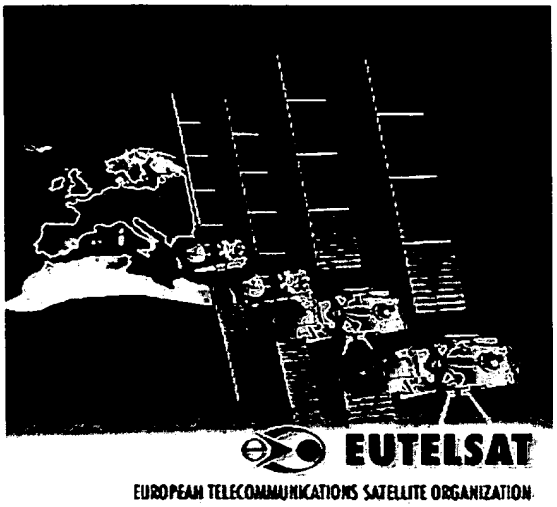
EUTELSAT

Organisation Européenne de Télécommunications par Satellite
European Telecommunications Satellite Organization
70, rue Balard — 75502 PARIS Cedex 15 — France

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DiSEqC 1.0 DiSEqC 2.0

Digital Satellite Equipment Control (DiSEqC™)



UPDATE AND

RECOMMENDATIONS FOR

IMPLEMENTATION

VERSION 2.0

April 18, 1997

This document is provided for information purposes. Whilst every effort has been made to provide accurate information, no responsibility is taken for errors or omissions. EUTELSAT reserves the right to change this information without notice.

Reference Documents that define the DiSEqC System:

DiSEqC™ Bus Specification Version 4.1 (April 18, 1997)

DiSEqC™ Slave Microcontroller Specification Version 1.0 (April 18, 1997)

DiSEqC™ Logos and Their Conditions of Use (April 18, 1996)

Associated Documents:

Update and Recommendations for Implementation Version 2.0 (April 18, 1997)

Application Information for Tuner-Receiver/IRDs (April 12, 1996)

Application Information for LNBs and Switchers (April 12, 1996)

Reset Circuits for the Slave Microcontroller (August 12, 1996)

Simple Tone Burst Detection Circuit (August 12, 1996)

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1. Introduction

This document describes the recommended implementation of the DiSEqC Bus Specification in certain defined configurations and applications. It does NOT replace the Bus Specification, and in case of inconsistencies between the two documents, the Bus Specification takes priority and is always the reference document. These recommendations are only intended to serve as a guide to manufacturers and should not be considered as restricting the application of DiSEqC in any way. This document, version 2.0, concentrates on "Enhanced" one-way DiSEqC (Level 1.1) which extends the range of applications that can be supported with one-way communication. In particular the need to repeat DiSEqC messages where switches are "cascaded", to offer more switching states as well as supporting remote frequency tuning. The equivalent level in two-way DiSEqC is also defined.

At this time with the first generation of DiSEqC products already in the market it is also necessary to plan the move to full DiSEqC and to drop the old switching protocols (namely the 13/17V) to fully realise the potential cost savings at a system level. It is likely, therefore that DiSEqC only products will emerge by the end of this year. This will mean that the need for repeated messages is increasingly important to support non-backwards compatible DiSEqC devices, LNBs for example.

2. Simple Tone Burst DiSEqC Commands

The DiSEqC specification includes some extra commands that have been designed to be detected by a cheaper analogue circuit in the case of a simple two-state switch. In this type of application *(see Figure 11: "DiSEqC Compatible" switch page 19)*, where the slave IC would not be used to provide any additional functionality (such as 13/17V detection, continuous 22 kHz detection etc.) it is reasonable to find the lowest possible cost solution. To allow for these applications tone burst commands are defined as alternatives to the DiSEqC commands for the Satellite Position switch.

These simple commands should be viewed as an extension to the DiSEqC command set to allow for cost-reduced, simple two-state analogue switches and to avoid the unnecessary proliferation of other simple propriety protocols which could be incompatible in a future DiSEqC environment. Receiver manufacturers should always implement BOTH the simple tone burst commands and the standard DiSEqC commands in order to qualify for the use of the DiSEqC logo *(see "Logos and Conditions of Use', "April 18, 1997")*.

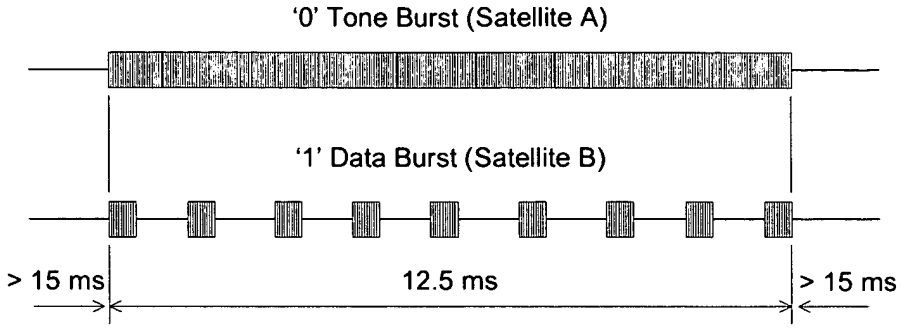


Figure 1: Timing Diagram for Tone Burst Control Signal

3. Definitions of DiSEqC Levels of Implementation

The full DiSEqC specification allows for many different levels of implementation and in order to clearly distinguish between these levels and the consequent functionality it is intended to indicate the implementation level in the branding of DiSEqC products, in the same way there are different versions of software packages or Dolby B or C etc.

The broad levels are defined as follows:

LEVEL	CONTROL	PRODUCT TYPE
"DiSEqC Compatible"	Tone Burst Command	Simple two-state switches only
DiSEqC 1.0	One-way DiSEqC Commands	Receivers only
DiSEqC 2.0	Two-way DiSEqC Commands	Receivers and Accessories
DiSEqC 3.0	Two-way Commands and external Bus Control	Receivers and intelligent interfaces for SMATV systems

Table 1: Definition of DiSEqC Levels

A more detailed description of the different levels of implementation is given below from either a receiver or accessory point of view:

3.1. Proposed Levels of Implementation for Receivers

The table below gives a more detailed definition of the different DiSEqC levels currently employed and proposed for receivers:

LEVEL	DIRECTIONALITY	COMMANDS
DiSEqC 1.0*	One-way signals	Control of the 4 committed switches, and Tone Burst commands, one repeat
DiSEqC 1.1	One-way signals	As level 1.0 above plus control of the 4 uncommitted switches, 2nd repeated commands and remote tuning mode
DiSEqC 2.0	Two-way signals	At least the 4 committed switches as above plus LNB L.O. frequency reading etc.
DiSEqC 2.1	Two-way signals	As level 2.0 above plus control of the 4 uncommitted switches, 2nd repeated commands and remote tuning mode
etc.		
DiSEqC 3.0	Two-way signals	All level 2.n plus external bus control of master

Table 2: DiSEqC Levels - Receivers

Note: * The exact definition of DiSEqC level 1.0 is now being standardised through the ad hoc working group of SIMAVELEC (the French national association of audiovisual manufacturers) and EUTELSAT. It is important to note that it will be necessary to provide at least one repetition of the DiSEqC command within level 1.0 *(see Annex B.)*.

3.2. Proposed Levels of Implementation for Accessories

The table below gives a more detailed definition of the different DiSEqC levels currently employed and proposed for accessories (switches, LNBs etc.):

LEVEL	DIRECTIONALITY	DETECTION METHOD
Tone Burst ("DiSEqC Compatible")	One-way signals	Simple Analogue circuit
DiSEqC 1.0	One-way signals	NOT RECOMMENDED (*see section 5.2.*)
DiSEqC 1.1	One-way signals	NOT RECOMMENDED (*see section 5.2.*)
DiSEqC 2.0	Two-way signals	Slave IC
DiSEqC 2.1	Two-way signals	Propriety Microcontroller
DiSEqC 3.0	Two-way signals	Propriety Microcontroller

Table 3: DiSEqC Levels - Accessories

4. Recommended Implementation for Receivers

4.1. One-way DiSEqC

This is implemented by simply NOT requesting a reply in the framing byte of the DiSEqC message:

E0 = Command from Master, No reply required, First transmission

E1 = Command from Master, No reply required, Repeated transmission

In a one-way system there are obvious limitations compared with a full two-way system, the main problem being that the automatic identification of the actual installation configuration is impossible. Therefore as the installation configurations become more complex (e.g. three or four LNB/IF inputs) the necessary "links" within the receiver software become more complicated and yet still require a reasonable level of understanding from the installer or user during installation. In a two-way system, with self-interrogation of the bus, it is possible to tailor the menus according to the devices found on the bus and even allow, automatically, for differences in local oscillators (assuming DiSEqC LNBs are used).

Therefore, in one-way applications, to ensure compatibility between different manufacturers' equipment and to limit the complexity of the receiver software we suggest that only a limited number of "common" installation configurations are to be supported *(see Annex A.)* in terms of pre-programmed software in the receiver. Of course even one-way DiSEqC allows for many

other types of installations but these other configurations will require a higher level of understanding from the installer and possibly re-programming of the receiver as required. To accommodate the "Enhanced" one-way DiSEqC it would be advisable to have a DiSEqC installation menu where the different features can be selected by the user/installer (see later).

The simplest method to implement one-way DiSEqC 1.0 is to send all types of signals every time the receiver changes channels. The DiSEqC commands must be sent first (so that if a Slave IC is present it will then react in DiSEqC mode), the Tone Burst commands should be sent next followed by the continuous signalling, see diagram below:

4.1.1. Recommended sequence of commands for one-way DiSEqC 1.0

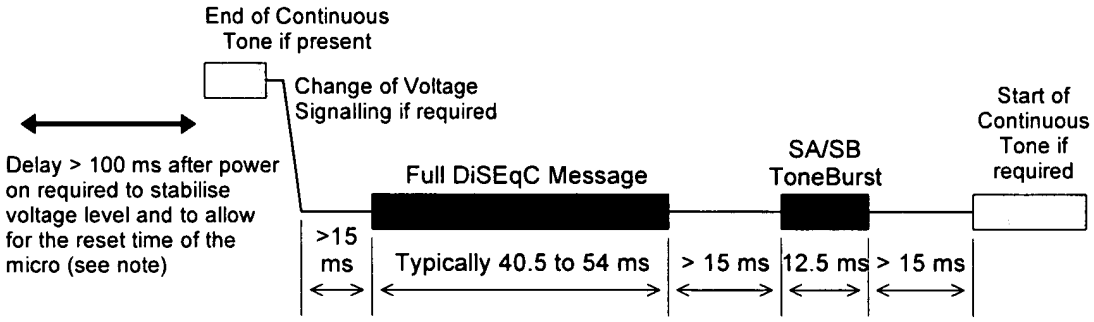


Figure 2: Timing Diagram for DiSEqC 1.0

Note: It is important that the power rail has stabilised and the voltage is above 12 V BEFORE the messages are transmitted, if for example the receiver is coming out of stand-by (e.g. power-on or for a timer event) and the messages are sent too quickly then the detection circuits may not operate correctly. A delay is also required depending on the reset time of the Slave IC. Therefore, a minimum delay of 100 ms is recommended in these cases.

4.1.2. Command Structure DiSEqC Level 1.0

DiSEqC level 1.0 is restricted to the "committed" switches which can all be addressed with only one command: "Write Port N0" = 38h.

Name	Continuous commands	Tone Burst	DiSEqC commands	
Band (low/high)	0/22 kHz	-	"Write N0" 38	20/24
Polarity (ver/hor)	13/17 V	-		21/25
Sat Position (A/B)	(0/22 kHz)	No mod/mod		22/26
Option (A/B)	-	-		23/27

Table 4: DiSEqC Level 1.0 commands

Note: See annex 2 for more details regarding the definition of DiSEqC level 1.0

4.2. Enhanced one-way DiSEqC

Various manufacturers have requested three further applications that should be supported by one-way DiSEqC, these can be summarised as:

1. More switching options
1. Cascaded devices which require several repeated DiSEqC messages
2. Remote tuning for subscriber controlled SMATV headends for single cable IF distribution systems

Note: EUTELSAT strongly recommends that receiver manufacturers not intending to implement two-way DiSEqC in the medium term should at least move to enhanced one-way DiSEqC level 1.1 as quickly as possible.

4.2.1. Recommended sequence of commands for enhanced one-way DiSEqC 1.1

In order to support "cascaded" DiSEqC devices *(see Figure 15: Cascaded DiSEqC switches, page 21)* it is necessary to repeat the DiSEqC commands for the "distant" devices which are beyond an IF switch. Otherwise, if the "nearby" switch is open there is no IF path connected until the first DiSEqC message causes the switch to close and connects the distant switch. The dc path is only connected at the same time and therefore, it is necessary to allow at least 100 ms for the distant DiSEqC slave IC to power-up BEFORE repeating the message to correctly control this new device. To make use of this "dead" time we recommend that an uncommitted switch message is sent in the 100 ms gap between the repeated committed switch messages. The reason for this is, that if both committed and uncommitted switches are employed, it is most likely to be inside the same device (typically a large SMATV node with up to 32 inputs) and there is no need allow a 100 ms gap between these messages (or to repeat the uncommitted message). This

solution also provides the extra switching commands requested in a very time efficient manner.

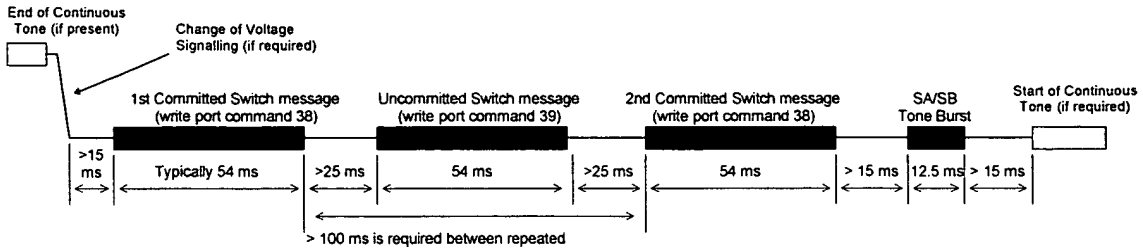


Figure 3: Timing Diagram for DiSEqC 1.1 (one repeat)

This is the recommended default setting for the Setup menu (see section 4.2.8).

4.2.2. Repeated DiSEqC Messages

The number of times the same message will need to be repeated will depend on the number of levels of cascaded devices that are required to be supported. Obviously the more times the message is repeated the longer the delay in selecting the required channel. To avoid unnecessarily long delays in simple systems we recommend that the number of repeats be user selectable in the DiSEqC installation menu (*see section 4.2.8.*) It is unlikely that there are many applications requiring more than two repetitions (i.e. the same message is sent three times), this allows for two levels of switches plus a DiSEqC LNB.

Note: In a two-way system the receiver can interrogate the bus to establish the exact configuration and automatically select the required number of repeats.

Note: The Tone Burst signal must always be at the end of the message, AFTER the last repeated DiSEqC command. Therefore, if a Tone-Burst switch is used, it MUST be farthest from the receiver to operate correctly.

4.2.3. Recommended sequence of commands for double repeated messages

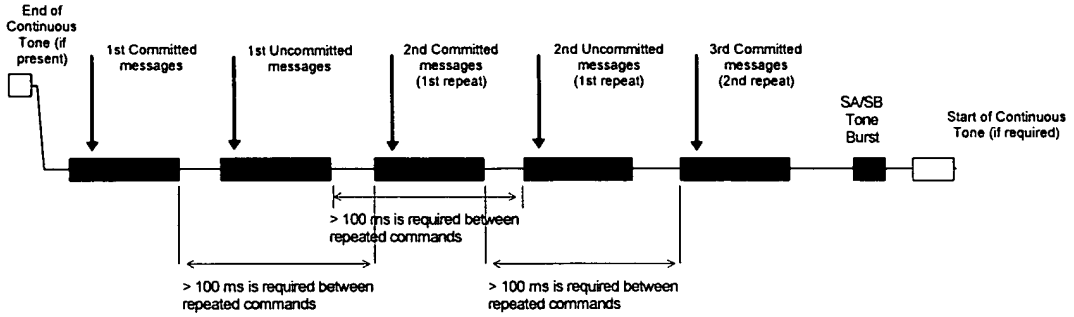


Figure 4: Timing Diagram for DiSEqC 1.1 (multiple repeats)

4.2.4. Remote Tuning

There has been a strong request from several manufacturers (namely the members of the ZVEI group in Germany) to include a special SMATV mode within one-way DiSEqC to allow for the interface with subscriber controlled SMATV headends.

In future there will be intelligent SMATV headends which only transmit the desired transponder to each user. The great advantage of this concept is that it is possible to use existing single cable "tree" distribution network installed in many buildings today.

The SMATV headend has one remote controllable frequency convertor for each user. This convertor must be controllable by the satellite receiver/IRD. In a special SMATV mode of the receiver this is achieved by transmitting, in addition to the DiSEqC 1.0 commands, the desired transponder frequency via the DiSEqC "write frequency" command (58h). This message is sent in the usual way at every programme change and at the initialisation procedure after power on.

It is important to understand that the DiSEqC signals are simply used as an "open interface" for the data transmission from the satellite receiver to a propriety modem located between the receiver and the wall outlet*(see Figure 19: Subscriber controlled SMATV Headendpage 23)*. The modem converts the DiSEqC commands to a suitable propriety bus format (typically a faster multi-master bus) for the transmission to the headend.

In the remote tuning SMATV mode the tuner in the receiver stays fixed on the subscriber's individual transmission frequency of the SMATV headend. The selection of this SMATV mode and the fixed transmission frequency need only be entered one time during the installation procedure.

4.2.5. Transmission of the desired transponder frequency

The desired transponder frequency can be written in a packed BCD string form, the message is structured as follows:

FRAMING	ADDRESS	COMMAND	DATA	DATA	DATA

where:

FRAMING BYTE: E0h
Command from Master. No reply required.
First transmission

ADDRESS BYTE: 71h
Intelligent slave interface for Multi-Master Bus

COMMAND BYTE: 58h
Write channel frequency (BCD string)

DATA BYTES: Max. 3 bytes for the transponder frequency (GHz)

The high nibble of the first data byte contains the tens of GHz digit and the low nibble contains the GHz digit in BCD form. Subsequent bytes contain BCD nibbles in descending order until only trailing zeros remain.

For example 12.650 GHz would be transmitted in two bytes:

1	2	6	5	0	0
0001	0010	0110	0101	0000	0000

4.2.6. Full sequence of commands in Remote Tuning SMATV mode

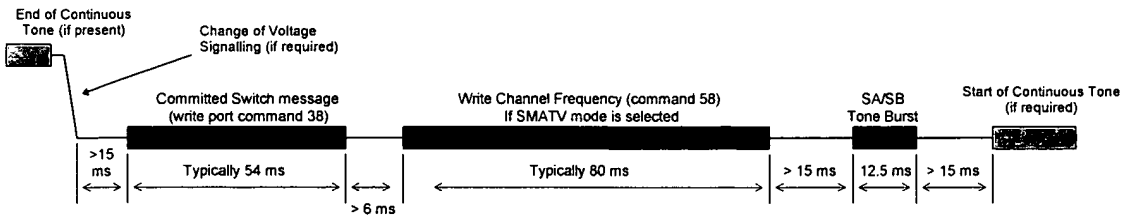


Figure 5: Timing Diagram for DiSEqC 1.1 (SMATV mode)

Note: It is still necessary to send the committed switch message in the SMATV mode to define the required polarity, band and satellite position required at the input to the frequency convertor.

4.2.7. Command Structure for DiSEqC Level 1.1

The table below gives the list of DiSEqC functional commands required to implement enhanced one-way DiSEqC level 1.1:

Name	Continuous commands	Tone Burst	DiSEqC commands	
Band (low/high)	0/22 kHz	-	"Write N0" 38h	20/24h
Polarity (ver/hor)	13/17 V	-		21/25h
Sat Position (A/B)	(0/22 kHz)	No mod/mod		22/26h
Option (A/B)	-	-		23/27h
Switch 1 (A/B)	-	-	"Write N1" 39h	28/2Ch
Switch 2 (A/B)	-	-		29/2Dh
Switch 3 (A/B)	-	-		2A/2Eh
Switch 4 (A/B)	-	-		2B/2Fh
Write channel frequency	-	-		58h

Table 5: DiSEqC Level 1.1 commands

Note: The reason for the two separate groups of 4 switches is very important. Each group of switches can be addressed with one DiSEqC message (4 bytes), this means that even in the case where it is necessary to change ALL 4 states of one group it will never take more than 4 bytes (54 ms).

4.2.8. Setup Menu for DiSEqC 1.1

To enable the features of enhanced one-way DiSEqC to be implemented it is necessary for the receiver to have a DiSEqC setup menu as part of the installation procedure. In this menu the first level is to select either "DTH" mode or "SMATV" mode, below which there are sub-menus as follows:

OPERATIONAL MODE	SELECTION POSSIBILITIES
DTH	No repeat
	One Repeat (Default)
	Two Repeats
SMATV (Multi-Switches)	Program Committed and Uncommitted switches and setup LNB L.O.s for each input
SMATV (Remote Tuning)	Enable Write channel frequency commands and enter fixed subscriber frequency

Table 6: DiSEqC Level 1.1 Setup Menu

4.3. Two-way DiSEqC

All the above recommendations for one-way DiSEqC are applicable to full two-way DiSEqC in terms of the functional definition of levels 2.0, 2.1, etc. However, it is of course possible to significantly simplify the user operation of the receiver by making use of the replies (remember all accessories using the slave IC should have reply capability). In fact the setup menu described above can be completely transparent to the user if the receiver interrogates the bus to find out exactly which configuration exists and to setup the DiSEqC implementation accordingly *(see "Application Information for Tuner-Receiver/IRDs", April 12, 1996)*. The real benefits of two-way DiSEqC are only realised through intelligent software in the receiver.

The reply capability of DiSEqC LNBs to declare their actual local oscillator frequency is one of the most obvious examples of the benefit of two-way communications. In additions "hand-shaking" ensures the correct operation of the slave devices and any errors in communication can be automatically resolved.

Many more advanced features are already specified for two-way DiSEqC, some of which are already implemented in the existing slave IC. For example, it is possible to "signal" to the master the special addresses 18h to 1Fh by configuring the slave IC to only support the uncommitted switches *(see "Slave microcontrollerversion 1.0", Table 4: SMATV addresses, page 10)*.

In order to realise all these benefits of two-way communication it is only necessary to implement in hardware the required source impedance and a few Bus interface components (typically one transistor), everything else remains in software. As the industry gains experience in DiSEqC messaging the improved functionality of a two-way system will quickly out-weigh any software overhead.

5. Implementation for Accessories

5.1. Detection of Tone Burst commands using an analogue circuit

The cost advantage of the analogue detection of the Tone Burst is only achieved in applications where the Slave IC cannot be used to add any additional functionality *(see Annex A. Common configurations for one-way DiSEqC, page 19).* Please refer to the document *"Simple "ToneBurst" Detection Circuit"*, for more details, but the exact design will depend on the manufacturer's own preferred solution.

5.2. Detection using the Slave IC

The advantage of the Slave IC is that in one very cheap microcontroller a large amount of functionality is included:

1. DiSEqC detection
2. Tone Burst detection
3. 13/17 V and continuous 22 kHz tone detection
4. Reply capability
5. Decode mode

It is STRONGLY recommended that any accessory utilising the Slave IC should always implement the return path modem (only one transistor) since two-way capability significantly improves the user friendliness of the system and some receiver manufacturers will start with two-way communication. It has been estimated (by a manufacturer) that a typical detection circuit using a Slave IC with all the above functionality (but excluding voltage regulation and PCB space) is approximately 1.1 ECU (i.e. < £1), this replaces the cost for the existing analogue detection circuits.

Note: Accessories using the Slave IC but NOT implementing the return path will NOT be eligible for DiSEqC branding.

5.2.1. Dual Functionality of continuous 22 kHz signal

In many existing installations (particularly in SMATV) the continuous 22 kHz tone is used for position switching rather than frequency band. When the Slave IC is used in backwards compatible mode it is therefore necessary to be able to select either mode of operation:

22 kHz = Frequency band (for receivers wanting low and high band)

or

22 kHz = Position (receivers wanting one band from two positions)

In the current software (versions 0.2 & 1.0) the mode of operation is determined by connecting a diode between pins Strobe E and S3 of the Slave IC *(see "Slave Microcontroller Version 1.0', section 7.1. Backwards Compatibility, on page 21)*. This feature could be implemented in an eight input/output multi-switch by using an eight way dip switch which can switch the diode in or out for each Slave IC. This allows a "mixed" population of receivers to use the same type of multi-switch without any additional logic inside the switch.

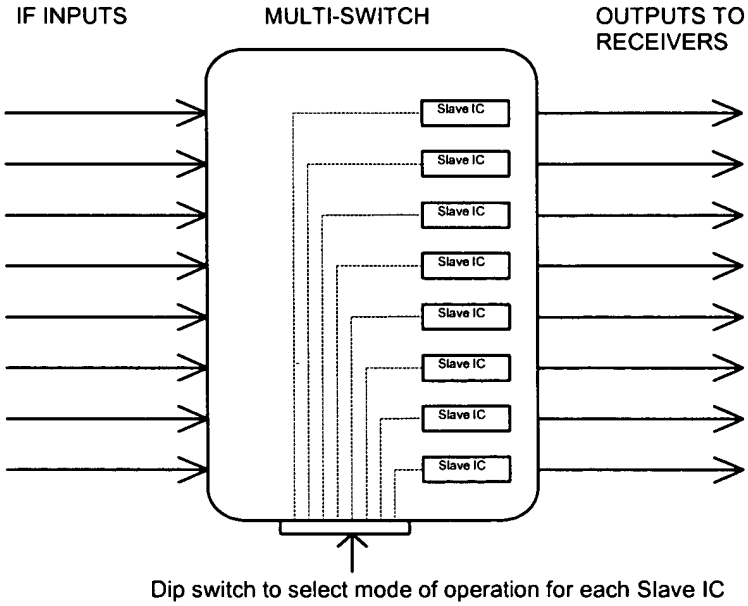


Figure 6: Possible configuration to support old and new receivers in 8-way distribution systems

5.2.2. Decode (de-multiplex) Mode

Given the current configuration of the Slave IC which has 8 output lines, several manufacturers have requested a decode (or de-multiplex) mode from

three input lines (i.e. $2^3 = 8$ states) in order to avoid additional logic and to be able to drive switches directly. In the final version there are 4 groups of 3 inputs which can be configured to decode to the 8 output lines, and each mode can be inverted giving a total of 8 different decode configurations. *Figure 7:*, shows how the inputs are grouped, for a full description of the decode mode please refer to the updated DiSEqC Slave Microcontroller Specification (version 1.0) and the latest application documents.

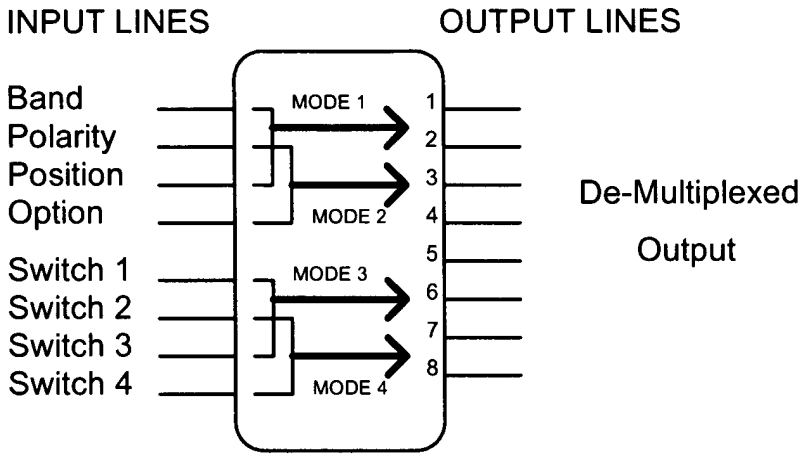


Figure 7: Decode (de-multiplex) Modes

6. Trade Mark and Self-Certification

6.1. DiSEqC Logo

The DiSEqC logo has been designed to be suitable for use on products as well as in printed format. The logo will clearly indicate the level of implementation employed to allow consumers to easily exercise choice in selecting the most appropriate system for their requirements and to ensure inter-compatibility between different manufacturer's products.

The use of the logo will be controlled in the following way:

1. Manufacturers will self-certify compliance to the bus specification by testing with the Test Tool.

2. Two samples (from mass production) must be submitted to the "product library" at EUTELSAT which will be accessible by all manufacturers.
3. Any incompatibilities between products are to be resolved between manufacturers.

Please refer to the document *"Logos and Conditions of Use", "April 18, 1997"*

6.2. Test Tool

To allow fast development and self-certification, the idea a Test Tool has been developed (based on the original evaluation boards) which allows the precise performance of a device to be measured in terms of the bus specification. Revisions to the bus specification would be accompanied by the appropriate changes (if necessary) to the Test Tool. In order to self-certify compliance to the bus specification it will be mandatory that manufacturers procure a Test Tool for their own use. Owners of evaluation boards are entitled to receive one of the Test Tools free of charge. For new manufacturers the cost of the Test Tool will be a nominal sum simply to cover the hardware costs, please send enquiries directly to EUTELSAT at the address at the end of the document.

7. Reset Procedure

7.1. IF Loop-Through



For receivers employing an IF Loop-Through (e.g. digital IRDs with a loop-through for an analogue receiver) **MUST** include a reset for the Slave IC each time the IF path is switched. This is to ensure backwards compatibility with old receivers.

Please refer to the following diagrams:

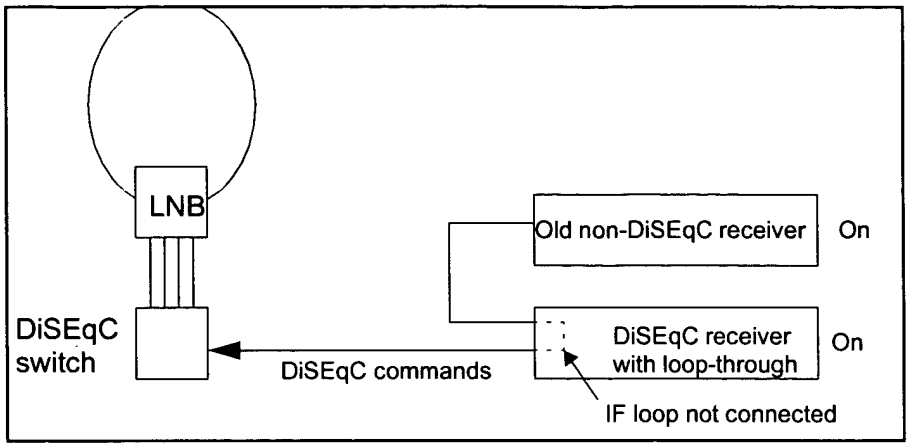


Figure 8: DiSEqC receiver with loop-through is controlling DiSEqC devices using DiSEqC commands

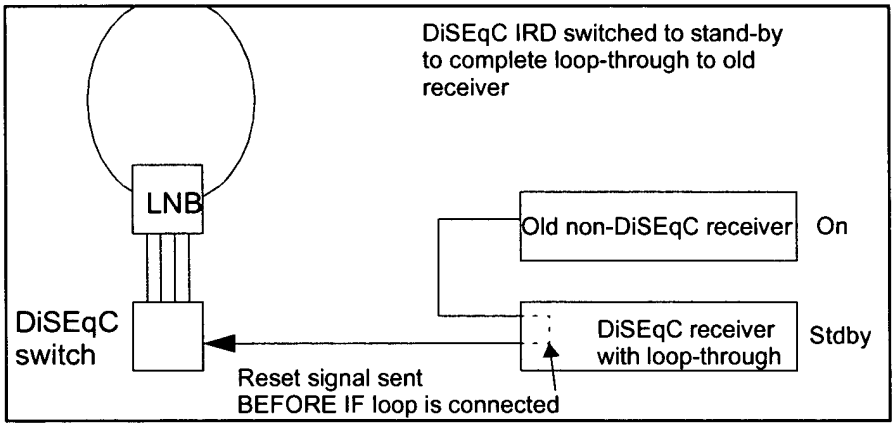


Figure 9: When DiSEqC receiver is switched to stand-by a reset signal must be sent to the DiSEqC switch (and/or LNB)

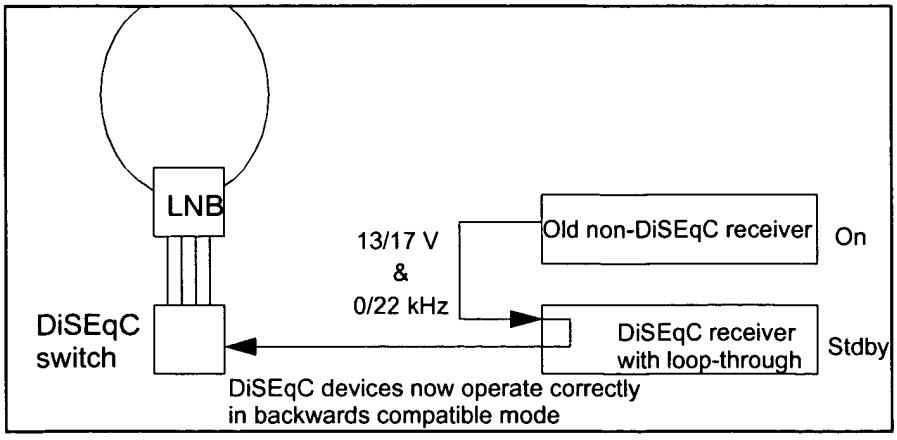


Figure 10: Slave ICs in the DiSEqC devices can now operate in backwards compatible mode

If NO reset signal is sent AND the analogue receiver is ALREADY switched on when the Digital IRD is powered down, then there is a strong possibility that power to the bus is maintained (particularly if the IF switching is very quick) and the Slave IC is then LOCKED into DiSEqC mode and would not respond to the conventional signals. In this case the user must switch-off the analogue receiver (i.e. remove the power from the bus) to force the Slave IC to reset. Therefore we STRONGLY RECOMMEND that all receivers with an IF Loop-Through implement a RESET command WHENEVER THE IF PATH IS SWITCHED. In general it is advisable that all receivers send a reset command when switching to stand-by.

The reset signal can be generated in two ways:

1. DiSEqC reset command 00h
2. Power-down (at least 50 ms)

Note: In the case of the Power-down technique, it will be necessary to allow an additional 100 ms delay on the subsequent power-on to allow the slave IC to reset, this gives a total reset period of at least 150 ms before a new command can be detected. The DiSEqC reset command will only take 40 ms and no additional delay is required.

8. Contact details

For further information please contact:

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France

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Fax: + 33 1 53 98 40 23
E-mail: gwilkins@eutelsat.fr

Note: All documents are available on the EUTELSAT web site :

http://www.eutelsat.org/press/tv_recept1.html#DiSEqC

If you are not already receiving regular DiSEqC mailings, please remember to complete the registration form on the web site.

Annex A. Common configurations for one-way DiSEqC

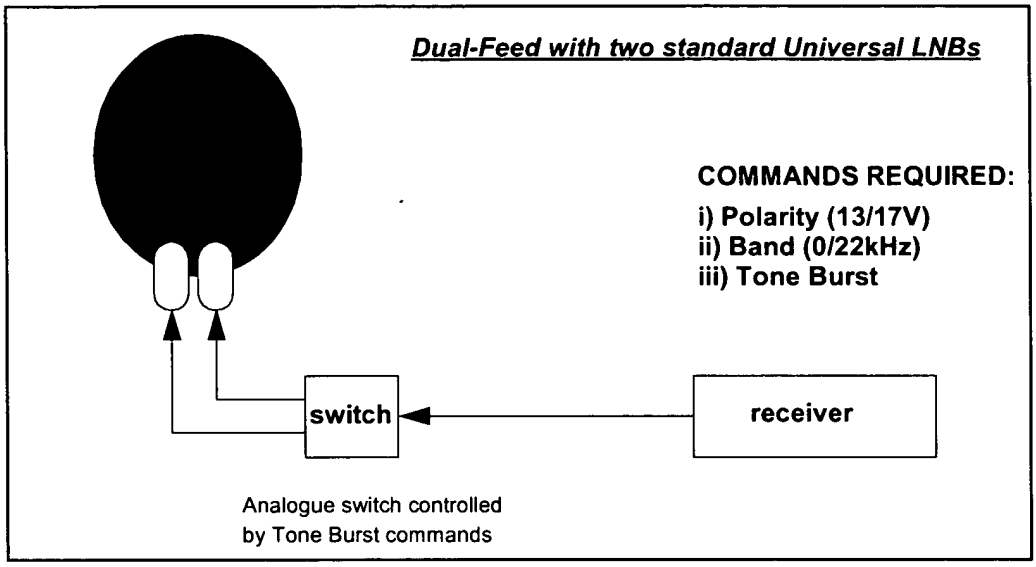


Figure 11: "DiSEqC Compatible" switch

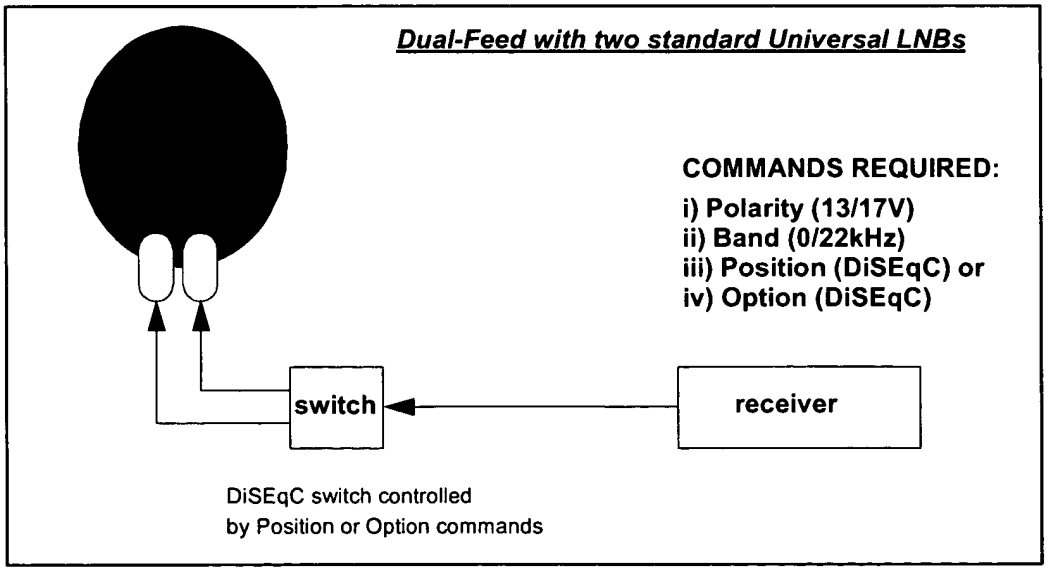


Figure 12: DiSEqC switch

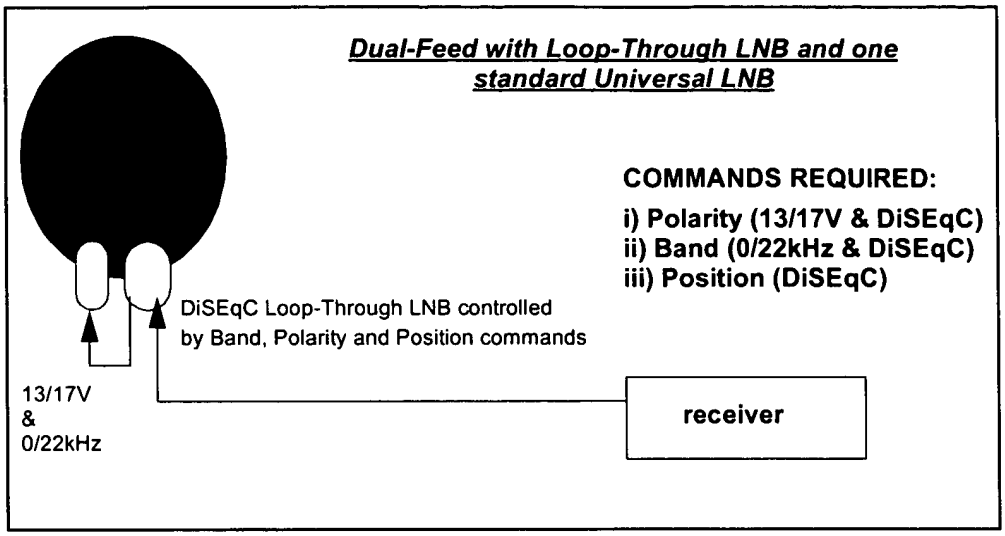


Figure 13: DiSEqC Loop-Through LNB

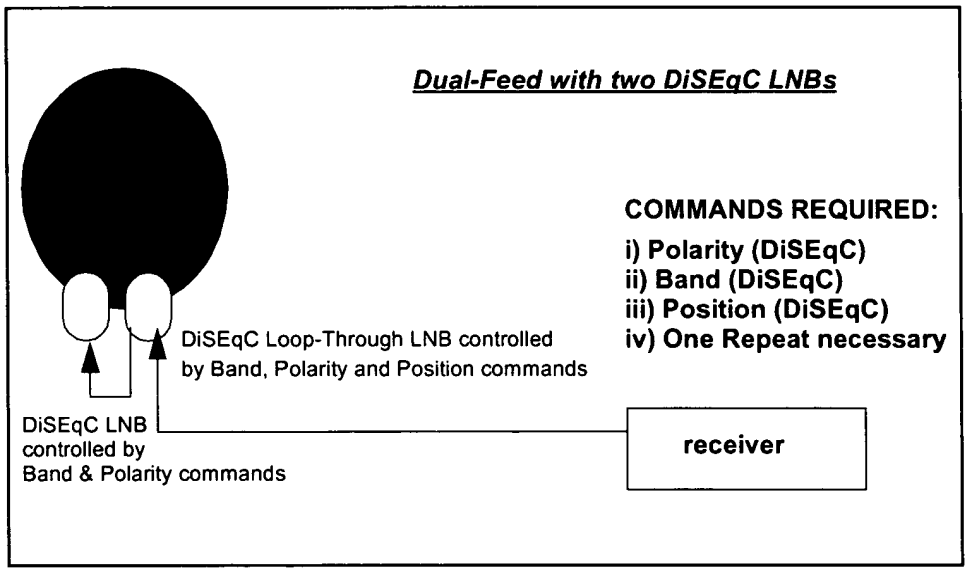


Figure 14: Two DiSEqC LNBs

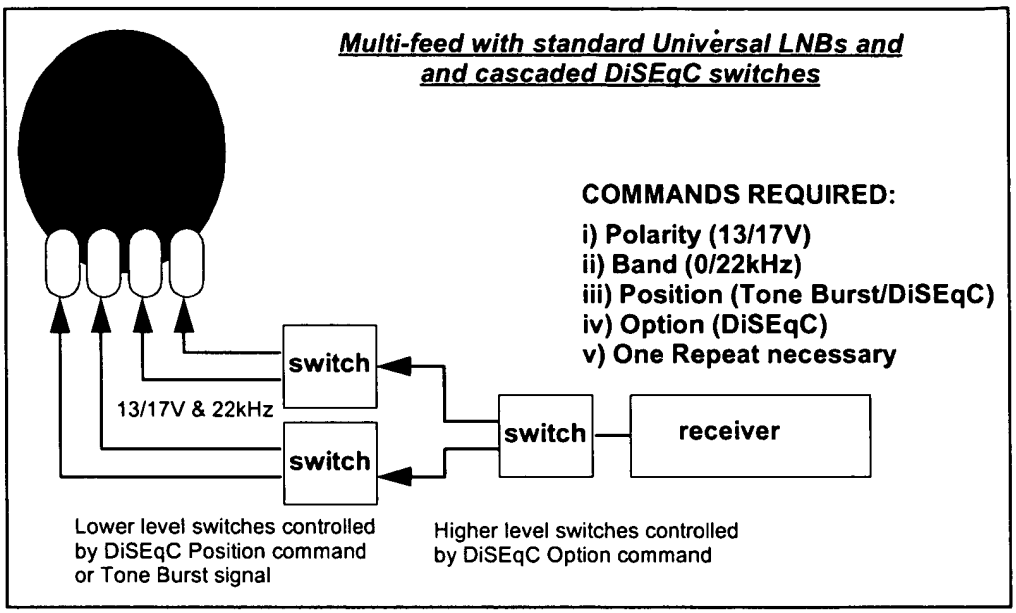


Figure 15: Cascaded DiSEqC switches

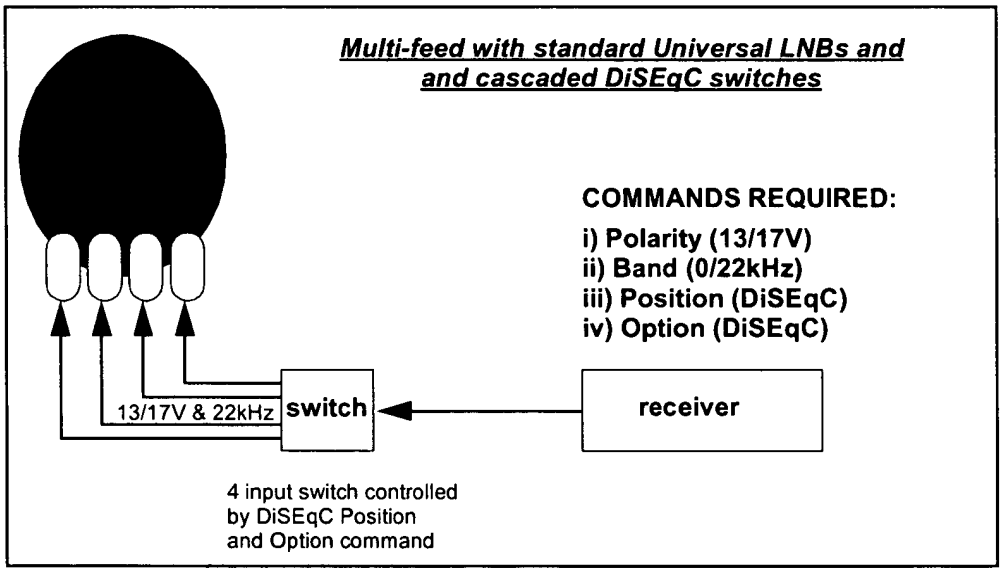


Figure 16: 4 Input DiSEqC switch

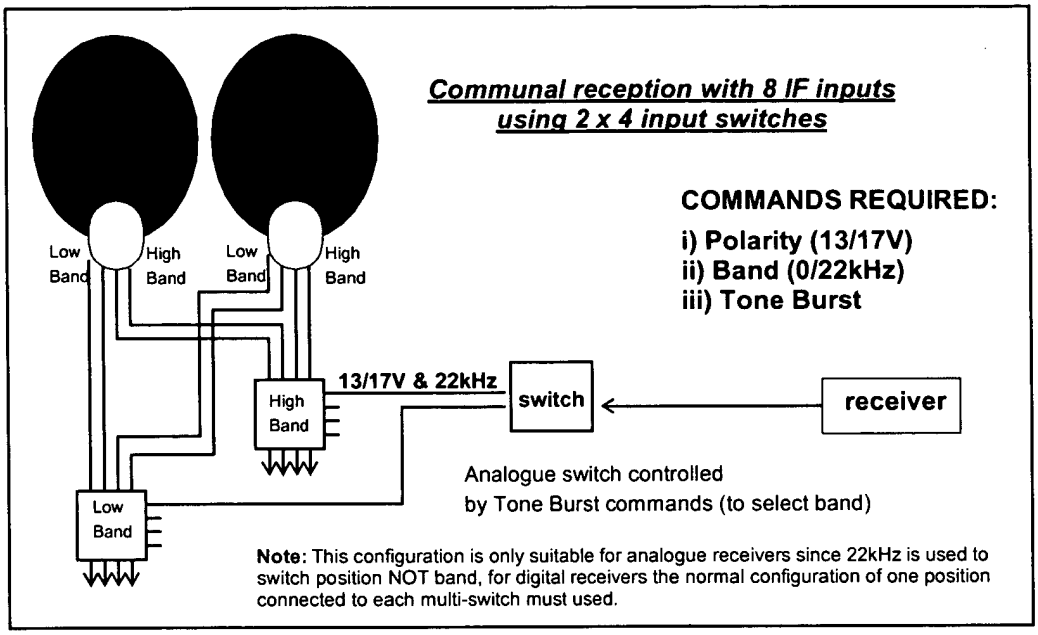


Figure 17: 8 cable switched IF distribution with Tone Burst control

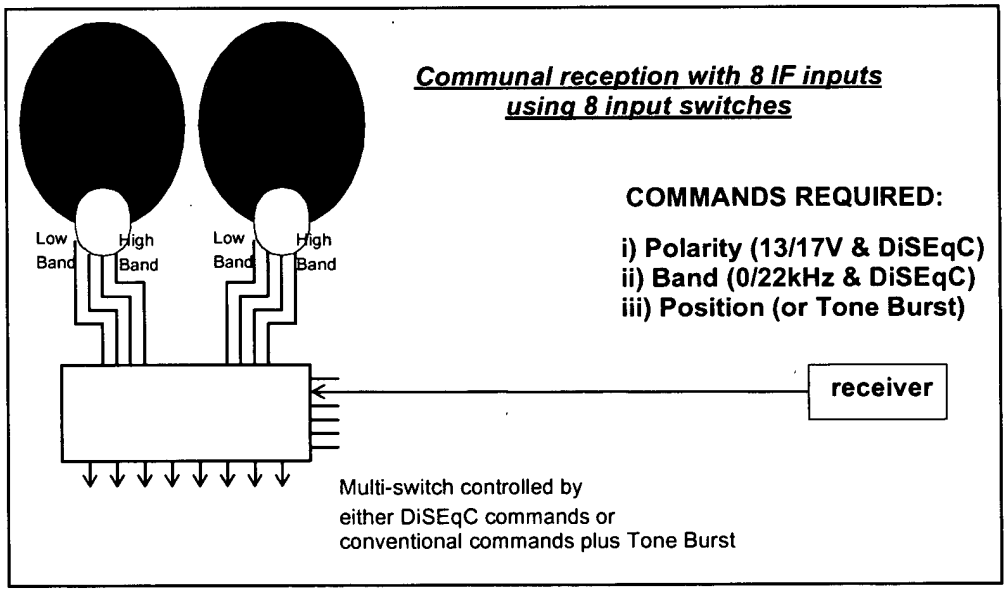


Figure 18: DiSEqC Multi-switch

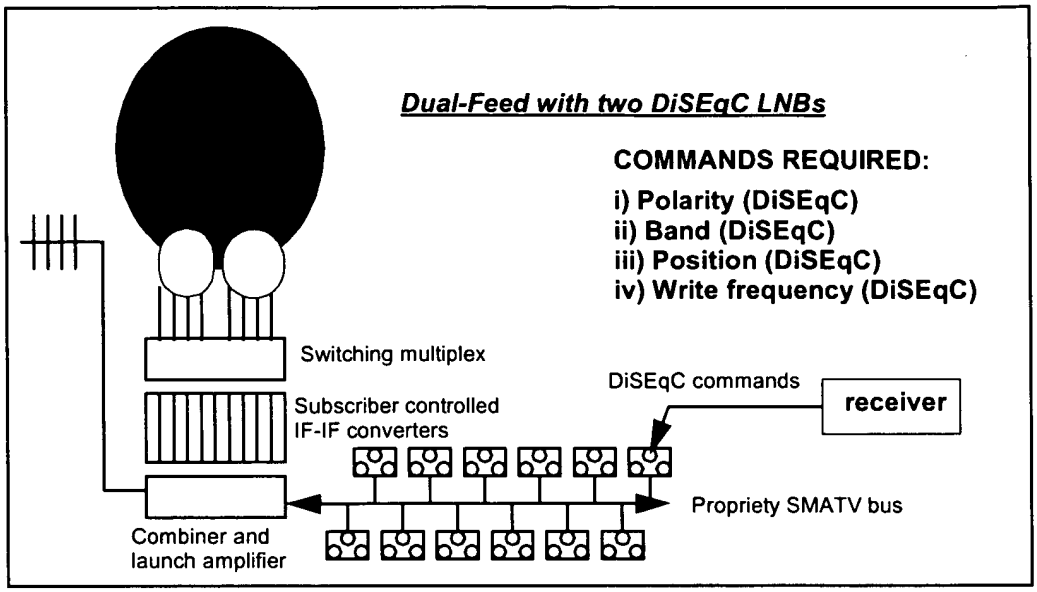


Figure 19: Subscriber controlled SMATV Headend

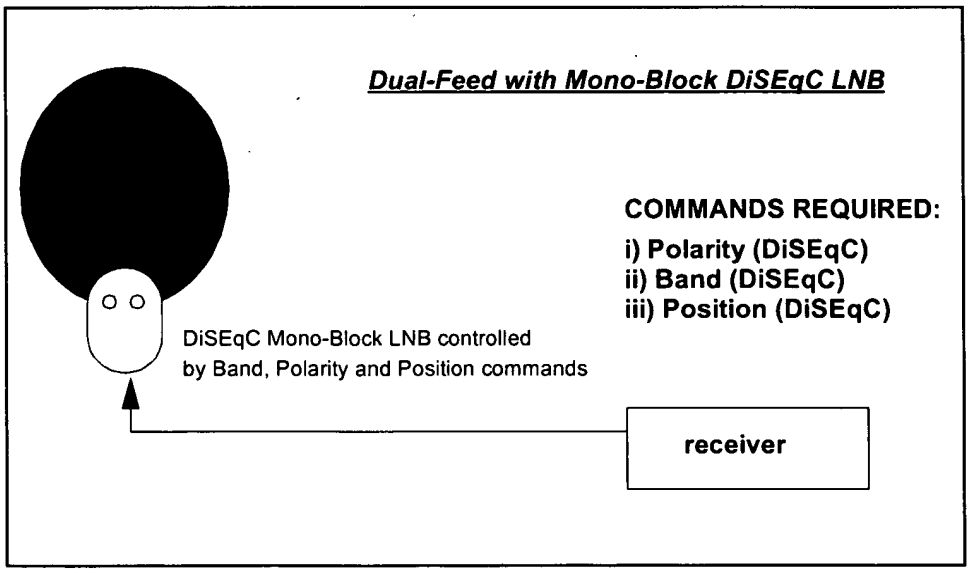


Figure 20: DiSEqC Mono-Block LNB

Annex B. Progress of SIMAVELEC/EUTELSAT DiSEqC ad hoc working group

B.1. Objective of the ad hoc working group

The objective of this group is to finalise the exact definition of DiSEqC level 1.0 in a neutral forum and to prepare the necessary documentation for international standardisation through CENELEC and IEC.

B.2. Current status of work

After several meetings within SIMAVELEC the current status of work can be summarised as follows:

1. Preparation of draft document for discussion of SIMAVELEC members (open to ZVEI members for observation)
2. Application for work item for amendment to IEC 1319-1"Interconnections of satellite receiving equipment - part 1 Europe"
3. Co-ordination with CENELEC TC206 and IEC SC100C

B.3. Summary of Technical Recommendations

Most of the requests from the manufacturers represented by SIMAVELEC are already incorporated in the latest DiSEqC documents. Below is a list of the most important points:

1. Only DiSEqC level 1.0 is considered, although attention is given to maintain compatibility with two-way DiSEqC in the future.
2. Modulation and timing diagrams in accordance with DiSEqC bus specification 4.1.
3. Command 38h and subsequent data bytes F0h to FFh must be implemented.
4. One repeat of the DiSEqC message must be supported, although it need only be sent when necessary.

5. Reset of slave microcontrollers will be achieved by power-up and a delay of 100 ms before start of message.

Note: Note, in case of IRD with IF loop-through reset may be more easily achieved with the DiSEqC reset command (*see 7.1. "IF Loop-Through" on page 15*).

6. All IF switches will only allow ONE DC path from the master to the final slave to prevent overloading the master's power supply.
7. Precise definition of power supply voltage requirements, rise time and limit conditions on voltage transitions (13/17V etc.).
8. Harmonisation of all standards relating to control signals on the IF cable.

EXHIBIT G

A Single-Chip Universal Digital Satellite Receiver with 480-MHz IF Input

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***Abstract*—This paper presents a complete single-chip universal digital satellite receiver supporting all current DBS system standards. The mixed-signal device accepts a modulated data stream at up to 90 Mbps and delivers a demodulated, error-corrected output data stream. The IC features an analog front end with 480-MHz intermediate-frequency downconversion and dual 8-bit analog-to-digital converters, an all-digital BPSK/QPSK/OQPSK variable-rate receiver supporting 1–45-MBaud operation with phase/frequency recovery, variable-rate digital filters, square-root Nyquist matched filters, acquisition and tracking loops, and a DVB/DSS/DigiCipher I/II-compliant concatenated Viterbi/Reed–Solomon forward error correction decoder with on-chip deinterleaver RAM. All required clocks are generated on chip from a single reference crystal. The chip contains 1.2 million transistors in a die area of 22 mm^2 and was implemented in a single-poly 0.35-μm CMOS process with four layers of metal.**

I. Introduction

A BLOCK diagram of a typical satellite TV system is shown in Fig. 1. The system contains an antenna that receives the K-band signal (11–12 GHz) transmitted by the satellite and a low noise block (LNB) that downconverts the signal for transmission over a coaxial cable to the set-top box. In Europe, the signal is downconverted by the LNB to 950–2150 MHz; in North America, the LNB downconverts the signal to 950–1450 MHz. An L-band tuner then selects the desired transponder channel. Fig. 2 shows a block diagram of a typical L-band satellite TV tuner. Most tuners in use today downconvert the signal to a 480-MHz intermediate-frequency (IF) and then use either a 36- or 55-MHz surface acoustic wave (SAW) filter to remove adjacent channels and out-of-band noise. An analog I/Q demodulator then produces a quadrature baseband (I/Q) output. Next, the digital data bitstream is recovered by a receiver, and error correction is performed to improve the bit error rate of the data. The data stream is then passed to a conditional access module that controls access to pay-per-view and premium channels. Last, an MPEG decoder recovers the digitized video data, and a video encoder produces an NTSC or phase alternation line (PAL) video output for a television.

Manuscript received May 12, 1999; revised June 15, 1999.

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Publisher Item Identifier S 0018-9200(99)08336-5.

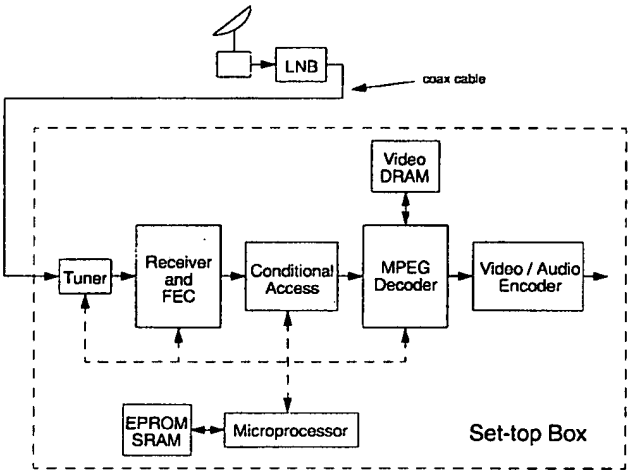


Fig. 1. Satellite TV system block diagram.

II. Chip Architecture

Fig. 3 shows a block diagram of the universal digital satellite receiver IC. The chip contains an analog front end, an all-digital receiver, and a concatenated Viterbi/Reed–Solomon (RS) forward error correction (FEC) decoder. The analog front end consists of a 480-MHz IF downconversion block, dual 8-bit analog-to-digital (A/D) converters that operate up to 128 MHz, and a low-jitter phase-locked loop (PLL) that generates all required clocks for the chip from a single external reference crystal.

The digital receiver supports variable symbol rates from 1 to 45 MBaud with BPSK, QPSK, or OQPSK modulation. The 8-bit A/D converter(s) operate with a free-running sample clock, and symbol timing is recovered digitally using multirate digital filters and a digital symbol timing recovery loop. The receiver also contains dual square-root Nyquist matched filters and digital carrier frequency recovery and phase-tracking loops with additional circuitry for automatic carrier acquisition that avoids all false lock points.

The error-correction block consists of a 64-state Viterbi decoder concatenated with a $t = 8$ RS decoder. The Viterbi decoder supports puncture modes for rate 5/11, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 6/7, and 7/8 operation with circuitry to automatically scan the data for the correct puncture mode. The decoder operates as a rate 1/2 based decoder for European

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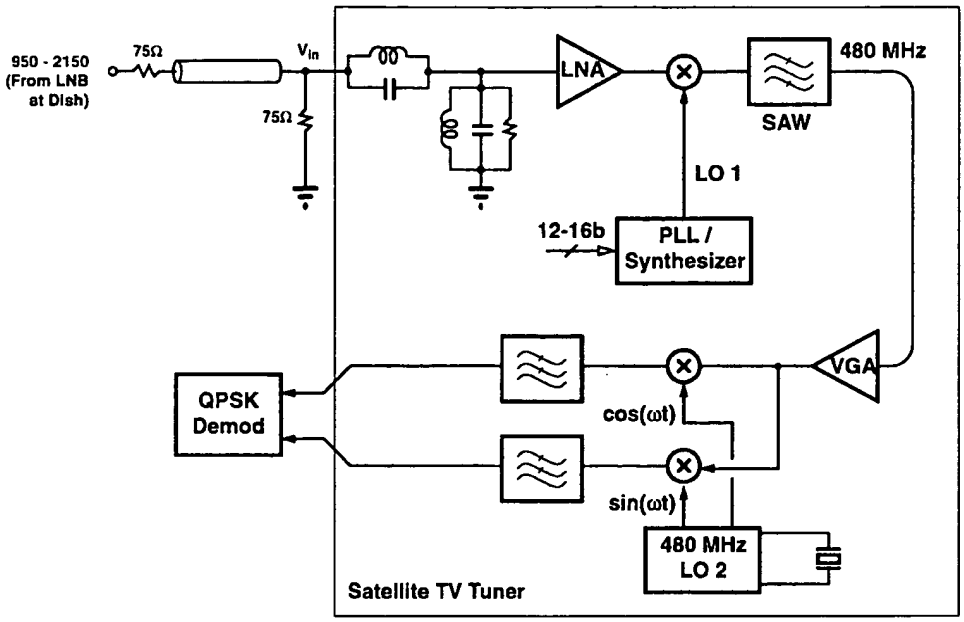


Fig. 2. Block diagram of a typical L-band satellite TV tuner.

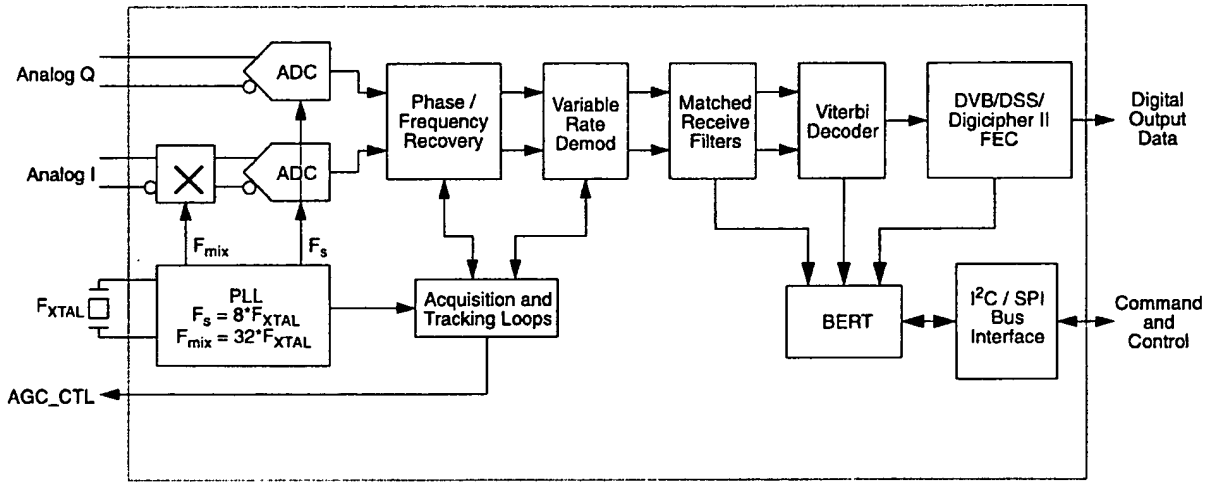


Fig. 3. Universal digital satellite receiver IC block diagram.

Digital Video Broadcast (DVB), or DirecTV Digital Satellite System (DSS), and as a rate 1/3 based decoder for Digicipher I/II operation. The RS decoder implements the DVB, DSS, and Digicipher I/II standards. It contains an on-chip deinterleaving RAM and can output either DSS or MPEG-2 formatted packets.

The chip architecture supports three tuner interface modes: baseband I/Q, low IF, and 480-MHz IF. For the baseband I/Q mode, the dual 8-bit A/D converters are used with a conventional tuner supplying quadrature baseband outputs, as shown in Fig. 4(a). Alternatively, the low-IF tuner interface mode allows the I/Q demodulator in the tuner to be replaced with a simple mixer that downconverts the signal to a low IF frequency within the bandwidth of the A/D converter, as shown in Fig. 4(b). A single A/D converter sampling at 128 MHz is used in this mode. For the lowest overall system cost, the I/Q demodulator in the tuner can be eliminated entirely and the chip can accept the 480-MHz IF signal directly, as shown in Fig. 4(c). In this mode of operation, the signal is downconverted on-chip to a 32-MHz IF using a 512-MHz mixer clock generated by the PLL and then directly sampled by a single 8-bit A/D converter operating at a 128-MHz sample rate. The I/Q demodulation is then performed digitally in the receiver.

III. Analog Front End

The integrated analog front end (AFE) accepts an analog input waveform in one of three formats: 480-MHz IF, low-frequency IF, or baseband I/Q. Fig. 5(a) shows a block diagram of the AFE, which switches the input signal according

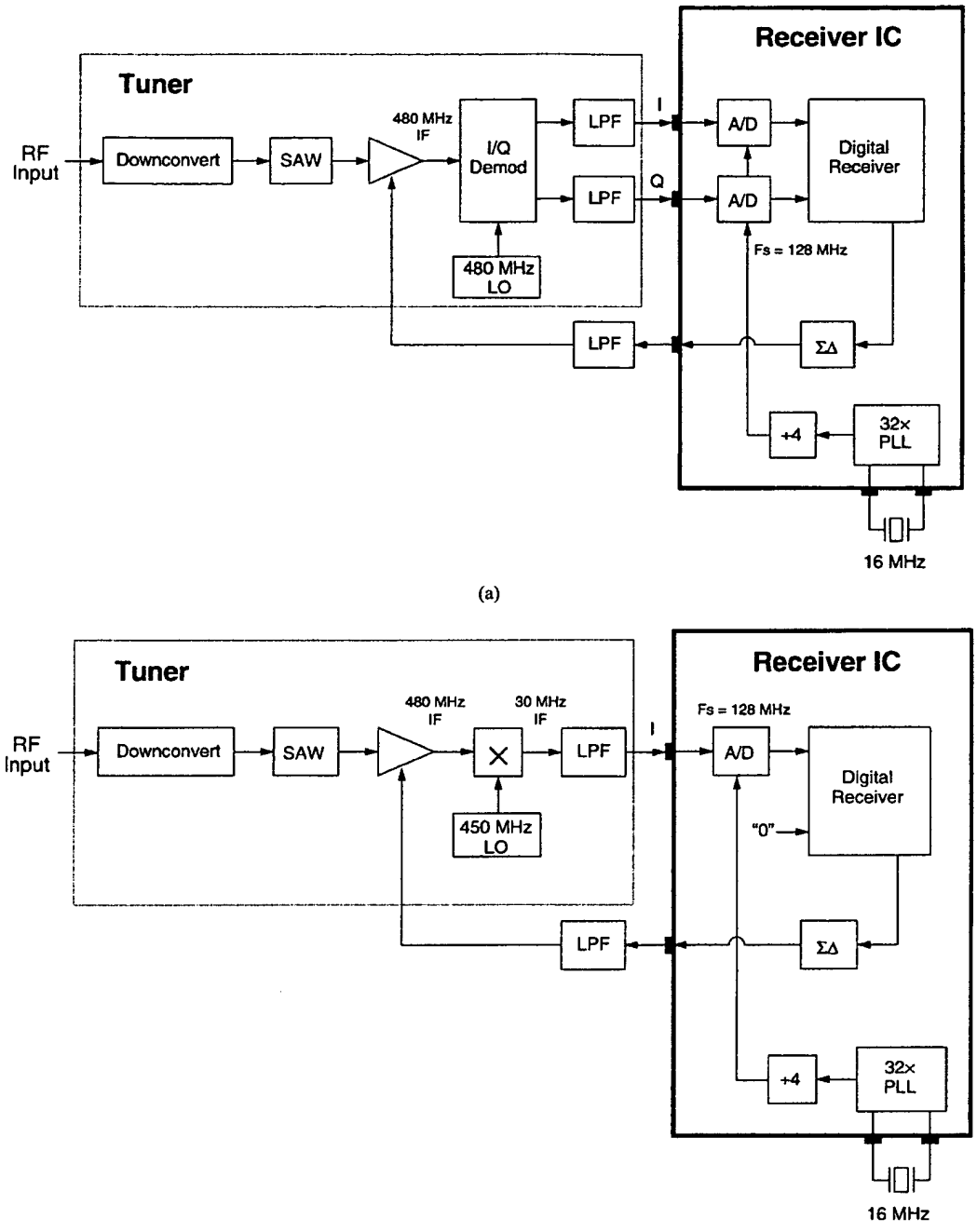
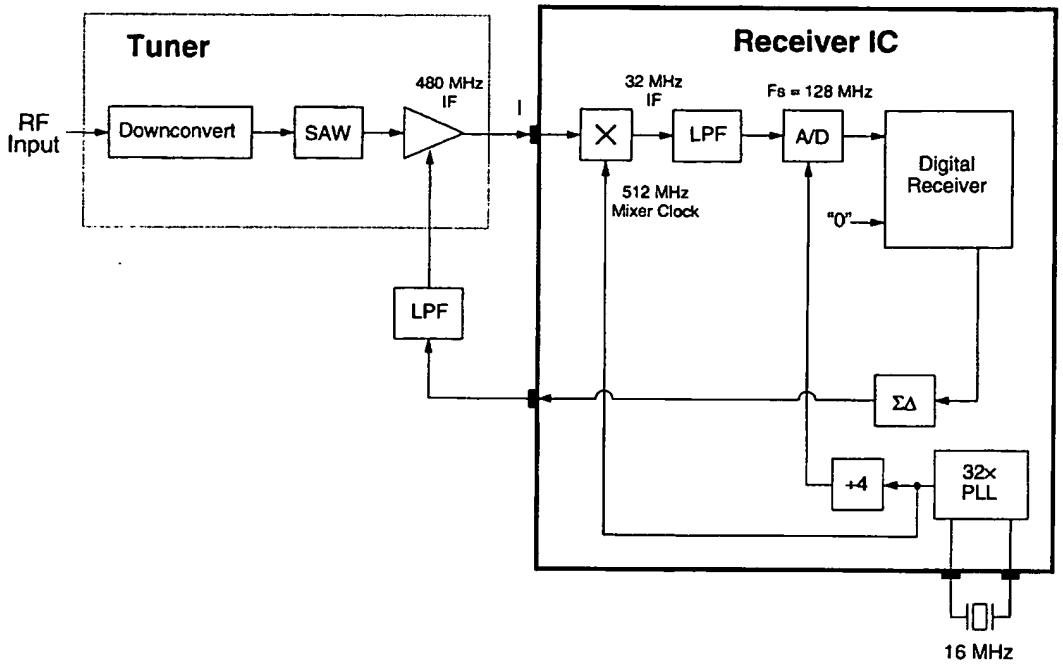


Fig. 4. Tuner interface modes: (a) baseband I/Q and (b) low IF.

to the desired mode of operation. The signal path for each of the three modes is indicated in the figure.

In the 480-MHz IF mode, the chip accepts a BPSK/QPSK/OQPSK input signal centered at 480 MHz. This signal is internally mixed to a lower IF frequency of 32 MHz using a 512-MHz on-chip PLL. It is then low-pass filtered and converted to a digital signal by an 8-bit A/D converter operating at a sampling rate of 128 MHz. A simplified schematic of the CMOS mixer and a block diagram of the PLL are shown in Fig. 5(b) and (c). The on-chip PLL is a four-stage differential ring oscillator operating at an internal frequency of 512 MHz. The 512-MHz clock is divided by 32 and phase-locked to a 16-MHz off-chip crystal reference.

In the low-frequency IF mode of operation, the chip accepts an IF input signal with a frequency spectrum within the A/D converter's Nyquist bandwidth. In this low-IF mode, the on-chip 480-MHz mixer is bypassed, and the signal is converted by the 8-bit A/D converter operating at a sampling rate of 128 MHz. Last, in the baseband I/Q mode, the chip accepts



(c)

Fig. 4. *(Continued.)* Tuner interface modes: (c) 480-MHz IF.

baseband I and Q input signals, which are sampled by dual 8-bit A/D converters operating at a maximum sampling rate of 128 MHz.

The ADC utilizes folding, interpolation, and averaging to achieve good integral- and differential-nonlinearity with relatively low complexity and power [1]. It differs from the ADC described in [1] in that it operates at a much higher sample rate (128 versus 50 Msample/s) with reduced resolution (8 versus 10 bits). Also the noise environment on the chip is quite different due to the integrated 45-MBaud digital receiver and FEC circuits. The ADC uses two cascaded stages of three times folding to reduce the number of comparators required from 256 to 32. Fig. 6(a) and (b) shows the measured integral nonlinearity (INL) and differential nonlinearity (DNL) for the 8-bit ADC. Fig. 7 shows the measured ADC output frequency spectrum for an input tone at 11 MHz. All measured data were taken with the chip in 480-MHz IF mode and with the digital receiver and FEC locked (i.e., all digital circuitry on the chip operating). The power dissipation of the ADC is approximately 160 mW from a 3.3-V supply. Since the 512-MHz mixer was designed to achieve 10-bit linearity, the performance of the analog front end is dominated by that of the ADC.

IV. Digital Receiver

The digital receiver is a BPSK/QPSK/OQPSK receiver capable of variable-rate operation from 1 to 45 MBaud. It consists of a frequency recovery loop, variable-rate digital filters controlled by a timing recovery loop, square-root Nyquist matched filters, a phase tracking loop, and circuitry to control loading the inputs to the Viterbi decoder. A block diagram of the receiver is shown in Fig. 8. The inputs to the frequency recovery loop and phase tracking loop can be taken from several different points in the system, allowing the loops to be operated independently or nested together under software control. This flexibility provides optimal performance of the receiver under varying operating conditions.

The automatic gain control (AGC) loop is a noncoherent loop designed to maintain a constant input power level into the A/D converters. The loop produces a 1-bit $\Delta\Sigma$-modulated output that is filtered off chip by a simple RC low-pass filter, providing a voltage control for the tuner's AGC amplifier. Input for the loop can be taken from either the I-channel or the Q-channel data, or an average of the two. A programmable loop threshold allows the input power level to be specified by the user.

The carrier frequency recovery and phase tracking loops are high-speed all-digital phase/frequency circuits capable of tracking out relatively large amounts of frequency offsets and phase noise such as those contributed by conventional tuners and LNB's. The loops are each filtered by an integral-plus-proportional filter. Programmable integrator and linear coefficients are provided to set the bandwidth of the loops, and a carrier sweep capability is included to reduce acquisition time and avoid all false lock points [2]. The output of the loop filter is used to control a complex derotator [3], providing extremely fine phase and frequency resolution. The phase/frequency recovery loops are capable of removing residual phase and frequency offsets in the signal of up to ± 16 MHz. An important parameter for satellite receivers is acquisition time. The automated frequency recovery loop in this receiver can acquire an input signal with ± 16-MHz offset in less than 50 ms.

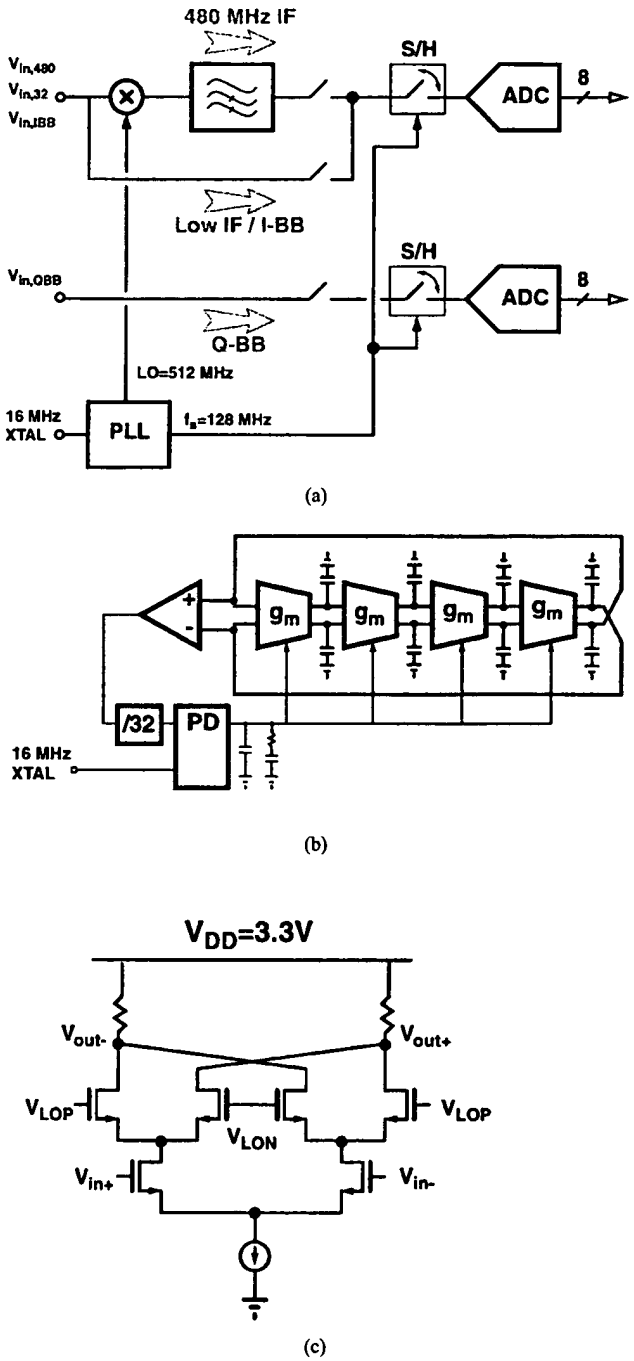


Fig. 5. (a) Analog front end block diagram, (b) PLL block diagram, and (c) CMOS mixer schematic.

The timing recovery loop consists of a timing error discriminant, a loop filter, and a digital timing recovery block, which controls the digital resampler. The timing error discriminant outputs a new value each symbol, which is filtered by a digital integral-plus-proportional low-pass filter. The output of the loop filter is applied to a numerically controlled oscillator, which allows the symbol rate to be varied from 1 to 45 MBaud. The variable-rate interpolation filters [4], which are under the control of the timing recovery loop, resample the input data at the correct frequency and phase to ensure that ideally sampled symbols are input to the matched filters. The matched filters consist of dual square-root Nyquist filters with a programmable 20% or 35% excess bandwidth factor. The output of the Nyquist filters is then scaled to optimally load the Viterbi decoder.

The receiver can also be configured to perform spectral analysis of the input signal with a resolution less than 50 kHz to aid in "blind" acquisition when the carrier frequency and/or symbol rate are not known.

Although the satellite-TV QPSK receiver architecture is similar to that of a quadrature amplitude modulation (QAM) receiver for cable-TV applications [5], there are some significant differences. The first major architectural difference is that the carrier recovery loop must be closed at the front end of the receiver to compensate for the large allowable frequency offset in the input signal (up to ±5 MHz). This frequency offset is introduced in the LNB when the signal is downconverted from 11–12 GHz to 950–2150 MHz. This offset is very small as a percentage of the K-band carrier frequency; however, it is a rather large absolute offset that must be removed at the front of the receiver to ensure that the signal is within the passband of the matched filters. In the case of a cable system, the transmitted signal is typically on a carrier less than 1 GHz so the frequency offsets at the input of the receiver are much smaller. The second major architectural difference is that little or no equalization is required in the satellite-TV receiver. In a cable system, the channel contains many impairments that cause notches in the spectrum and intersymbol interference (ISI). An equalizer is typically required to remove these impairments. In the satellite-TV system, however, cable-type impairments are not typical because the signal is transmitted on a very high-frequency carrier (11–12 GHz) through a "line-of-sight" channel to the receiving antenna. The main impairment in the satellite-TV system is noise in the channel. Since the signal is transmitted from a satellite in orbit many miles from the receiver, it typically has a very low signal-to-noise ratio (SNR) at the input to the receiver (typically 5–10 dB). The cable channel, on the other hand, typically has a very high SNR (~30 dB). The low SNR of the satellite-TV system mandates the use of a lower order modulation format (QPSK) versus the higher order modulation formats used in the cable-TV systems (64/256/1024-QAM). Because of the lower order modulation format, the symbol rate must be increased to achieve comparable bit rates, thus requiring the use of more dedicated hardware (i.e., less hardware sharing in the architecture).

Fig. 9 shows the receiver constellation for a 1-MBaud input signal with no noise, clearly illustrating the wide dynamic range of the 8-bit A/D converters and the datapath in the receiver. The receiver performance including a conventional tuner is typically within 0.2 dB from theory at quasi-error-free operating conditions. Fig. 10 shows measured bit error rate (BER) performance of the receiver for 1-, 20-, and 45-MBaud input signals. All data were taken using the 480-MHz IF input mode with the A/D converter sampling at 128 MHz and include the degradation of a conventional 480-MHz L-band tuner. For all symbol rates, the overall

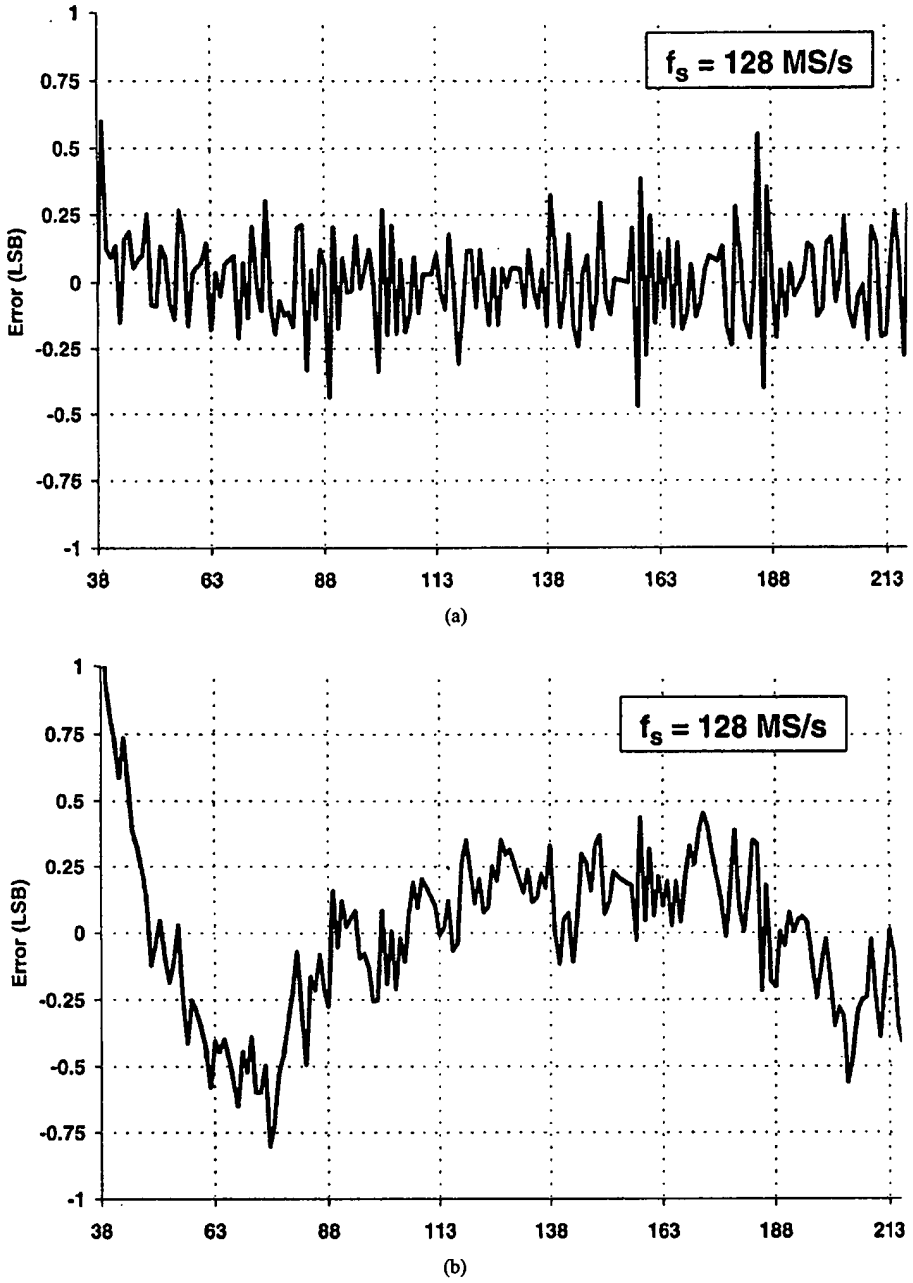


Fig. 6. Measured (a) ADC DNL and (b) ADC INL.

degradation (receiver + tuner) is well within the required DVB limit of 0.8 dB. The best performance occurs at 20 MBaud, approximately in the center of the 1–45-MBaud range. The performance degrades slightly at the two extremes of 1 and 45 MBaud. The degradation at 1 MBaud is primarily due to phase noise in the tuner and finite wordlength effects in the digital filters that recover the symbol timing from the highly oversampled input data (128-MHz sample rate versus 1-MBaud input signal) when adjacent channel interferers are present. The primary cause for the performance degradation at 45 MBaud is that the tuner's 55-MHz SAW filter cuts off some of the excess bandwidth of the input signal. (Note that a 45-MBaud signal shaped by a square-root Nyquist filter with a 0.35 alpha has a bandwidth of 60.75 MHz.) Additionally, the performance of the chip's analog front end degrades as the signal approaches the Nyquist frequency of the A/D converters.

Typical satellite systems operate in extremely noisy environments. Thus, receiver performance under low SNR conditions (i.e., high noise levels) is extremely important. Also, since the tuner's SAW filter bandwidth must be wide enough to pass a 45-MBaud signal, at lower symbol rates significant out-of-band energy is allowed to pass through to the receiver, and sufficient filtering must be performed in the variable-rate

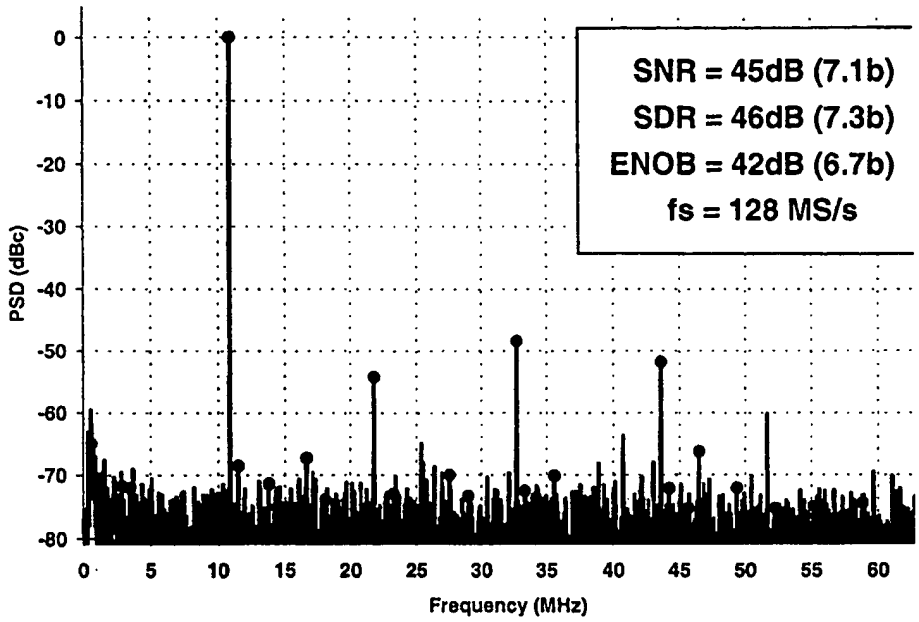


Fig. 7. Measured ADC frequency spectrum for 11-MHz input tone.

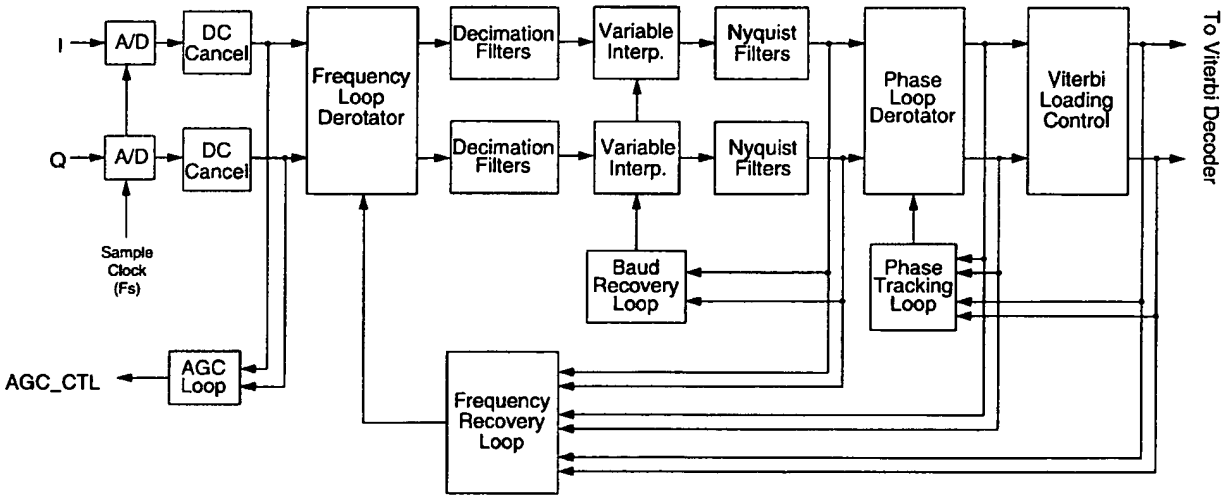


Fig. 8. BPSK/QPSK/OQPSK receiver.

receiver to remove the out-of-band energy. Fig. 11 shows a 4.42-MBaud signal in a 3-dB SNR (0-dB Eb/No) noise environment with two interfering signals within the bandwidth of the A/D converters, each +8 dB higher in power. Measured data show that the receiver's BER degradation due to the interferers is less than 0.1 dB. This is due to the 8-bit resolution of the A/D converters and the advanced multirate digital filtering in the datapath. Under high-noise operating conditions, QPSK receivers also suffer from a phenomenon known as cycle slips, where the receiver instantaneously "slips" phase lock by 90°, 180°, or 270°. The cycle slip cannot be detected by the receiver because it remains in lock, just with a different phase. Cycle slips occur when transmitted symbols repeatedly appear to the receiver as an adjacent symbol because of the additive noise in the channel. As the noise level in the channel increases, the cycle slip rate of the receiver also increases. The IC described in this paper uses two approaches to improve the cycle-slip performance of the receiver. The first is to use a low delay loop for carrier phase tracking (see Fig. 8), which allows for a much wider loop bandwidth and improved phase noise performance. The second improvement is the addition of a nondecision directed phase detector in the carrier tracking loop that has been optimized for low SNR operation [6]. Using these techniques, the receiver is capable of reliably acquiring an input signal at an SNR of 2.0 dB (Eb/No = −1.0 dB) with measured cycle-slip performance better than one slip every three hours using a conventional satellite tuner. Fig. 12 shows measured cycle-slip

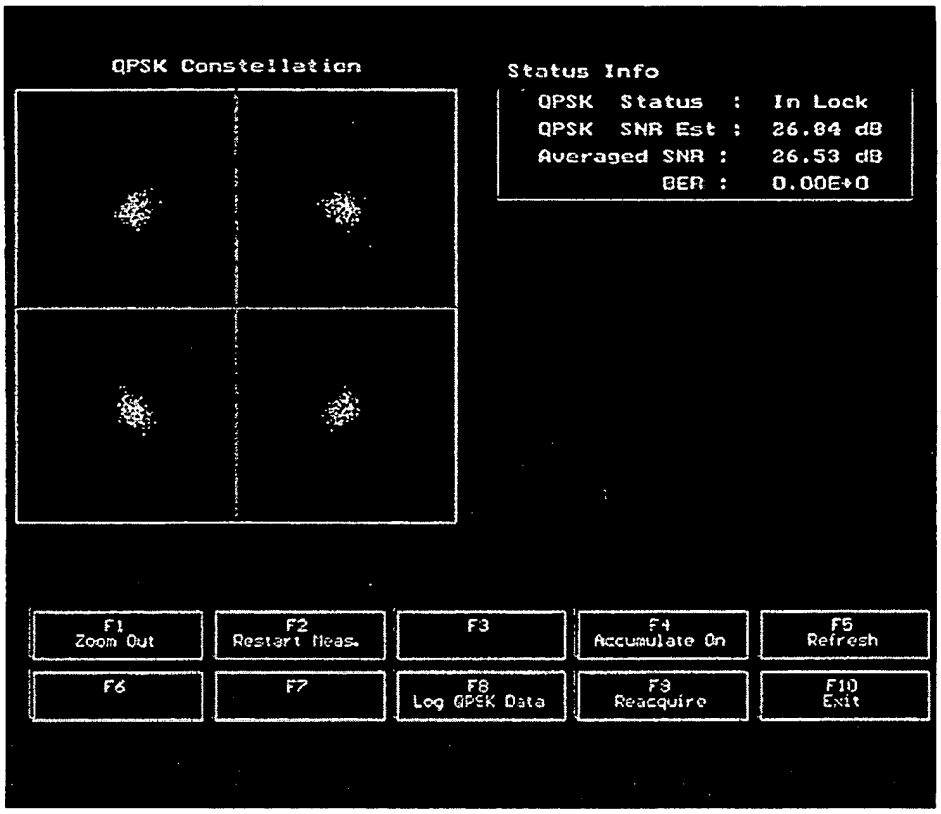


Fig. 9. Receiver constellation for a 1-MBaud input signal with no noise.

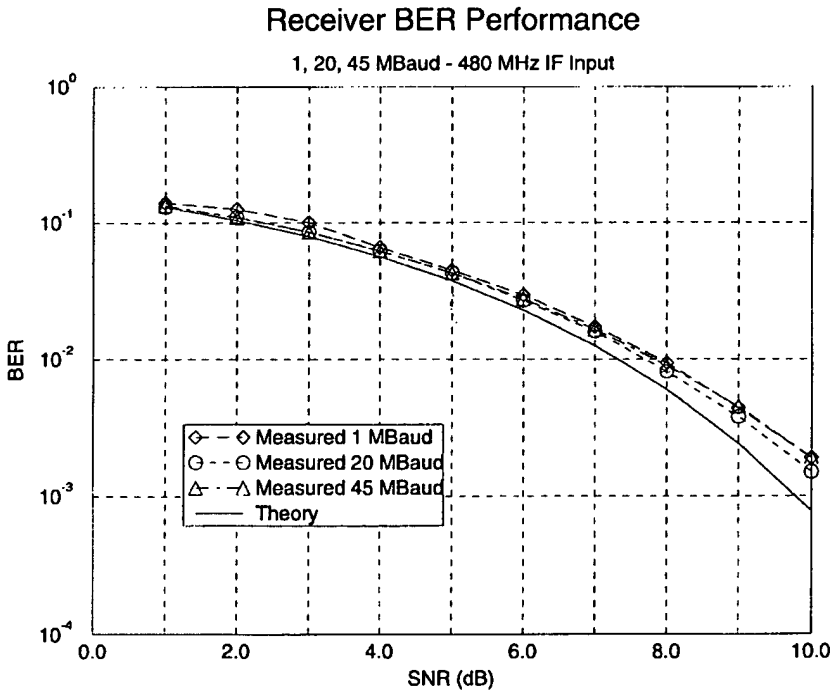


Fig. 10. Receiver BER performance for 1, 20, and 45 MBaud.

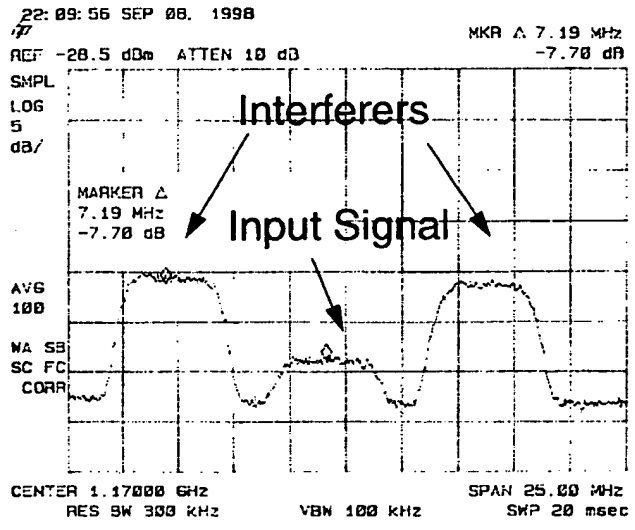


Fig. 11. Input spectrum and QPSK constellation plot for 4.42-MBaud input with +8-dB interferers in 3-dB SNR noise environment.

performance of the receiver versus SNR using the 480-MHz IF input mode with a conventional L-band tuner.

V. Forward Error Correction

Since satellite systems operate in extremely noisy environments, powerful error correction is required to achieve bit error rates appropriate for transmission of digitally compressed video signals. This IC contains an FEC decoder compatible with the European Digital Video Broadcast (DVB), DirecTV Digital Satellite System (DSS), and Primestar DigiCipher I/II forward error correction and framing scheme for satellite transmission. To achieve the level of error detection and correction required, a concatenated FEC code is used. This code is based on convolutional encoding for the inner code and RS encoding for the outer code. Protection against burst errors is achieved using byte interleaving. To support these functions, the decoder consists of five layers: Viterbi decoding, frame synchronization, convolutional deinterleaving, RS error correction, and derandomization.

The Viterbi decoder can decode two families of constraint length $K = 7$, 64-state punctured convolutional codes: the DVB/DSS rate 1/2 (171, 133) code and the DigiCipher I/II rate 1/3 (117, 135, 161) code. The Viterbi decoder consists of a depuncturing block, a dual-rate capable 64-state Viterbi core, and a node synchronization block, as shown in Fig. 13. The depuncturing block supports puncture rates 1/2, 2/3, 3/4, 5/6, 6/7, or 7/8 for the DVB/DSS rate 1/2 code, and puncture rates 5/11, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, or 7/8 for the DigiCipher I/II rate 1/3 code. The depuncture block accepts QPSK, BPSK, or offset QPSK (OQPSK) soft decisions from the receiver and inserts dummy cycles to restore the original rate 1/2 or 1/3 timing relationship before sending the data stream to the Viterbi core. The 64-state Viterbi core design employs a dual-rate capable add-compare-select block that can handle both codes with minimal chip area penalty. The node synchronization block corrects the receiver phase ambiguity and depuncturing timing ambiguity in the decoding process. In the case of a receiver cycle slip, the node synchronization logic will attempt to correct the cycle slip before triggering the resynchronization process. The node synchronization block also provides the capability to automatically scan for the correct puncture rate. The frame synchronization block will recover either MPEG-2 or DSS transport framed data streams as defined in the DVB, DSS, and DigiCipher I/II specifications.

In order to deal with burst errors in the channel, the coded data stream is interleaved so that the bursty channel is transformed into a channel having independent channels. The convolutional deinterleaver supports all of the standards by providing programmable interleaving depths of 1, 2, 3, 4, 6, 12, and 13 and programmable block sizes. The deinterleaving RAM is included on-chip.

The RS decoder supports $t = 8$, $(n, k) = (204, 188)$ or $(146, 130)$; or $t = 5$, $(125\,115)$ systematic Reed–Solomon codes. For DVB, DSS, or DigiCipher II applications, the RS code is a systematic code with 8-bit symbols, shortened from a block length of 255 symbols and correcting up to $t = 8$ symbols per block. The finite field GF (256) is constructed from the primitive polynomial $P(x) = x^8 + x^4 + x^3 + x^2 + 1$. The generator polynomial is $g(x) = (x + \alpha^0)(x + \alpha^1) \cdots (x + \alpha^{15})$. The data randomization block scrambles data with a pseudorandom number sequence for energy dispersal and to ensure a high data transition density for timing recovering purposes.

VI. Chip Performance

The IC has been extensively tested and is being deployed in DBS systems around the world. BER performance of the device has been measured to be well within all DVB, DSS, and DigiCipher I/II specifications. Fig. 14 shows BER performance for 1-, 20-, and 45-MBaud operation at three different Viterbi puncture rates using the 480-MHz IF input mode and a conventional L-band tuner. These performance data span the chip's operating range from 1 to 45 MBaud symbol

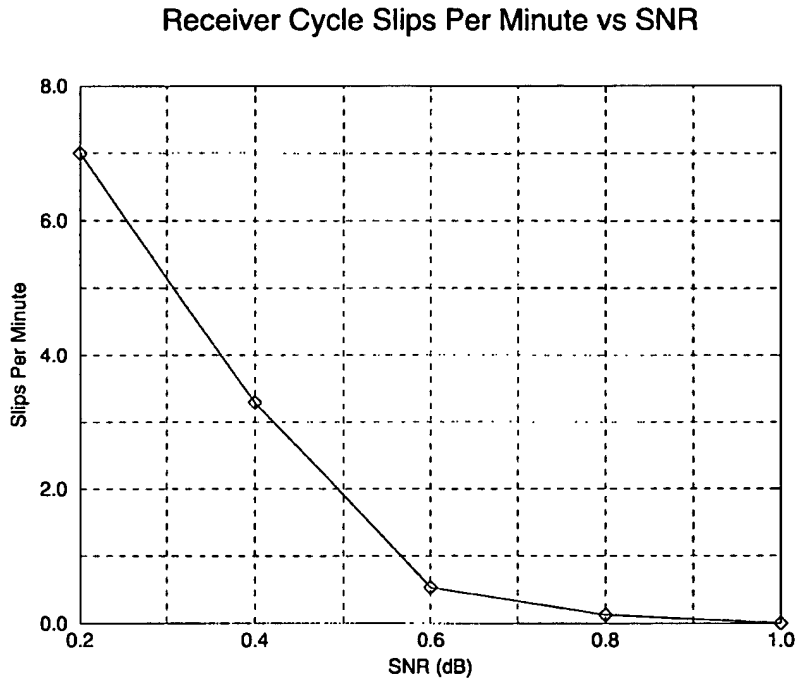


Fig. 12. Receiver cycle-slip performance.

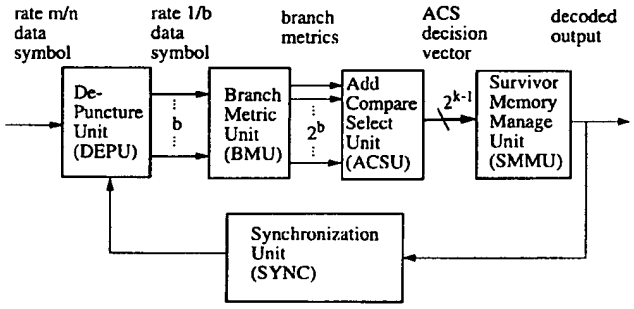


Fig. 13. Viterbi decoder block diagram.

TABLE I
IC SUMMARY

function	BPSK / QPSK / OQPSK satellite receiver and FEC
symbol rate	1 - 45 MBaud variable rate
FEC	DVB / DSS / DigiCipher I/II
sample rate	128 MHz
# of transistors	1.2 million
die area	22 mm^2 (including pads)
technology	0.35-μm single poly, quad metal
power dissipation	2.1W @ 45 MBaud, Fs=128 MHz
package	80-pin PQFP

rates and puncture rates from 1/2 to 7/8. Since the Viterbi and Reed–Solomon decoders are all-digital operations whose performance degradation is independent of the symbol rate, the chip's performance loss is dominated by the performance loss of the receiver. Thus the best performance for the overall chip occurs in the 20-MBaud example with some performance degradation at the two extremes of 1 and 45 MBaud, as was the case for the receiver performance by itself. For all cases, the chip's performance is within the required DVB limit of 0.8-dB loss, including the effects of the L-band 480-MHz tuner.

Fig. 15 shows the chip micrograph. The IC is packaged in an 80-pin PQFP package. Power dissipation is 2.1 W at worst case supply voltage of 3.465 V (3.3 V + 5%) with 128-MHz sample rate and 45-MBaud symbol rate under worst case temperature and process. The power dissipation breakdown is 0.7 W for the analog circuitry and 1.4 W for the digital circuitry.

Table I summarizes the details of the IC.

VII. CONCLUSION

Currently, most satellite tuners output analog I- and Q-waveforms at baseband. The 480-MHz IF mode for the IC

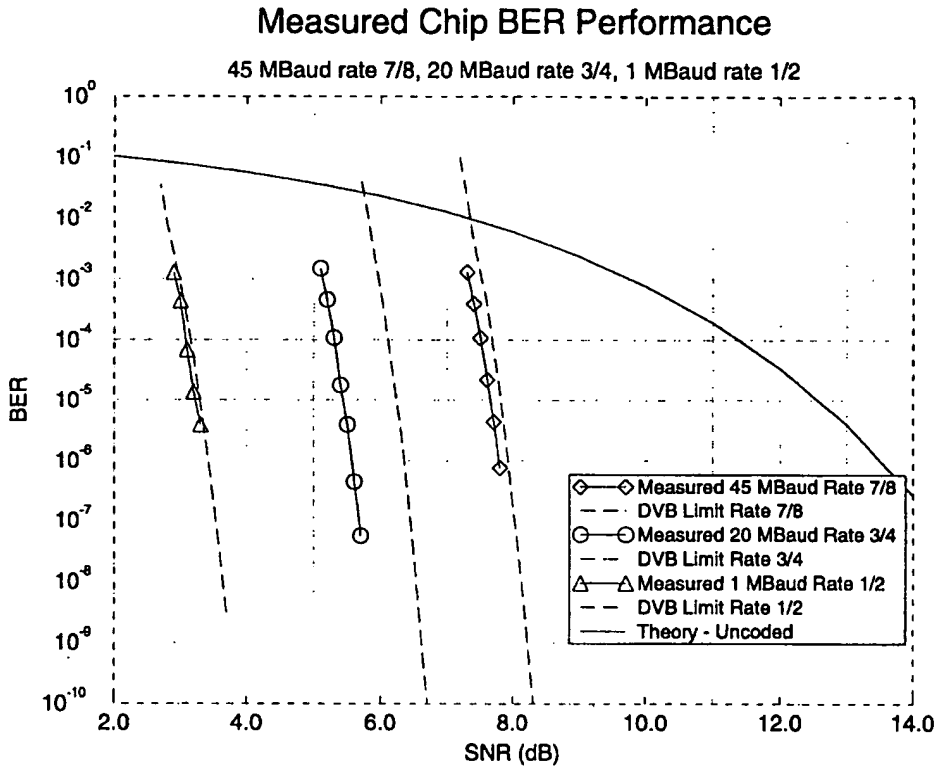


Fig. 14. Overall chip BER performance for 1-MBaud rate 1/2, 20-MBaud rate 3/4, and 45-MBaud rate 7/8 QPSK.

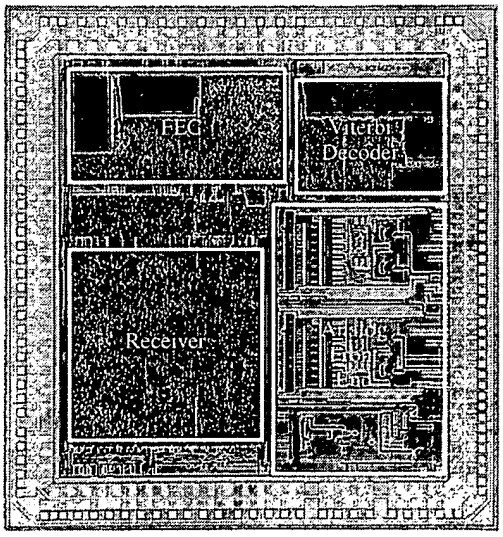


Fig. 15. Chip micrograph.

described above allows the I/Q demodulator in the tuner to be removed, significantly reducing the overall system cost. Similar solutions accepting 480-MHz IF input reported previously have been implemented as two or more chips, with the high-IF analog signal processing being realized in a bipolar IC and the digital signal processing in a CMOS IC [7]. All components of the AFE described above are implemented in a standard digital CMOS process, and all measured system performance data include the effects of digital switching noise on the 480-MHz analog front end.

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Alan Y. Kwentus (S'93–M'95), for for photograph and biography, see p. 1043 of the August 1999 issue of this JOURNAL.

Patrick Pai, photograph and biography not available at the time of publication.

Steve Jaffe, photograph and biography not available at the time of publication.



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Klaas Bult, photograph and biography not available at the time of publication.



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Charles Reames, photograph and biography not available at the time of publication.



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Semiconductors

PHILIPS

Frequency Shift Keying (FSK) receiver UAA3202M

FEATURES

- Low cost single-chip FSK receiver
- Superheterodyne architecture with high integration level
- Few external low cost components
- Wide supply voltage range
- Low power consumption
- Wide frequency range, 150 to 450 MHz
- High sensitivity
- IF band determined by application
- High selectivity
- Very low spurious radiation, –60 dBm (meets FTZ 17TR2100)
- Automotive temperature range
- Power-down mode
- SSOP20 package.

Applications

- Keyless entry systems
- Car alarm systems
- Remote control systems
- Security systems
- Telemetry systems
- Wireless data transmission
- Domestic appliances.

GENERAL DESCRIPTION

The UAA3202M is a fully integrated single-chip receiver, primarily intended for use in VHF and UHF systems employing direct Frequency Shift Keying (FSK) modulation. The UAA3202M incorporates a SAW stabilized local oscillator, balanced mixer, IF amplifier, limiter, Received Signal Strength Indicator (RSSI), RSSI comparator, FSK demodulator, data filter and data slicer. The device features a power-down mode in order to minimize the average receiver supply current.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage		3.5	–	6	V
I_{CC}	supply current for					
	operating mode on	V_{PWD} = 0 V; R_2 = 560 Ω	2.0	3.4	4.7	mA
	operating mode off	V_{PWD} = V_{CC}	–	3	30	µA
P_{sens}	sensitivity	f_i = 433.92 MHz; f_{mod} = 250 Hz square wave; Δf = ±25 kHz; BER ≤ 3%	–	–	–94	dBm
T_{amb}	operating ambient temperature		–40	–	+85	°C

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
UAA3202M	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1

BLOCK DIAGRAM

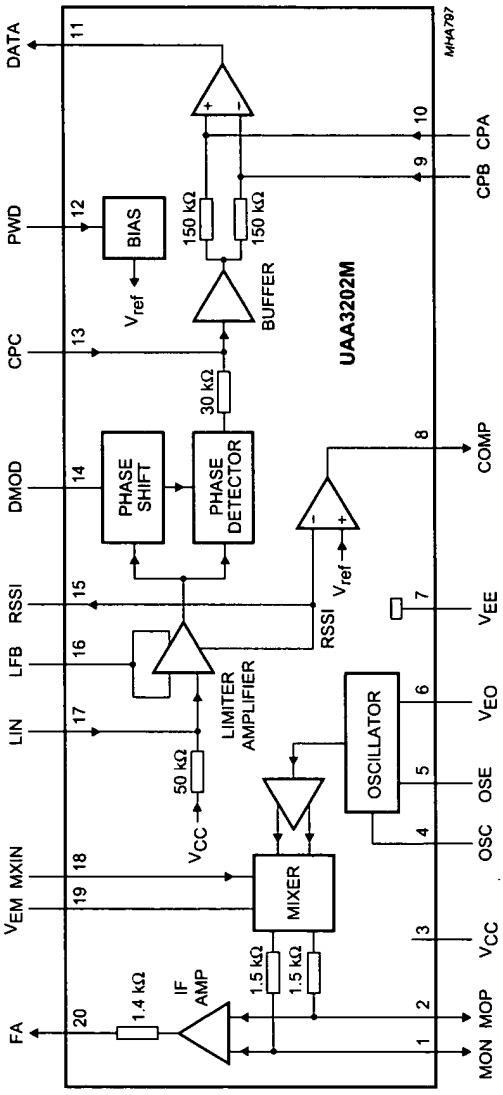


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
MON	1	negative mixer output
MOP	2	positive mixer output
V_{CC}	3	positive supply voltage
OSC	4	oscillator collector
OSE	5	oscillator emitter
V_{EO}	6	negative supply voltage for oscillator
V_{EE}	7	negative supply voltage
COMP	8	RSSI comparator output
CPB	9	comparator input B
CPA	10	comparator input A
DATA	11	data output
PWD	12	power-down control input
CPC	13	comparator input C
DMOD	14	demodulator frequency adjustment
RSSI	15	RSSI current output
LFB	16	limiter feedback
LIN	17	limiter input
MXIN	18	mixer input
V_{EM}	19	negative supply voltage for mixer
FA	20	IF amplifier output

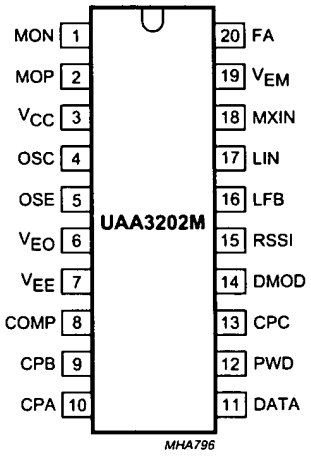


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

The device is based on the superheterodyne architecture incorporating a mixer, local oscillator, IF amplifier, limiter, RSSI, RSSI comparator, FSK demodulator, data filter, data slicer and power-down circuitry. The device employs a low IF frequency of typically 1 MHz in order to allow IF filtering by means of external low cost R, L and C components. If image rejection is required it can be achieved by applying a matching external front-end SAW filter. The device provides a wide IF range of 300 kHz in order to allow the use of a SAW stabilized oscillator.

The on-chip local oscillator provides the injection signal for the mixer. Tuning of the on-chip local oscillator is not necessary. The oscillator frequency is determined by an external 1-port SAW resonator. The RF input signal is fed to the mixer and down converted to the IF frequency. After amplification and filtering the RF signal is applied to a limiter. The IF filter order and characteristics are determined by the external low cost R, L and C components. The limiter amplifier provides a RSSI signal which can be routed to an on-chip RSSI level comparator in order to derive a field strength indication for external use. The limited IF signal is fed to the FSK demodulator. The demodulator centre frequency is determined by an external capacitor. No alignment is necessary for the FSK demodulator. After filtering the demodulated data signal is fed to a data slicer and is made available at the data output. The data filter characteristics are determined by external capacitors. The data slicer employs an adaptive slice reference in order to track frequency offsets.

The device is switched from power-down to operating mode and vice versa by means of a control input. Extremely low supply current is drawn when the device is in power-down mode. Measures are taken to allow fast receiver settling when the device is switched from power-down to operating mode.

Mixer

The mixer is a single balanced emitter coupled mixer with internal biasing. Matching of the RF source impedance to the mixer input requires an external matching network.

Oscillator

The oscillator consists of an on-chip transistor in common base configuration. An external tank and SAW resonator determines the oscillator frequency. Oscillator alignment is not necessary. Oscillator bias is controlled by an external resistor.

Post mixer amplifier

The Post Mixer Amplifier (PMA) is a differential input, single-ended output amplifier. It separates the first and second IF filters from each other. Amplifier gain is provided in order to reduce the influence of the limiter noise figure on the total noise figure.

Limiter

The limiter is a single-ended input multiple stage amplifier with high total gain. Amplifier stability is achieved by means of an external DC feedback capacitor, which is also used to determine the lower limiter cut-off frequency. An RSSI signal proportional to the limiter input signal is provided.

IF filters

IF filtering with high selectivity is realized by means of external low cost R, L and C components. The first IF filter is located directly following the mixer output. An external L/C network assembles a band-pass with low sensitivity in order to meet the bandwidth of an elliptic low-pass filter external to the device and is located in front of the limiter. The filter source impedance is determined by the drive impedance of the IF amplifier. In order to improve the IF filter selectivity below the pass-band a high-pass characteristic is added by means of a DC blocking capacitor in front of the limiter input and by means of the limiter DC feedback capacitor.

RSSI

The RSSI signal is a current proportional to the limiter input level (RF input power). By means of an external resistor the resulting RSSI voltage level is set in order to fit the application. The RSSI voltage is available to external circuits and is fed to the input of the RSSI level comparator. For RSSI filtering an external capacitor is connected.

RSSI level comparator

The RSSI level comparator compares the RSSI level with a fixed and independent internal reference voltage. If the RSSI level exceeds the internal reference voltage a logic HIGH signal is generated. The level comparator provides some hysteresis in order to avoid spurious oscillation. The output of the level comparator is designed as an open-collector with internal pull-up.

FSK demodulator

The limited IF signal is converted into baseband data by means of a quadrature FM demodulator consisting of an all-pass filter and a mixer stage. No alignment of the demodulator is necessary. The demodulator centre frequency is set by a capacitor external to the device. The demodulator provides a large audio bandwidth in order to allow high data rate applications.
The demodulator can detect a small IF frequency deviation even if a relatively large IF frequency offset is encountered.

Data filters

After demodulation a two-stage data filtering circuit is provided in order to suppress unwanted frequency components. Two R/C low-pass filters with on-chip resistors are provided which are separated by a buffer stage.

Data slicer

Data detection is provided by means of a level comparator with adaptive slice reference. After the first data filter stage the pre-filtered data is split into two parts. One part passes the second data filter stage and is fed to the positive comparator input.

The other path is fed to an integration circuit with a large time constant in order to derive the average value (DC component) as an adaptive slice reference which is presented to the negative comparator input. The adaptive reference enables the received data over a large range of demodulator frequency offsets to be detected.
The integration circuit consists of a simple R/C low-pass filter with on-chip resistor. The level comparator output is designed as an open-collector with internal pull-up.

Power-down circuitry

The device provides a power-down mode. While in power-down mode the device disables the majority of the internal circuits and consumes extremely low current. Measures are taken to allow fast receiver settling when normal operation is resumed. Thus circuits with large time constants are only powered down partly or provide a high impedance during power-down in order to avoid the discharge of external capacitors as much as possible. Power-down mode is entered when the control input is active HIGH. The control input provides an internal pull-up resistor of high impedance.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	supply voltage		−0.3	+8.0	V
T_{amb}	operating ambient temperature		−40	+85	°C
T_{stg}	storage temperature		−55	+125	°C
V_{esd}	electrostatic handling	note 1			
	pins 4 and 5		−2000	+1500	V
	pins 18 and 19		−1500	+2000	V
	all other pins		−2000	+2000	V

Note

1. Human body model: equivalent to discharging a 100 pF capacitor through a 1.5 kΩ series resistor.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air	125	K/W

DC CHARACTERISTICS

V_{CC} = 3.5 V; T_{amb} = 25 °C; for application diagram see Fig.11; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supplies						
V_{CC}	supply voltage		3.5	–	6	V
I_{CC}	supply current for	note 1				
	operating mode on	V_{PWD} = 0 V; R_2 = 560 Ω	2.0	3.4	4.7	mA
	operating mode off	$V_{PWD} = V_{CC}$	–	3	30	µA
$V_{PWD(on)}$	PWD voltage for operating mode ON		0	–	300	mV
$V_{PWD(off)}$	PWD voltage for operating mode OFF		V_{CC} – 0.3	–	V_{CC}	V
$I_{PWD(on)}$	PWD current for operating mode ON	V_{PWD} = 0 V	–30	–10	–3	µA
$I_{PWD(off)}$	PWD current for operating mode OFF	$V_{PWD} = V_{CC}$	–	1	3	µA
Oscillator						
$V_{OSC(DC)}$	DC operating point pin 4		3.28	3.34	3.40	V
Mixer						
$V_{MXIN(DC)}$	DC operating point pin 18		0.68	0.78	0.88	V
$V_{MOP(DC)}$	DC operating point pin 2		2.78	2.98	3.18	V
$V_{MON(DC)}$	DC operating point pin 1		2.78	2.98	3.18	V
Post mixer amplifier						
$V_{FA(DC)}$	DC operating point pin 20		2.14	2.27	2.40	V
Limiter						
$V_{LIN(DC)}$	DC operating point pin 17		3.45	3.49	3.50	V
$V_{LFB(DC)}$	DC operating point pin 16		2.76	2.81	2.86	V
$V_{RSSI(DC)}$	DC operating point pin 15		2.21	2.36	2.51	V
Demodulator						
$V_{DMOD(DC)}$	DC operating point pin 14		1.63	1.83	2.03	V
Data slicer						
$V_{CPC(DC)}$	DC operating point pin 13	note 2	1.43	1.93	2.43	V
$V_{CPA(DC)}$	DC operating point pin 10	note 2	1.43	1.93	2.43	V
$V_{CPB(DC)}$	DC operating point pin 9	note 2	1.43	1.93	2.43	V
$V_{OH(DAT)}$	HIGH-level data output voltage	I_{DATA} = –10 µA	V_{CC} – 0.5	–	V_{CC}	V
$V_{OL(DAT)}$	LOW-level data output voltage	I_{DATA} = 200 µA	0	–	0.6	V
RSSI comparator						
$V_{OH(RSSI)}$	HIGH-level comparator output voltage	I_{RSSI} = –10 µA	V_{CC} – 0.5	–	V_{CC}	V
$V_{OL(RSSI)}$	LOW-level comparator output voltage	I_{RSSI} = 200 µA	0	–	0.6	V

Notes

1. The given values are valid for the whole temperature range from T_{amb} = –40 to +85 °C.
2. Tune RF input frequency until IF = 1 MHz.

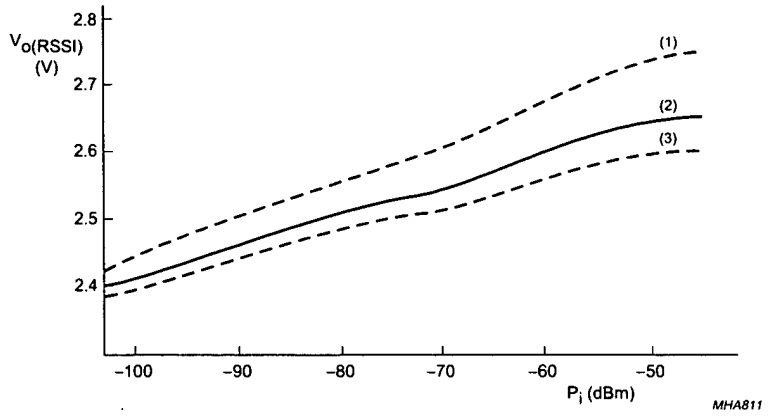
AC CHARACTERISTICS

V_{CC} = 3.5 V; T_{amb} = 25 °C; for application diagram see Fig.11; f_i = 433.92 MHz; Δf = ±25 kHz; f_{mod} = 250 Hz square wave, i.e. 500 bits/s; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
System performance						
P_{sens}	sensitivity	BER ≤ 3%	–	–	–94	dBm
$P_{i(max)}$	maximum input power	BER ≤ 3%	–	–	–30	dBm
α_{rad}	spurious radiation	note 1	–	–	–60	dBm
t_{st}	receiver settling time	$P_i = P_{sens}$ + 10 dB; see Fig.5	–	2	5	ms
B_{IF}	IF bandwidth range	$P_i = P_{sens}$ + 3 dB	850	1000	1150	kHz
f_D	data frequency		140	–	250	Hz
Mixer						
G_{mix}	mixer conversion gain		31	33	35	dB
$R_{o(mix)}$	mixer output resistance		2.7	3	3.3	kΩ
Post mixer amplifier						
$IP3_{PMA}$	interception point (mixer + PMA)	note 2	–38	–35	–	dBm
G_{PMA}	PMA gain	note 2	9	10.4	12	dB
$P_{<1dB}$	compression (mixer + PMA)	P_i = –45 dBm	0	–	1	dBm
BW_{PMA}	PMA LP cut-off frequency		5	–	–	MHz
R_{oPMA}	PMA output resistance		1.2	1.4	1.6	kΩ
Limiter						
G_{lim}	limiter gain		60	63.5	67	dB
B_{lim}	limiter LP cut-off frequency		2	5	8	MHz
$R_{i(lim)}$	limiter input resistance		40	50	60	kΩ
Demodulator						
G_{DMOD}	demodulator gain	note 2	0.8	1	1.2	$\frac{mV}{kHz}$
$f_{c(DMOD)}$	demodulator centre frequency		800	1000	1200	kHz
Δf	frequency deviation		20	25	70	kHz
$R_{o(DMOD)}$	demodulator output resistance		24	30	36	kΩ
Data slicer						
B_{DS}	data slicer bandwidth		35	50	–	kHz
$R_{o(DS)}$	data slicer output resistance		120	150	180	kΩ
RSSI comparator						
$V_{o(RSSI)}$	RSSI output voltage	see Fig.3	–	–	–	–
$V_{o(COMP)}$	COMP output voltage	see Fig.4	–	–	–	–
$P_{th(on)}$	threshold for switching COMP output voltage to HIGH		–99.5	–95.5	–91.5	dBm
$P_{hys(W)}$	hysteresis width of COMP output voltage		1	2	4	dBm

Notes

1. Measured at the RF input connector of the test board.
2. Measured at test point A in Fig.11.



(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 RSSI output voltage as a function of RF input power.

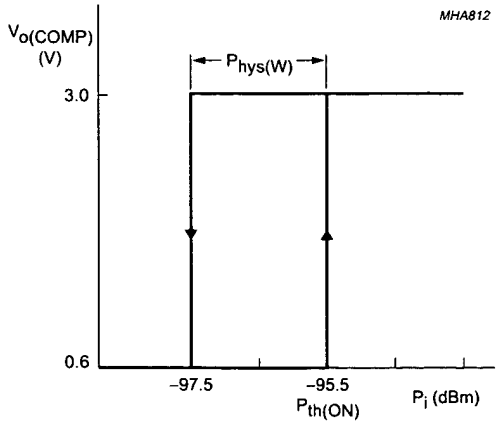
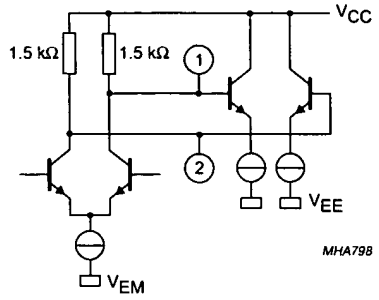
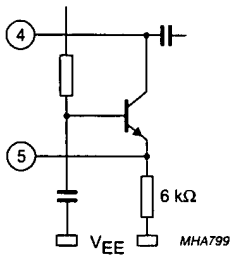
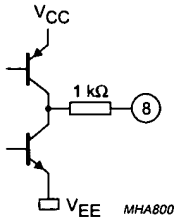
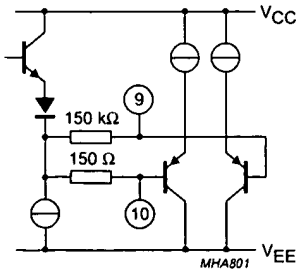
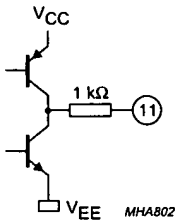
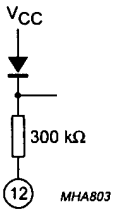
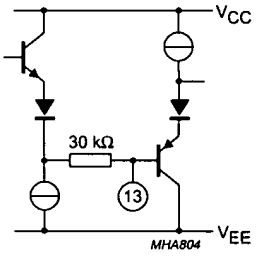
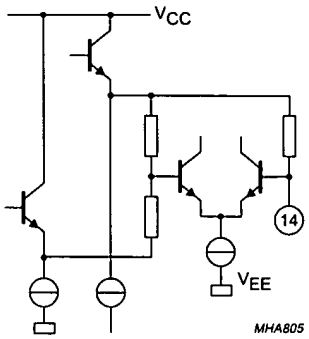


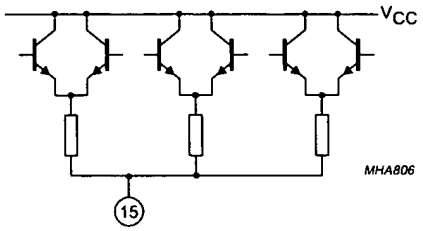
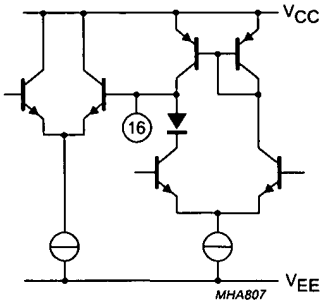
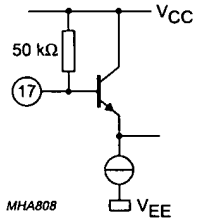
Fig.4 Comparator output voltage as a function of HF input power.

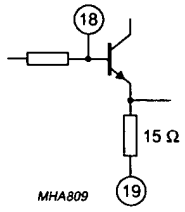
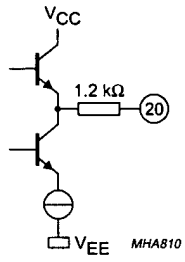
INTERNAL CIRCUITRY

Table 1 Equivalent pin circuits and pin voltages for rough test of printed circuit board; V_{CC} = 3.5 V; no input signal

PIN	SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT
1	MON	2.98	
2	MOP	2.98	
3	V_{CC}	–	
4	OSC	3.34	
5	OSE	–	
6	V_{EO}	0	
7	V_{EE}	0	
8	COMP	–	
9	CPB	1.93	
10	CPA	1.93	

PIN	SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT
11	DATA	–	
12	PWD	–	
13	CPC	1.93	
14	DMOD	1.83	

PIN	SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT
15	RSSI	2.36	
16	LFB	2.81	
17	LIN	3.49	

PIN	SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT
18	MXIN	0.78	
19	V_{EM}	0	
20	FA	2.27	

TEST INFORMATION

Tuning procedure for AC tests

1. Turn on the signal generator (f_i = 433.92 MHz; no modulation; RF input level = –60 dBm).
2. Tune C6 (RF stage input) to obtain a peak voltage on test point A (see Fig.11).
3. Turn on modulation (f_i = 433.92 MHz; f_{mod} = 250 Hz square wave; Δf = 25 kHz; RF input level = –60 dBm).
4. Check that data is appearing on the data output (pin 11) and proceed with the AC tests.

AC test conditions

Table 2 Test signals

The reference signal level P_{ref} for the following tests is defined as the minimum input level in dBm to give a BER $\leq 3 \times 10^{-2}$ (e.g. 15 bit errors per second for 500 bits/s).

TEST SIGNAL	FREQUENCY (MHz)	DATA SIGNAL	MODULATION	FREQUENCY DEVIATION
1	433.92	250 Hz square wave	FM (FSK)	25 kHz
2	433.92	–	no modulation	–
3	433.82	–	no modulation	–

Table 3 Test results

P_1 is the maximum available power from signal generator 1 at the input of the test board; P_2 is the maximum available power from signal generator 2 at the input of the test board.

TEST	GENERATOR		RESULT
	1	2	
Sensitivity into pin MXIN (see Fig.6)	modulated test signal 1; $P_1 \leq -94$ dBm	–	BER $\leq 3 \times 10^{-2}$ (e.g. 15 bit errors per second for 500 bits/s)
Maximum input power (see Fig.6)	modulated test signal 1; $P_1 \geq -30$ dBm (minimum P_{max})	–	BER $\leq 3 \times 10^{-2}$ (e.g. 15 bit errors per second for 500 bits/s)
Receiver turn-on time; note 1	test signal 1; $P_1 = P_{ref} + 10$ dB	–	check that the first 10 bits are correct; error counting is started 10 ms after PWD switched to operating mode: ON
Intercept point (mixer + PMA) see note 2 and Fig.7	test signal 3; $P_1 = -55$ dBm	test signal 2; $P_2 = P_1$	IP3 = $P_1 + \frac{1}{2} \times$ IM3 (dB); IP3 ≥ -38 dBm
Spurious radiation see note 3 and Fig.8	–	–	no spurious radiation (25 MHz – 1 GHz) with level higher than –60 dBm (maximum P_{spur})
1 dB compression point (mixer + PMA) see note 2 and Fig.9	test signal 3; $P_{11} = -70$ dBm; $P_{12} = -45$ dBm (minimum P_{1dB})	–	$(P_{o1} + 70$ dB) – [$P_{o2} + 45$ dB (minimum $P_{1\,dB}$)] ≤ 1 dB, where P_{o1}, P_{o2} is the output power for test signals with P_{11} or P_{12}, respectively

Notes

1. The power-down voltage V_{PWD} alternates between operating mode ON (100 ms) and OFF (100 ms); see Fig.5.
2. Probe of spectrum analyzer connected to test point A.
3. Spectrum analyzer connected to the input of the test board.

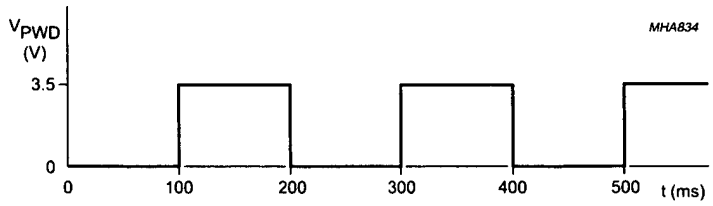
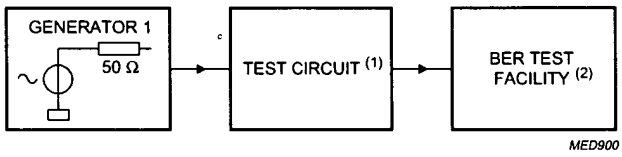
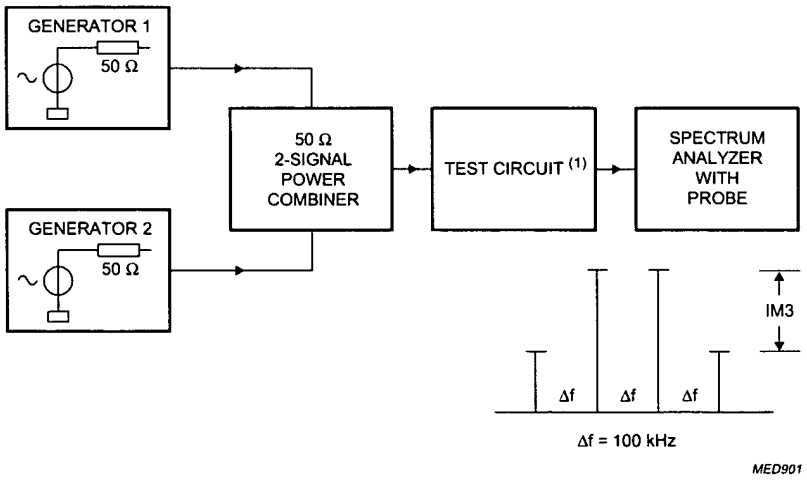


Fig.5 Timing diagram for pulsed power-down voltage.



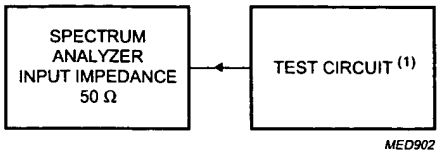
(1) For test circuit see Fig.11.
(2) For BER test facility see Fig.10.

Fig.6 Test configuration A (single generator).



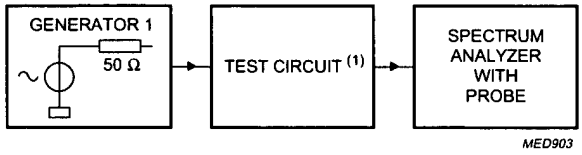
(1) For test circuit see Fig.11.

Fig.7 Test configuration B (IP3).



(1) For test circuit see Fig.11.

Fig.8 Test configuration C (spurious radiation).



(1) For test circuit see Fig.11.

Fig.9 Test configuration D (1 dB compression point).

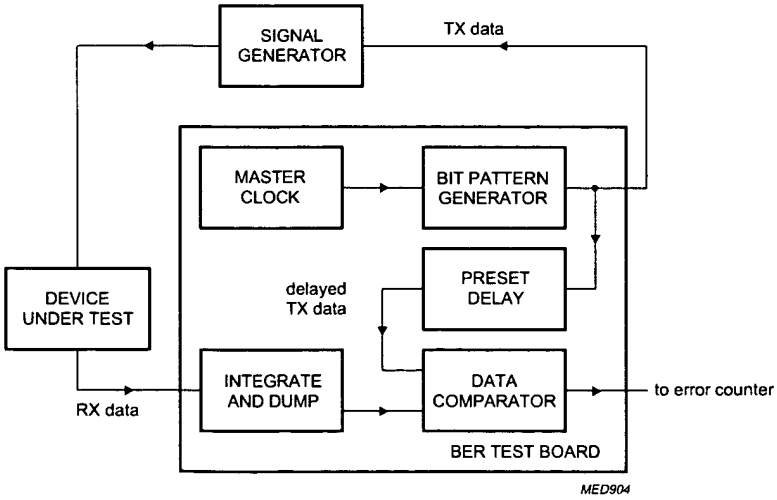


Fig.10 BER test facility.

APPLICATION INFORMATION

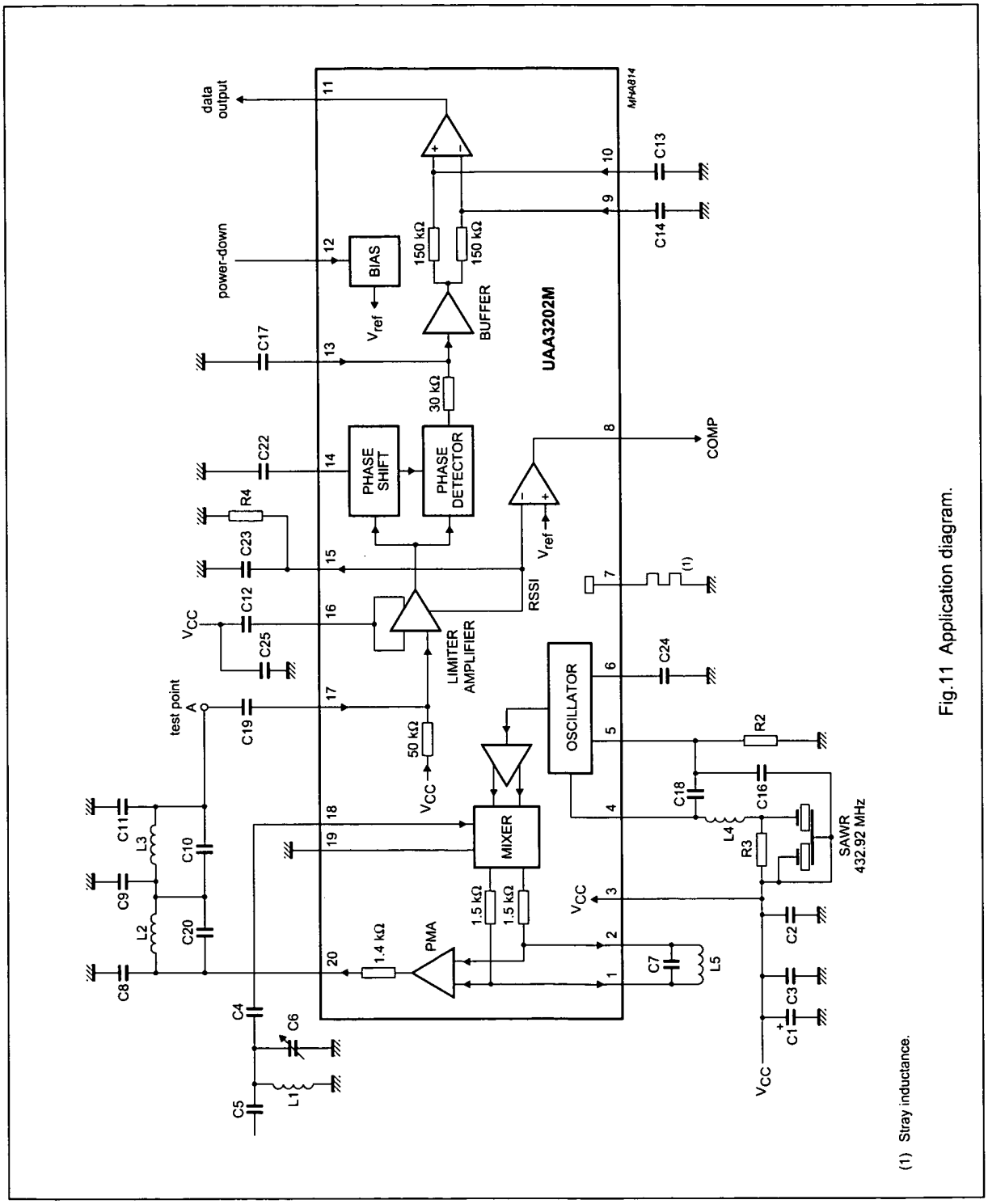


Fig.11 Application diagram.

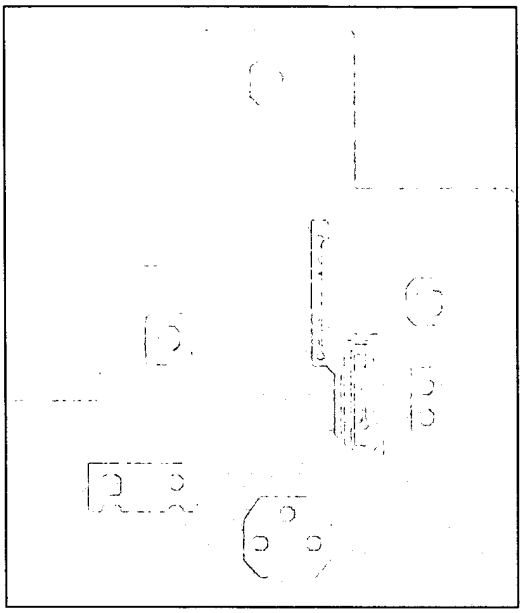
Table 4 Application component list for Fig.11

COMPONENT	VALUE	TOLERANCE	DESCRIPTION
R2	560 Ω	±2%	TC = 50 ppm/K
R3	220 Ω	±2%	TC = 50 ppm/K
R4	820 kΩ	±2%	TC = 50 ppm/K
C1	4.7 µF	±20%	–
C2	150 pF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C3	100 nF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C4	100 pF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C5	2.7 pF	±10%	TC = 0 ±150 ppm/K; $\tan\delta \leq 30 \times 10^{-4}$; f = 1 MHz
C6	3 to 10 pF	–	TC = 0 ±300 ppm/K; $\tan\delta \leq 20 \times 10^{-4}$; f = 1 MHz
C7	56 pF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C8	33 pF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C9	100 pF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C10	5.6 pF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 20 \times 10^{-4}$; f = 1 MHz
C11	100 pF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C12	100 nF	±10%	$\tan\delta \leq 25 \times 10^{-3}$; f = 1 kHz
C13	2.2 nF	±10%	$\tan\delta \leq 25 \times 10^{-3}$; f = 1 kHz
C14	33 nF	±10%	$\tan\delta \leq 25 \times 10^{-3}$; f = 1 kHz
C16	3.9 pF	±10%	TC = 0 ±150 ppm/K; $\tan\delta \leq 30 \times 10^{-4}$; f = 1 MHz
C17	10 nF	±10%	$\tan\delta \leq 25 \times 10^{-3}$; f = 1 kHz
C18	1.8 pF	±10%	TC = 0 ±150 ppm/K; $\tan\delta \leq 30 \times 10^{-4}$; f = 1 MHz
C19	39 pF	±10%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C20	3.3 pF	±10%	TC = 0 ±150 ppm/K; $\tan\delta \leq 30 \times 10^{-4}$; f = 1 MHz
C22	18 pF	±5%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C23	47 nF	±10%	$\tan\delta \leq 25 \times 10^{-3}$; f = 1 kHz
C24	22 pF	±5%	TC = 0 ±30 ppm/K; $\tan\delta \leq 10 \times 10^{-4}$; f = 1 MHz
C25	1 nF	±10%	$\tan\delta \leq 25 \times 10^{-3}$; f = 1 kHz
L1	10 nH	±10%	Q_{min} = 50 to 450 MHz; TC = 25 to 125 ppm/K
L2	150 µH	±10%	Q_{min} = 45 to 800 kHz; $C_{stray} \leq 1$ pF
L3	220 µH	±10%	Q_{min} = 45 to 800 kHz; $C_{stray} \leq 1$ pF
L4	33 nH	±10%	Q_{min} = 45 to 450 MHz; TC = 25 to 125 ppm/K
L5	470 µH	±10%	Q_{min} = 45 to 800 kHz; $C_{stray} \leq 1$ pF

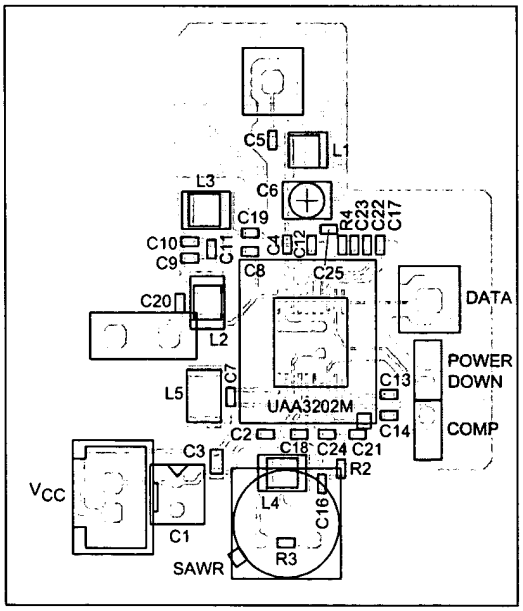
Table 5 Surface Acoustic Wave Resonator (SAWR) data

DESCRIPTION	SPECIFICATION
Type	one-port
Centre frequency	432.92 MHz ±75 kHz
Maximum insertion loss	1.5 dB
Typical loaded Q	1600 (50 Ω load)
Temperature drift	0.032 ppm/K^2
Turnover temperature	43 °C

LAYOUT OF PRINTED-CIRCUIT BOARD FOR AC APPLICATION



a. Copper side.

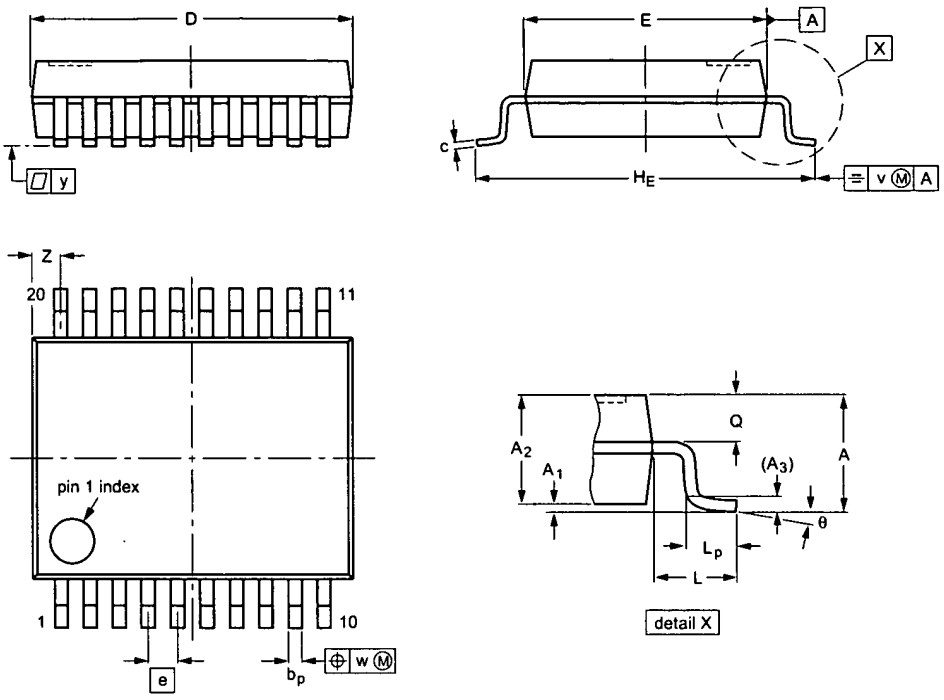


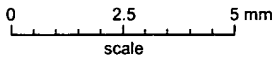
b. Component side.

Fig.12 Printed-circuit board layout.

PACKAGE OUTLINE

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm **SOT339-1**





DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8° 0°

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT339-1		MO-150AE				~~93-09-08~~ 95-02-04

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Reflow soldering

Reflow soldering techniques are suitable for all SSOP packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Wave soldering

Wave soldering is **not** recommended for SSOP packages. This is because of the likelihood of solder bridging due to closely-spaced leads and the possibility of incomplete solder penetration in multi-lead devices.

If wave soldering cannot be avoided, the following conditions must be observed:

- **A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.**
- **The longitudinal axis of the package footprint must be parallel to the solder flow and must incorporate solder thieves at the downstream end.**

Even with these conditions, only consider wave soldering SSOP packages that have a body width of 4.4 mm, that is SSOP16 (SOT369-1) or SSOP20 (SOT266-1).

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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Datasheets for electronics components.

EXHIBIT K

Translation of Abstract for EPO 1009113A1

An improved satellite reception plant, which exhibits: an entrance receipt circuit with converter circuits (9), an electronic control unit (15), and with a data bus for the controlling of several participants/Receiver (13), who at an antenna line (11) is connectable, the data bus consists of a multi-master bus (11 '), about what between the connectable participant/Receiver (13) and the electronic control unit (15) data communication for the control and allocation satellite programs requested of the individual participant/Receiver selected and is feasible, the data bus (11 ') consists of the antenna line (11), and those participants/Receiver (13) are provided with a mechanism to the production and evaluation of a collision protection signal, whereby guaranteed it is that at a certain time communication with the CONTROLLER (156) is out feasible on the part of only one participant/Receivers (13).

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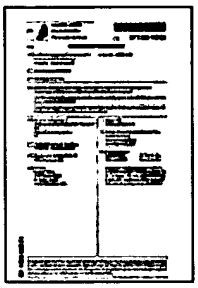
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Title: **EP1009113B1: Satellite communication system, in particular satellite receiving system and method for management of an antenna receiving system**[German][French]

Derwent Title: Satellite reception installation with associated data bus [Derwent Record]

Country: **EP** European Patent Office (EPO)
Kind: **B1** Patent (See also: EP1009113A1)



High Resolution
Low Resolution
18 pages

Inventor: **Ilsanker, Anton**;
Dr. Ephan, Norbert;
Flinner, Udo;

Assignee: **Kathrein-Werke KG**
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Published / Filed: **2001-05-02** / 1998-12-01

Application Number: **EP1998000122808**

IPC Code: Advanced: **H04H 1/00**; **H04H 1/02**; **H04L 12/413**; **H04L 29/12**; **H04N 7/20**;
Core: **H04L 12/407**; more...
IPC-7: **H04H 1/00**;

ECLA Code: **H04H40/20**; H04H1/02; H04L12/413; H04L29/12A; H04N7/20;

Priority Number: 1998-12-01 **EP1998000122808**
1997-11-06 **DE1997019749120**

Abstract: [From equivalent EP1009113A1] Eine verbesserte Satelliten-Empfangsanlage, die aufweist:eine Eingangs-Empfangsschaltung mit Konverterschaltungen (9),einer Steuerungseinheit (15),und mit einem Datenbus zur Steuerung mehrerer Teilnehmer/Receiver (13), die an einer Antennenleitung (11) anschließbar sind,der Datenbus besteht aus einem Multimaster-Bus (11'), worüber zwischen den anschließbaren Teilnehmer/Receivern (13) und der Steuerungseinheit (15) eine Datenkommunikation zur Steuerung und Zuordnung der von den einzelnen Teilnehmer/Receivern ausgewählten und angeforderten Satellitenprogramme durchführbar ist,der Datenbus (11') besteht aus der Antennenleitung (11), unddie Teilnehmer/Receiver (13) sind mit einer Einrichtung zur Erzeugung und Auswertung eines Kollisionsschutz-Signals versehen, wodurch sichergestellt ist, daß zu einem bestimmten Zeitpunkt eine Kommunikation mit dem Controller (156) nur von Seiten

eines einzigen Teilnehmers/Receivers (13) aus durchführbar ist.

Attorney, Agent or Firm: **Flach, Dieter Rolf Paul, Dipl.-Phys.** ;

INPADOC Legal Status: Show legal status actions **Buy Now:** Family Legal Status Report

Designated Country: AT BE CH DE DK ES FR GB GR IE IT LI LU NL PT SE SI

Family: Show 8 known family members

Claims: Hide claims

1. Satellite communication installation, in particular satellite reception installation having a circuit arrangement (1) for selectively receiving electromagnetic waves which are emitted from one or possibly more satellites with vertical and horizontal polarization in a lower or upper frequency band, as appropriate, having the following features:

- - a control unit (15), and
- - a data bus for controlling a plurality of subscribers/receivers (13),

characterized by the following further features:

- - the data bus comprises a common multimaster data bus (11') which can be used to carry out data communication between the connectable subscribers/ receivers (13) and the control unit (15) for the purpose of controlling and allocating the satellite programmes requested and selected by the individual subscribers/receivers;
- - the common multimaster data bus (11') comprises a common antenna line (11), and
- - the subscribers/receivers (13) are provided with a device for producing and evaluating a collision prevention signal which ensures that, at one particular instant, communication with the control unit (15) can be carried out only by a single subscriber/ receiver (13).

2. Satellite communication installation according to Claim 1, characterized in that the device for producing and evaluating a collision prevention signal is designed such that, before a control signal is dispatched, a collision prevention phase preceding the actual control signal is first executed, said collision prevention phase involving the multimaster data bus (11') first being checked for activities of another subscriber/receiver (13) and/or of the control unit (15), with the result that the subscriber/receiver (13) concerned dispatches actual control signals to the control unit (15) only when no activity can be established on the multimaster data bus (11').

3. Satellite communication installation according to Claim 2, characterized in that the collision prevention phase is in at least three parts and, in this context, comprises a first bus activity observation phase for a time period (t0) in which a check is carried out to determine whether other subscribers/receivers (13) or the control unit (15) are active on the multimaster data bus (11'), a subsequent bus request phase with a time period (t2) in which a signal which signals an activity is output to the multimaster data bus (11') by the subscriber/receiver (13), and a subsequent further bus observation phase for a second time period (t2), in which no signal (11) is output to the multimaster data bus (11').

4. Satellite communication installation according to one of Claims 1 to 3, characterized in that the data transmission serving the purpose of

collision prevention on the multimaster bus (11') for controlling the connected subscribers/receivers (13) is based on the basis of a signal changeover, communication between a subscriber/receiver (13) and the control unit (15) being able to be started only when the presence of a predefined signal has first been detected on the multimaster bus (11').

5. Satellite communication installation according to Claim 4, characterized in that the signal changeover is based on the basis of a DC voltage level changeover, communication between a subscriber/receiver (13) and the control unit (15) being able to be started only when the presence of a predefined DC voltage level has first been detected on the multimaster bus (11').

6. Satellite communication installation according to one of Claims 1 to 5, characterized in that the data transmission serving the purpose of collision prevention on the multimaster bus (11') for controlling the connected subscribers/receivers (13) is based on a signal changeover system, communication between a subscriber/receiver (13) and the control unit (15) being able to be carried out only when a predefined signal has been detected on the multimaster bus (11').

7. Satellite communication installation according to Claim 6, characterized in that the signal changeover is based on a DC voltage level changeover system, communication between a subscriber/receiver (13) and the control unit (15) being able to be carried out only when a predefined DC voltage level has been detected on the multimaster bus (11').

8. Satellite communication installation according to one of Claims 1 to 7, characterized in that the connected subscribers/receivers (13) comprise a DC voltage detector device or a DC voltage threshold value discriminator which can be used to recognize the "blocked" or "operational" operating state for the subscriber/receiver (13) concerned on the basis of a DC voltage signal which is higher or lower than a threshold value.

9. Satellite communication installation according to one of Claims 1 to 8, characterized in that the signal structure for data interchange between a subscriber/receiver (13) and the control unit (15) is fundamentally designed such that the actual control signal is preceded by a "header" comprising at least three phases, namely a first bus observation phase for a time period (t0), a subsequent bus request phase for the time period (tl), and a renewed subsequent further bus observation phase for a time period (t2), the bus request phase involving the subscriber/receiver concerned outputting a DC voltage signal to the antenna line (11), i.e. to the bus (11'), for the time period (t1), which indicates bus activity to the other connected subscribers/receivers (13).

10. Satellite communication installation according to one of Claims 1 to 9, characterized in that at least some of the values for the bus observation phase (tO) are preselected or preset to be different for the different subscribers/receivers.

11. Satellite communication installation according to one of Claims 1 to 10, characterized in that, when a subscriber/receiver (13) is newly added or connected, the times (tl, t2) allocated to it in connection with a preceding address allocation for the bus request phase and/or the subsequent second bus activity monitoring phase are set so as to be changed, preferably increased.

12. Satellite communication installation according to one of Claims 1 to 11, characterized in that the time phase (t2) for the second bus observation phase is shorter than the first bus observation phase with the time (tO) for all connected subscribers/receivers (13).

13. Satellite communication installation according to one of Claims 1 to 12, characterized in that all the subscribers/receivers (13) have the same values for the time period (t0) for the first bus observation phase of a signal instruction.

14. Satellite communication installation according to one of Claims 1 to 13, characterized in that the connected subscribers/receivers (13) are designed such that their mode of operation and driving can be implemented on the basis of a DiSEqC protocol.

15. Satellite communication installation according to one of Claims 1 to 14, characterized in that the connected subscribers/receivers (13) are designed such that, once a subscriber/receiver (13) has sent an instruction, no further instruction can be dispatched for a minimum waiting time.

16. Method for operating a satellite communication installation according to one of Claims 1 to 15, characterized in that, before a control signal, in particular an address request signal or a programme instruction signal, is dispatched to the control unit (15) by a receiver, a collision prevention checking method having a collision prevention phase which precedes the actual control signal is first carried out, said collision prevention phase involving the bus (11') first being checked for activities of another subscriber/receiver (13) and/or of the control unit (15), with the result that the subscriber/receiver (13) concerned dispatches actual control signals to the control unit (15) only when no activity can be established on the bus (11').

17. Method according to Claim 16, characterized in that the collision prevention phase is in at least three parts and, in this context, comprises a first bus activity observation phase for a time period (tO) in which a check is carried out to determine whether other subscribers/receivers (13) or the control unit (15) are active on the bus (11'), a subsequent bus request phase with a time period (t2) is carried out [sic] in which a signal which signals an activity is output to the bus (11') by the subscriber/receiver (13), and a subsequent further bus observation phase for a second time period (t2), in which no signal (11) is output to the bus (11').

18. Method according to Claim 16 or 17, characterized in that, once the bus request signal has been output, the subscriber/receiver (13) first changes over to a bus observation phase again, which outputs no signal, in order then to output an address request signal or a programme instruction signal to the controller only when there is no activity observed on the bus (11, 11').

19. Method according to one of Claims 16 to 18, characterized in that the collision prevention checking method takes place with its changeover between two DC voltage values, preferably between a DC voltage value "0" and a DC voltage value which is different from this, and in that the supply of a predefined DC voltage value can be detected by the other connected subscribers/receivers (13) and can be interpreted as bus activity of another connected subscriber/receiver (13) or of the control unit (15), with the result that the output of an individual address request signal or of a programme instruction signal [lacuna] not be started or a preliminary phase serving the purpose of collision prevention must be terminated again.

[German] [French]

Description

Expand description

Die Erfindung betrifft eine Satelliten-Kommunikationsanlage, insbesondere Satelliten-Empfangsanlage, sowie ein zugehöriges Verfahren zu deren Betrieb nach dem Oberbegriff des Anspruches 1 bzw. 16.

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(54) Satelliten-Kommunikationsanlage, insbesondere Satelliten-Empfangsanlage sowie zugehöriges Verfahren zum Betrieb einer Antennen-Empfangsanlage

(57) Eine verbesserte Satelliten-Empfangsanlage, die aufweist:

- eine Eingangs-Empfangsschaltung mit Konverterschaltungen (9),
- einer Steuerungseinheit (15),
- und mit einem Datenbus zur Steuerung mehrerer Teilnehmer/Receiver (13), die an einer Antennenleitung (11) anschließbar sind,
- der Datenbus besteht aus einem Multimaster-Bus (11'), worüber zwischen den anschließbaren Teilnehmer/Receivern (13) und der Steuerungseinheit (15) eine Datenkommunikation zur Steuerung und Zuordnung der von den einzelnen Teilnehmer/Receivern ausgewählten und angeforderten Satellitenprogramme durchführbar ist,
- der Datenbus (11') besteht aus der Antennenleitung (11), und
- die Teilnehmer/Receiver (13) sind mit einer Einrichtung zur Erzeugung und Auswertung eines Kollisionsschutz-Signals versehen, wodurch sichergestellt ist, daß zu einem bestimmten Zeitpunkt eine Kommunikation mit dem Controller (156) nur von Seiten eines einzigen Teilnehmers/Receivers (13) aus durchführbar ist.

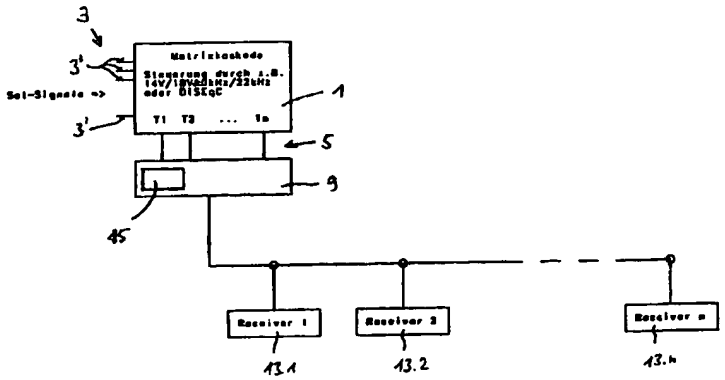


Fig. 1

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Beschreibung

[0001] Die Erfindung betrifft eine Satelliten-Kommunikationsanlage, insbesondere Satelliten-Empfangsanlage, sowie ein zugehöriges Verfahren zu deren Betrieb nach dem Oberbegriff des Anspruches 1 bzw. 12.

[0002] Für die unterschiedlichen Einsatzzwecke sind unterschiedlichste Satellitenanlagen bekannt geworden. Zu den Satellitenanlagen gehören neben den bekannten Satelliten-Empfangsanlagen auch sogenannte Transceiver, die zum Empfangen und Senden dienen, wie aber auch Sendeanlagen. Insbesondere bei Mehrfamilienhäusern kann eine Satelliten-Empfangsanlage mit einer Kopfstation vergleichbar der aus dem Prospekt "Kathrein-Antennen-Electronic", Ausgabe 8/96 bekannten Empfangsanlage UFO eingesetzt werden. Die Empfangsanlage umfaßt in der Kopfstation eine Vielzahl von Konvertern, wobei jeweils ein zu empfangendes Programm mittels eines Konverters in eine terrestrische Empfangs-Frequenz umgesetzt wird. Sollen n verschiedene Programme empfangen werden, so muß die Kopfstation n Receiver aufweisen. Alle angeschlossenen Teilnehmer können dann durch entsprechende Kanalauswahl an ihrem Fernsehgerät oder Videorecorder die entsprechenden Programme empfangen oder aufzeichnen.

[0003] Darüber hinaus ist auch bereits eine sogenannte Kathrein Mini-Ufo-Anlage bekanntgeworden. Diese Anlage umfaßt eine Satelliten-Empfangsanlage, d.h. eine Kopfstation mit für jeden angeschlossenen Teilnehmer einem Receiver, der aber nunmehr teilnehmerabhängig von jedem Teilnehmer angesteuert wird. Dazu ist für jeden Teilnehmer in der Regel in dem Raum, in dem der Fernseher oder Videorecorder aufgestellt ist, ein Infrarot-Steuergerät angeschlossen, worüber die Steuersignale über das 220 V Netz zur Kopfstation, d.h. bis zu den in der Kopfstation vorgesehenen einzelnen Receivern weitergeleitet werden können. Auch wenn beispielsweise über die Satelliten-Empfangsanlage grundsätzlich fünfzig unterschiedliche Satelliten-Programme empfangbar sind, wird bei fünf angeschlossenen Teilnehmer das von jedem Teilnehmer ausgewählte Satellitenprogramm auf eine bestimmte Kanalfrequenz umgesetzt. Sind vier angeschlossene Teilnehmer aktiv, so werden fünf ausgewählte Programme auf fünf unterschiedlichen Kanalfrequenzen über eine Antennenleitung zu den fünf angeschlossenen Teilnehmern weitergeleitet.

[0004] Ansonsten sind Einzel-Empfangsanlagen bekannt, bei welchen jeweils nur ein Teilnehmer über den angeschlossenen Receiver ein von ihm ausgewähltes Programm empfangen kann. Darüber hinaus sind auch sogenannte Twin-Konverter (Twin-LMB) bekannt, um gleichzeitig zwei unterschiedliche Programme empfangen zu können. Dazu ist es jedoch erforderlich, daß die die Konverterschaltung umfassende Eingangsempfangs-Schaltungsanordnung zwei Ableitungen zum angeschlossenen Teilnehmer bzw. Receiver umfaßt, um dann beispielsweise am angeschlossenen Fernsehgerät ein Programm zu empfangen und über ein am Twin-Receiver angeschlossenes Videogerät (VCR) das über die zweite Antennenleitung eingespeiste weitere Programm aufnehmen zu können.

[0005] Auch bei derartigen Einzel-Empfangsanlagen kann durch Einschaltung eines Umschalttones von 0 KHz auf 22 KHz in jedem der beiden Konverterzweige eine Umschaltung von einem unteren auf ein oberes Frequenzband und zum Empfang von vertikalen und horizontalen Polarisationen von dem angeschlossenen Twin-Receiver aus vorgenommen werden.

[0006] Obgleich die beiden erstgenannten Lösungen nur eine einzige Antennenleitung zu der Vielzahl von angeschlossenen Teilnehmern benötigt, sind diese technischen Lösungen jedoch aufwendig und dadurch kostenintensiv. Die zuletzt genannte Twin-Lösung zum Empfang zweier Programme oder die Verwendung einer entsprechenden Umschaltmatrix, von der zu jedem Teilnehmer eine separate Antennenleitung verläuft, ist demgegenüber preislich deutlich günstiger, da hier unterschiedlicher Konverter an jedem Antennenkabel angeschlossen werden können. Das Problem besteht jedoch in der Praxis häufig darin, daß in vielen Häusern zu den angeschlossenen Teilnehmern nicht ausreichend viele Antennenleitungen verlegt sind.

[0007] Schließlich wird auch auf die Vorveröffentlichungen HENNING, KRIEBEL: Digitales Schaltkonzept für Sat-Anlagen, in: Funkschau 1995 Heft 22, S. 58,59 sowie MÜLLER, K.: Sat-Anlagen DiSEqC gesteuert, in: RFE 1997, Heft 6, S. 32-34 verwiesen. Aus diesen Druckschriften sind jeweils DiSEqC-gesteuerte Satelliten-Empfangsanlagen bekannt, welche eine Eingangs-Empfangsschaltung, eine Schaltmatrixanordnung (Multischalter) zum auswahlmäßigen Empfang von einem oder mehreren Satelliten mit vertikaler oder horizontaler Polarisation in einem unteren oder oberen Frequenzband sowie eine Steuerungseinheit (in dem Receiver) umfassen. Die Steuerung zwischen der Steuerungseinheit und den separat angeschlossenen Receivern erfolgt jeweils über eine zwischen dem Receiver und der Steuerungseinheit geschaltete Antennenleitung.

[0008] Auch bei diesen Lösungen werden also mehrere Antennenkabel benötigt.

[0009] Aufgabe der vorliegenden Erfindung ist es von daher, eine Satelliten-Anlage, d.h. eine Satelliten-Empfangs- und/oder Sendeanlage bzw. ein zugehöriges Verfahren zu deren Betriebsweise zu schaffen, bei der zwei Teilnehmer und mehr angeschlossen werden können, die gegenüber herkömmlichen Lösungen technisch einfacher und damit günstiger aufgebaut und dadurch letztlich einfacher und kostengünstiger betreibbar ist.

[0010] Die Aufgabe wird erfindungsgemäß bezüglich der Satellitenanlage entsprechend den im Anspruch 1 und bezüglich des Betriebsverfahrens entsprechend den im Anspruch 12 angegebenen Merkmalen gelöst. Vorteilhafte Ausgestaltungen der Erfindung sind in den Unteransprüchen angegeben.

[0011] Die vorliegende Erfindung beschreitet nunmehr einen völlig anderen Weg. Erfindungsgemäß können also

an einer einzigen Antennenleitung z.B. vier oder acht Teilnehmer angeschlossen werden, ohne daß es zu Problemen bezüglich der Datenübertragung und Ansteuerung der Teilnehmer und Zuordnung bestimmter Adressen kommt.

[0012] So kann gemäß der Erfindung beispielsweise in einer Kopfstation ein Konverterblock vorgesehen sein, in welchem für jeden angeschlossenen Teilnehmer eine separate Konverterstufe vorgesehen ist. Dort wird das jeweils vom einzelnen angeschlossenen Teilnehmer ausgewählte Satellitenprogramm, d.h. die entsprechende Satellitenprogramm-Kanalfrequenz in unterschiedliche Kanalfrequenzen mit ausreichendem Frequenzabstand umgesetzt und über eine Summenschaltung mit einem gemeinsamen zu allen Teilnehmern führenden Receiverbus, d.h. einer Antennen-Ableitung eingespeist.

[0013] An dieser Antennenleitung sind dann die verschiedenen Teilnehmer angeschlossen.

[0014] Bevorzugt erfolgt dabei in der jeweiligen Konverterstufe eine Umsetzung in einen einem einzelnen Teilnehmer und damit Receiver zugeordneten Frequenzkanal, der im Bereich der empfangenen Satellitenfrequenzebene liegt, so daß vom Prinzip her teilnehmerseitig herkömmliche Receiver angeschlossen werden können.

[0015] Die angeschlossenen Receiver arbeiten mit einer Controller-Einheit so zusammen, daß mittels eines entsprechenden Receiver-Signals die ihm zugeordnete Konverterstufe so angesteuert wird, daß am entsprechenden Ausgang dieser Konverterstufe des Konverterblockes das ausgewählte Programm auf einen voreingestellten Frequenzkanal umgesetzt und in die alleinige Antennenleitung eingespeist wird. Dazu ist erfindungsgemäß nunmehr ein Datenbus für die Steuerung der angeschlossenen Teilnehmer/Receiver im Zusammenspiel mit der Controller-Einheit vorgesehen, der erfindungsgemäß aus dem Antennenkabel, d.h. üblicherweise aus einem einzigen zu den mehreren angeschlossenen Teilnehmer führenden Antennenkabel besteht. Dieser Datenbus kann als Multimaster-Bus bezeichnet werden, da die angeschlossenen Teilnehmer nicht in einer Master-Slave-Konfigurationen betrieben werden, sondern im Prinzip gleichberechtigt an diesen Multimaster-Bus angeschlossen sind.

[0016] Über diesen Multimaster-Bus ist es dann möglich, vom Controller aus jedem Receiver eine bestimmte Adresse in der Konverterstufe zuzuordnen, so daß über die dem jeweiligen Receiver zugeordnete Konverterstufe ein teilnehmerseitig ausgewähltes Programm auf einen anderen Kanal, d.h. eine andere Kanalfrequenz umsetzt wird, so daß alle angeschlossenen Teilnehmer/Receiver über diesen ihnen zugewiesenen Kanal auswahlmäßig alle über die Satelliten-Empfangsantenne grundsätzlich empfangbaren Programme auswählen und empfangen können. Dem Konverterblock ist eine Matrix vorgeschaltet, die es den einzelnen Teilnehmern, d.h. den angeschlossenen Receivern, unabhängig voneinander erlaubt, jedes beliebige Programm, unabhängig davon, ob es mit vertikaler oder horizontaler Polarisation in einem unteren oder oberen Frequenzband übertragen wird, auszuwählen und zu empfangen.

[0017] Die angeschlossenen Receiver arbeiten mit einer Controller-Einheit so zusammen, daß jeder Receiver nur dann Steuersignale senden und empfangen kann, wenn kein anderer Receiver aktiviert ist bzw. der Controller keine Signale an den Bus abgibt. Erfindungsgemäß sind dazu also Maßnahmen für einen Kollisionsschutz vorgesehen, worüber gewährleistet ist, daß zu einem gegebenen Zeitpunkt immer nur ein Receiver am Bus aktiv sein kann, also Daten aussenden oder vom Controller empfangen kann. Dazu wird der Multimaster-Bus mittels einer Gleichspannungs-Pegelumschaltung so betrieben, daß stets erkennbar ist, ob der Multimaster-Bus zur Übertragung neuer Sendesignale durch einen anderen Receiver betriebsbereit oder gesperrt ist. Sobald ein Receiver Sendesignale an die Controllerstationen abgibt oder von dieser empfängt, ist durch die erwähnte bevorzugt durchgeführte Gleichstrompegelumschaltung der Multimaster-Bus in seinen Zustand "gesperrt" versetzt, so daß andere Receiver nicht in eine Kommunikation mit dem Controller eintreten können.

[0018] In einer bevorzugten Ausführungsform der Erfindung ist das Übertragungsprotokoll so aufgebaut, daß dann, wenn zwei oder drei Receiver gleichzeitig betätigt werden sollten, diese nach einer unterschiedlich eingestellten Zeit jeweils überprüfen, ob noch ein anderer Receiver sich im "Kommunikationsstadium" befindet. Wird dies festgestellt, wird der jeweilige Receiver, der dies erkennt, wieder in seine Ausgangslage zurückgeschaltet und muß einen erneuten Wartezyklus abwarten. Dadurch kann gewährleistet werden, daß stets nur zu einem Zeitpunkt über einen Receiver eine Konverterstufe angesteuert wird.

[0019] Die Erfindung wird nachfolgend anhand eines Ausführungsbeispieles näher erläutert. Dabei zeigen im einzelnen:

Figur 1 : einen grundsätzlichen Aufbau der erfindungsgemäßen Satelliten-Empfangsanlage mit einer Matrixkaskade, an derem Ausgang ein Konverterblock mit einer Vielzahl von erfindungsgemäßen Konverterstufen vorgesehen ist;

Figur 2 : eine auszugsweise detailliertere Wiedergabe des Konverterblockes gemäß Figur 1;

Figur 3 : Struktur eines Befehls für die Multimaster-Kommunikation; und

Figur 4 : ein Beispiel für den erfindungsgemäß vorgesehenen Kollisionsschutz, wenn z.B. zwei Receiver gleichzeitig aktiviert werden.

[0020] In Figur 1 ist eine Matrixanordung 1 mit einem Eingang 3 und einem Ausgang 5 wiedergegeben. Die Matrix kann auch als Matrixkaskade aufgebaut sein, bzw. in der Form von zwei oder mehr nacheinander geschalteten vier x vier-Matrixblöcken. Beispielsweise über vier Eingänge können jeweils das vertikale und das horizontale untere und obere Band der über eine Satellitenposition ausgestrahlten Programme empfangen werden. Die verschiedenen über vertikale oder horizontale Polarisationen empfangenen Frequenzbänder liegen dann an den verschiedenen Eingangsleitungen 3' des Eingangs 3 der Matrix-Anordnung 1 an. Schließlich kann die Matrix-Anordnung so aufgebaut sein, daß eine Steuerung durch Umschaltung von 14 V/18 V und/oder von 0 KHz/22 KHz oder mittels DiSEqC erfolgen kann.

[0021] Auf der Ausgangsseite ist gemäß Figur 1 ein Konverterblock 9 geschaltet, auf den nachfolgend noch anhand von Figur 2 näher eingegangen wird.

[0022] Am Ausgang des Konverterblockes ist eine Antennenleitung, nachfolgend auch kurz Ableitung 11 genannt, angeschlossen, die zu den n-Receivern 13 führt.

[0023] Schließlich ist auch noch eine Steuerungseinheit 15 vorgesehen, die separat zum Konverterblock oder im Konverterblock 9 mit untergebracht sein kann, und die für die Ablaufsteuerung benötigt wird.

[0024] Wie anhand von Figur 2 zu ersehen ist, umfaßt der Konverterblock 9 entsprechend der Anzahl der angeschlossenen Receiver n-Konverterstufen 19. Jede Konverterstufe 19 ist zwischen einem Ausgangsanschluß T_1 bis T_n der Matrixanordnung 1 und einer Summenschaltung 21 vorgesehen, von der dann die erwähnte alleinige Antennenleitung 11 ausgeht, die nachfolgend teilweise auch als Receiverbus 11 bezeichnet wird.

[0025] Um die Matrix zu steuern, muß die Steuereinheit ein Umschaltsignal von 14 Volt bzw. 18 Volt Gleichspannung und ein Tonsignal von wahlweise 0 KHz und beispielsweise 22 KHz abgeben, um darüber die über vertikale oder horizontale Polarisationen in einem unteren oder oberen Frequenzband von einer Satellitenposition empfangenen Programme auszuwählen. Um die entsprechende Ansteuerung in der Matrix-Anordnung 1 in bekannter Weise vorzunehmen, umfaßt jede Konverterstufe 19 einen Spannungsschalter 23 sowie einen nachgeordneten 22 KHz-Modulator 25. Der jeweilige Spannungsschalter 23 und der 22 KHz-Modulator 25 werden vom Controller 15 entsprechend den von den Receivern 13.1 bis 13.n gesendeten Signalen gesteuert. Mit anderen Worten können die Receiver 13 mittels dem DiSEqC-Protokoll den Controller ansteuern, der diese Signale umsetzt bzw. weitergibt und dabei entsprechend dem betreffenden Modulator 22 und den Spannungschalter 23 zur Auswahl und Einstellung eines gewünschten Programmes ansteuert. Ebenso können die Receiver aber herkömmlich mittels einer Gleichspannungsumschaltung und einer Ab- und Zuschaltung eines Frequenztones beispielsweise von 22 KHz arbeiten, um hierüber das gewünschte Programm auszuwählen, wobei dann vom Controller ebenfalls wieder eine entsprechende Umsetzung zur Ansteuerung der Matrix 1 vorgenommen wird. Nur der Vollständigkeit halber wird angemerkt, daß eingangsseitig an einer oder mehrerer kaskadenartig zusammengeschalteter Matrizen beispielsweise auch acht Eingänge vorgesehen sein können, um nicht nur ein oberes und unteres vertikal bzw. horizontal polarisiertes Programm eines Satelliten, sondern Programme von mehreren Satelliten empfangen zu können. Auch hier kann dadurch dann teilnehmerseitig eine Vielfachauswahl vorgenommen werden.

[0026] Wie aus Figur 2 auch ersichtlich ist, umfaßt jede Konverterstufe 19 ferner in Empfangsrichtung folgend parallel zu dem Schaltzweig 27 einen Kondensator 31 zur galvanischen Trennung, einen ersten Mischer 33, einen nachgeschalteten Verstärker 35, einen nochmals nachgeschalteten SAW-Filter 37 sowie einen ausgangsseitig geschalteten weiteren Mischer 39.

[0027] Während der erste Mischer 33 über ein VCO 33a (also einen spannungsgesteuerten Oszillator) mit einer darüber unterschiedlich wählbaren Oszillatorfrequenz betreibbar ist, wird die Oszillatorfrequenz des zweiten Mischers 39 beispielsweise mittels einer festeingestellten Lokaloszillatorfrequenz f_1 bis f_n einem jeweils zugeordneten Lokaloszillators 39a angesteuert. Durch den zwischengeschalteten SAW-Filter 37 kann die kanalbezogene Durchlaßfrequenz von beispielsweise 479,5 MHz eingestellt werden.

[0028] Liegt beispielsweise das gesamte satellitenantennenseitig empfangene Frequenzspektrum zwischen 0,95 GHz bis 2,15 GHz (wobei dieses Frequenzspektrum an jedem Matrix-Ausgang T_1 bis T_n anliegen kann) und ist beispielsweise die Lokaloszillatorfrequenz des ersten variabel einstellbaren Lokaloszillators 33a von 1,4295 GHz bis 2,6295 GHz variierbar, so ist bei der angegebenen Durchlaßfrequenz des Filters 37 und bei einer fest eingestellten Lokaloszillatorfrequenz von beispielsweise 1,4795 GHz der ersten Konverterstufe die variabel einstellbare Lokaloszillatorfrequenz des ersten Mischers 33 so veränderbar, daß ein hierüber ausgewähltes Programm auf eine Kanalmittenfrequenz von 1,0 GHz eingestellt wird.

[0029] In der zweiten Konverterstufe 19b ist beispielsweise die ausgangsseitig fest eingestellte Lokaloszillatorfrequenz auf 1,5295 GHz eingestellt, also um 0,05 GHz höher. Dementsprechend wird hier die variabel einstellbare Lokaloszillatorfrequenz des ersten Mischers 33 hierüber so gewählt, daß das auswahlmäßig empfangene Programm mit einer Kanalfrequenz von 1,05 GHz in die gemeinsame Antennenleitung eingespeist wird. Entsprechend werden die fest eingestellten Lokaloszillatorfrequenzen einer jeden nachfolgenden Konverterstufe um 0,05 GHz höher eingestellt, wobei im gezeigten Ausführungsbeispiel die letzte Konverterstufe 19n eine ausgangsseitige Kanalfrequenz von 0 GHz zugewiesen werden kann.

[0030] Nachfolgend wird auf die Steuerung und Betriebsweise der Empfangsanlage näher eingegangen. Anders

als beim bekannten DiSEqC-Steuerungssystem wird hier die Gleichspannungskomponente zur Kommunikation mit verwendet. Dazu muß die Spannung auf dem Bus hochohmig gemessen werden.

[0031] Dabei wird zunächst einmal auf Figur 3 verwiesen, anhand der die Struktur eines Befehls für die Multimaster-Kommunikation erläutert wird.

[0032] Daraus ist zu ersehen, daß die Befehlsstruktur einen sog. "Header", also ein Vorsignal umfaßt, welches sich in drei Zeitabschnitte t0, t1 und t2 gliedert, die allesamt dem Kollisionsschutz dienen (worauf später noch eingegangen wird).

[0033] Daran schließt sich das eigentliche Steuerungssignal z.B. in Form eines Adreßanforderungs- oder Programmbefehl-Signals an, welches sich ebenfalls wieder in die drei Zeitabschnitte t3, t4 und t5 gliedert, wobei t3 und t5 Schutzintervalle darstellen, und im Zeitintervall t4 der eigentliche Signalbefehl, der eine DiSEqC-ähnliche Struktur besitzt, von dem jeweiligen Receiver abgegeben wird.

[0034] Von Seiten der Receiver bzw. des Controllers sind dabei vier Funktionszustände zu unterscheiden, nämlich

- der Zustand im Fall einer erstmaligen Adreßanforderung (nach dem Neuanschließen eines Receivers, oder aber, wenn die bereite früher einmal erhaltenen Adreßdaten nicht mehr zur Verfügung stehen oder gelöscht wurden),
- der Zustand im Fall einer nochmaligen späteren Adreßanforderung (nach dem bereits der jeweilige Receiver früher bereits einmal eine Adresse erhalten hatte),
- der Zustand im Fall eines sog. Programmbefehls, d.h. bei der Übermittlung der Daten bezüglich eines teilnehmerseitig am Receiver ausgewählten gewünschten Programms, und
- der Zustand, wenn ein Receiver das Signal für die Adreßvergabe als Antwort vom Controller 15 erhält.

[0035] Die möglichen Zeiten für die Werte t0 bis t5 können für die unterschiedlichen Multimaster-Kommunikationsbefehle bzw. -signale im gezeigten Ausführungsbeispiel folgende Werte aufweisen:

Erstmalige Adreßanforderung

t0 (ms) : 10
t1 (ms) : 40
t2 (ms) : 0
t3 (ms) : 10
t4 (ms) : 36 (3Byte E2 71 07)
t5 (ms) : 5

Spätere Adreßanforderung:

t0 (ms) : 10
t1 (ms) : 20, 24, 28, 32 (je nach ehemaliger Adresse)
t2 (ms) : 4, 8 (je nach ehemaliger Adresse)
t3 (ms) : 10
t4 (ms) : 36 (3Byte E2 71 F07)
t5 (ms) : 5

Adreßvergabe (Befehl als Antwort vom Controller):

t0 (ms) : 0
t1 (ms) : 0
t2 (ms) : 0
t3 (ms) : 10
t4 (ms) : 60 (5Byte E4 Ax yy zz zz)
t5 (ms) : 4

Programmbefehl:

t0 (ms) : 10
t1 (ms) : 4, 8, 12, 16 (je nach zugeteilter Adresse)
t2 (ms) : 4, 8 (je nach zugeteilter Adresse)
t3 (ms) : 10
t4 (ms) : 60 (5Byte EA Ax Fy zz zz)

t5 (ms) : 5

[0036] Die anhand von Figur 3 wiedergegebene Signalstruktur gilt gleichermaßen für ein von einem Receiver 13 erstmalig abgegebenes Adreßanforderungs-Signal, wie auch im Falle eines späteren Adreßanforderungs-Signals und im Falle eines Signale zur Abgabe eines Programmbefehls (Programmauswahl-Befehl). Lediglich im Falle des Adreßanforderungs-Signals ist das vom Controller als Antwort abgegebene Adreßvergabe-Signal insoweit unterschiedlich gebildet, als dort die Zeiten für t0, t1 und t2 jeweils 0 Sekunden beträgt.

[0037] In der nachfolgenden Tabelle sind Werte für die Zuordnung von Adresse und Kollissionsschutz-Header wiedergegeben, und zwar für den Fall eines Programmbefehls (also von Seiten des Receivers/Teilnehmers eine bestimmte Programm-Vorauswahl getroffen wurde und die Daten an den Controller gesendet werden), wie aber auch für den Fall eines an den Controller abgegebenen Adreßanforderungs-Signals:

Tabellen

Zuordnung von Adresse und Kollisionsschutz-Header				
	Programmbefehl		Adreßanforderung	
	t1 (ms)	t2 (ms)	t1 (ms)	t2 (ms)
A1	4	4	20	4
A2	8	4	24	4
A3	12	4	28	4
A4	16	4	32	4
A5	4	8	20	8
A6	8	8	24	8
A7	12	8	28	8
A8	16	8	32	8

[0038] Die Funktionsweise entsprechend dem in Figur 3 wiedergegebenen Befehl ist folgermaßen:

[0039] Wird ein Receiver erstmals an eine Satellitenanlage angeschlossen, so überprüft er zunächst für eine Busbeobachtungsphase t0 von 10 ms, ob auf dem Bus eine Busaktivität festgestellt wird. Nur wenn auf dem Bus keine Kommunikation stattfindet, also die vom betreffenden Receiver gemessene Gleichspannung auf der Antennenleitung 11, die nachfolgend teilweise auch als Datenbus 11' bezeichnet wird, 0 Volt beträgt (oder einen Wert unterhalb eines Schwellwertes aufweist), so wird dies als "keine Busaktivität" gewertet. Es findet also keine Datenkommunikation auf dem Datenbus 11', d.h. Antennenleitung 11 statt, so daß grundsätzlich die Abgabe eines erstmaligen Adreßanforderungs-Signals, eines sog. Call-for-Address-Befehles möglich ist.

[0040] Nach Ablauf der ersten Busbeobachtungsphase t0 von 10 ms gibt der betreffende Receiver ein Gleichspannungssignal (von beispielsweise 14 V, also über einem Schwellwert liegend) ab, und zwar für eine fest eingestellte Zeit t1 von 40 ms. Diese Phase t1 wird auch als Busanforderungs-Phase bezeichnet, in der ein Signal "High" an den Bus 11' abgegeben wird. Dadurch sollen die anderen Receiver erkennen, daß ein anderer Receiver nunmehr ein Signal zum Controller absenden möchte.

[0041] Sollte in dieser Phase ein anderer Receiver zuschalten, so würde er eine Gleichspannung auf der Antennenleitung 11 detektieren, also feststellen, daß bereits eine Datenkommunikation stattfindet. In diesem Falle würden alle anderen Receiver in "Warteposition" verbleiben, da durch die detektierte Gleichspannung der Datenbus für sie gesperrt ist.

[0042] Hat der Receiver im genannten Beispiel noch nie eine Adresse erhalten (oder ist eine ihm einmal zugewiesene Adresse im Receiver wieder gelöscht worden), so ist für diesen einmaligen Zustand die weiters Busbeobachtungsphase t2 auf 0 ms gesetzt, so daß sofort das eigentliche Steuersignal, hier das "Call-for-Address-Sendesignal" CfA entsprechend dem Zeitraum t3, t4 und t5 an den Controller 15 über die Antennenleitung 11 abgesendet wird.

[0043] Sobald der Controller erkennt, daß nach Ablauf der Zeit t5 das Call-for-Address-Signal abschließend vom Receiver erhalten ist und der Receiver wieder auf den "Low"-Zustand (keine Gleichspannungsfrequenz auf den Bus 11' abgeben) zurückgeschaltet hat, wird ohne Zeitverzögerung sofort vom Controller 15 ein Adreßvergabe-Signal an den betreffenden Receiver zurückgesendet, welches keinen Header aufweist, da entsprechend den oben wiedergegebenen Daten t0 bis t2 jeweils 0 ms betragen.

[0044] Für den Fall, daß sich ein Receiver zwischenzeitlich im Standby Betrieb befand oder ausgeschaltet wurde

und anschließend wieder neu eingeschaltet worden ist, gelten die oben wiedergegebenen Daten nicht für die erstmalige Adreßanforderung, sondern für eine allgemeine (spätere) Adreßanforderung, die sich nur durch die unterschiedlichen Zeiten t1 unterscheiden. Nach erneutem Zuschalten eines Receivers, der schon einmal eine Adresse zugeteilt bekam, werden die Zeiten t1 für den Header für das Adreßanforderungs-Signal aus den Zeiten t1 des diesem Receiver zugeordneten Programmbefehl-Signals hergeleitet, wobei diese ihm jeweils zugeordnete Zeit t1 um 16 ms erhöht wird. Hatte der betreffende, nunmehr wieder zugeschaltete Receiver vorab die Zeit t1 = 8 ms für das Programmbefehl-Signal zugeteilt bekommen, so erhöht sich dadurch die Zeit t1 bei nochmaligem späterem Anschalten für sein Adreßanforderungs-Signal auf t1 = 24 ms u.s.w. und z.b. t2 = 8 ms. Nach dem Busanforderungssignal für die Phase t1 schließt sich somit also noch eine weitere Busaktivitäts-Überprüfungsphase für den Zeitraum t2 an, um nochmals zu überprüfen, daß vor Absendung des eigentlichen Sendesignales (Call-for-Address-Signals oder Programmanforderungs-Signal) kein anderer Receiver vorrangig auf dem Bus aktiv ist.

[0045] Nachdem ein Receiver nach Abgabe eines Call-for-Address-Befehls vom Controller ein Adreßvergabe-Signal erhalten hat, kann er einen Programmbefehl an den Controller abgeben, der von seinem Aufbau und seiner Struktur her ebenfalls dem in Figur 3 wiedergegebenen Befehl für die Multimaster-Kommunikation entspricht. Die einzelnen Werte für t0 bis t5 sind in der oben wiedergegebenen Tabelle "Zuordnung von Adresse und Kollisionsschutz-Header" aufgeführt. Unterschiedlich zu einem Adreßanforderungs-Befehl ist lediglich, daß hier nach Abgabe des Programmbefehls an den Controller vom Controller kein Antwort-Signal abgegeben wird.

[0046] Aus der vorstehend erläuterten Schilderung ergibt, daß bei der Adreßvergabe das Signal folgendes Format hat:

E4 Az yy xx xx

beispielsweise in HEX E4 A8 42 1305 mit der folgenden

Bedeutung:

[0047]

Az	für die Adressen 1...8
A8	Adresse 8
yy	für den Kollisionsschutz, hier im gezeigten Ausführungsbeispiel beispielsweise 42 mit der Bedeutung 14 V 16 ms ein 8 ms Pause
xx xx	die Sat-ZF-Frequenz von 0950 Mhz bis 2150 Mhz und
0000	für nicht umgesetzte Signale, d.h. der Receiver arbeitet normal.

[0048] So können beispielsweise acht verschiedene Kollisionsschutz-Header für Befehle.

11, 12, 21, 22, 31, 32, 41, 42

bestehen, denen beispielsweise (programmtechnisch) folgende Bedeutung zugeordnet werden können:

11: erste Stelle 14 V 4 ms ein, zweite Stelle 4 ms Pause,
42: erste Stelle 14 V 16 ms ein, zweite Stelle 8 ms Pause,

usw.

[0049] Die dem Kollisionsschutz diendene Überprüfungsphase der Busaktivitäten in den Zeitintervallen t0 bis t2 wird nachfolgend anhand von Figur 4 erläutert.

[0050] Figur 4 geht davon aus, daß Receiver 2 bereits angeschaltet ist, also bereits eine Adreßvergabe vom Controller 15 zugeordnet bekam, und daß der Teilhehmer über Receiver 2 versucht, ein neues Programm auszuwählen, so daß Receiver 2 ein neues Programmbefehl-Signal abgeben will. Dazu beobachtet Receiver 2 in der dem Kollisionsschutz dienenden Vorphase t0 = 10 ms, ob eine Datenkommunikation auf der Antennenleitung 11 stattfindet oder nicht. Allenfalls problematisch könnte nunmehr sein, daß zum gleichen Zeitpunkt nunmehr ein zweiter Receiver mit seiner Busüberprüfungsphase beginnt, um nachfolgend ein Adreßanforderungs- oder Programmbefehl-Signal abzugeben. Um dies zu vermeiden, dient das nachfolgende, im Detail erörterte Kollisionsschutz-Verfahren.

[0051] Gemäß dem Ausführungsbeispiel nach Figur 4 wird z.B. gleichzeitig zu dem Zeitpunkt, zu dem Receiver 2 mit der Abgabe seines dem Kollisionsschutz dienenden Header-Signals eines Programmbefehl-Signals beginnen will, eingeschaltet. Hat Receiver 1 in einer vorhergehenden Betriebsphase die Adresse A1 zuerteilt bekommen, so lauteten die alten Daten für das Programmbefehl-signal des Adreßplatzes A1 gemäß der oben wiedergegebenen Tabelle t1 = 4

ms und t2 = 4 ms. Die Zeit für t1 wird dann bei einem erneuten Anschalten des Receivers und dem Versuch der Abgabe eines Call-for-Address-Befehls um 16 ms bezüglich des letzten Programmbefehls erhöht, so daß aus der t1 = 4 ms für den Adreßplatz A1 für die nachfolgende Adreßforderung entsprechend der oben wiedergegebenen Tabelle t1 = 20 ms wird. Dabei wird ferner in dem vorliegenden Beispiel gemäß Figur 4 davon ausgegangen, daß Receiver 2 die Adresse A2 zugewiesen erhielt, dessen Zeiten t1 = 8 ms und t2 = 4 ms betragen.

[0052] Wenn also gemäß Ausführungsbeispiel nach Figur 4 Receiver 2 einen neuen Programmbefehl an den Controller abgeben will und Receiver 1 zum gleichen Zeitpunkt angeschaltet wird (wobei mit einem "*" jeweils der Start einer neuen Sequenz gekennzeichnet ist), so beobachten beide Receiver für die Busbeobachtungsphase t0 = 10 ms, ob auf dem Bus 11 eine Kommunikation zwischen einem anderen Receiver und dem Controller stattfindet. Beide Receiver erkennen jedoch während der Vorphase t0 = 10 ms, daß der Bus in seinem Zustand "low" ist, also keine Gleichspannung auf dem Bus anliegt, also keine Kommunikation stattfindet.

[0053] Nach Ablauf der Zeit t0 schalten von daher beide Receiver gleichzeitig in ihren aktiven Zustand um, geben also ein Gleichspannungssignal an den Bus 11' ab, wodurch grundsätzlich die "Busanforderung" eingeleitet werden soll, d.h. der Versuch, den Bus für andere Receiver zu sperren, um ein Adreßanforderungssignal oder einen Programmbefehl-Signal an den Controller abzugeben.

[0054] Während nunmehr die Busanforderung von Receiver 1 20 ms dauert, bricht Receiver 2 die Befehlssequenz nach 8 ms Busanforderung ab, weil bei Beginn des nachfolgenden erneuten Busbeobachtungszeitraumes t2 das Signal von Receiver 1 noch am Bus anliegt, Receiver 2 also feststellt, daß der Bus zur Kommunikation mit dem Controller nicht frei ist.

[0055] Nach Ablauf der Busaktivität-Beobachtungsphase t1 = 20 ms schaltet Receiver 1 in die Phase t2 um, bei welcher von ihm wiederum kein Gleichspannungssignal an den Bus 11 abgegeben wird. Da auch vom Receiver 2 kein Gleichspannungssignal am Bus anliegt, erkennt Receiver 1, daß er sein Adreßanforderungssignal an die Kopfstation abschicken kann. Sein eigentliches "Call-for-Address-Signal" gemäß der Zeitfolge t3 bis t5 wird von Receiver 1 unmittelbar nach Ablauf der Phase t2 an die Kopfstation (Controller 15) abgesandt. Sofort nachdem Receiver 1 die Befehlssequenz beendet hat, startet die Kopfstation die Signalisierung und weist Receiver 1 eine freie Adresse zu (z. B. A6 mit t1 = 8 ms, t2 = 8 ms).

[0056] Während der gesamten Kommunikationsphase beobachtet Receiver 2, ob an dem Bus ein Gleichspannungssignal anliegt oder nicht. Nachdem Receiver 1 am Ende seiner Busanforderungs-Phase nach Ablauf der Zeit-t1 wieder in seinen Zustand "Low" umgeschaltet hat, also kein Gleichspannungssignal an die Antennenleitung 11 abgegeben hat, hat auch unmittelbar wieder Receiver 2 festgestellt, daß keine Busaktivität stattfindet. Zu diesem Zeitpunkt begann Receiver 2 wieder mit seiner Busbeobachtungsvorphase für die Zeit t0 = 10 ms. Da aber die erneute Busbeobachtungsphase des Receivers 1 nur für den kurzen Zeitraum t2 = 4 ms andauert, wurde Receiver 2 nach Ablauf dieses Zeitraums t2 = 4 ms erneut feststellen, daß ein anderer Receiver wieder bereits ein Gleichspannungssignal an den Bus 11 abgegeben und damit das Antennenkabel 11 für die Datenkommunikation für ihn gesperrt ist. Receiver 2 hat deshalb erneut sein Header-Signal abgebrochen und ist in die Busüberwachungsphase zurückgeschaltet worden.

[0057] Wenn, wie erläutert, das oben erwähnte Antwortsignal, d.h. das vom Controller an den Receiver 1 abgesandte Adreßvergabesignal beendet ist, erkennt Receiver 2 erneut, daß nunmehr der Bus wieder "frei" ist, da kein Gleichspannungssignal am Bus anliegt. Er beginnt (wie nach der Busanforderungsphase t1 des Receivers 1 schon einmal) eine neue mit "*" gekennzeichnete Sequenz, d.h. Receiver 2 startet seine Befehlssequenz erneut. Allerdings startet jetzt auch Receiver 1 mit der ihm vorher vom Controller zugewiesenen Adresse A6 einen Programmbefehl, weil mit dem Einschalten auch ein Programm eingestellt wird. Beide Receiver starten mit der Busbeobachtungs-Vorphase t0 = 10 ms, wobei auch die Busanforderungsphase ts = 8 ms bei beiden Receivern identisch ist. Im nachfolgenden Beobachtungsintervall t2 muß jedoch Receicer 1 die Befehlssequenz abbrechen, weil Receiver 2 schon nach t2 = 4 ms mit der Aussendung seines eigentlichen Programm-Signals beginnt. Erst wenn Receiver 2 den Befehl abgeschickt hat, startet Receiver 1 erneut seine Befehlssequenz, von dem im Diagramm gemäß Figur 3 nur der Startpunkt in Form eines "*" eingetragen ist.

[0058] Daraus ist also ersichtlich, daß neben dem eigentlichen Call-for-Address-Signal bzw. dem Programmbefehl-Signal die gesamte Struktur des Multimaster-Kommunikationsbefehls eine Vorphase mit der Zeitspanne t0 bis t2 umfaßt, die dem Kollisionsschutz dienen, und von einer anfänglichen Busbeobachtungsphase in eine Busanforderungssignalphase mit erneuter nachfolgender Busüberprüfungsphase gegliedert ist. Durch diesen Kollisionsschutz ist gewährleistet, daß immer nur ein Receiver Befehle an den Controller abgeben und im Falle einer Adreßanforderung unmittelbar danach vom Controller nur einen für ihn bestimmte Adreßplatz erhalten kann.

[0059] Als günstig erweist sich dabei auch, daß die Zeiten t2 für die zweite Busbeobachtungsüberprüfungsphase für alle Receiver kürzer sind als die für alle Receiver verbindliche erste Busbeobachtungsphase t0, die im gezeigten Ausführungsbeispiel 10 ms betragen, wohingegen die Zeiten t2 für alle Receiver kleiner als 10 ms sind. Dadurch konnte auch in dem oben erwähnten Ausführungsbeispiel Receiver 1 problemlos nach erfolgreicher Abgabe seines Header-Signals mit der Absendung seines Adreßanforderungs-Signals fortfahren.

[0060] Ebenso erfolgt der Kollisionsschutz bei einem oder mehreren Receivern, die nur ein Adreßanforderungssi-

gnal abgeben, oder auch im Falle von mehreren Receivern, die nur ein Programmbefehl-Signal zum Controller absenden wollen. Der Kollisionsschutz ist ebenso wirksam, wenn ein oder mehrere Receiver ein Adreßanforderungssignal und andere Receiver gleichzeitig ein Programmbefehl-Signal abgeben wollen.

Patentansprüche

1. Satelliten-Kommunikationsanlage, insbesondere Satelliten-Empfangsanlage mit einer Konverterschaltung (9) und vorzugsweise einer der Konverterschaltung (9) vorgeschalteten Matrixanordnung (1) zum auswahlmäßigen Empfang von elektromagnetischen Wellen, die von einem oder gegebenenfalls mehreren Satelliten mit vertikaler und horizontaler Polarisation gegebenenfalls in einem unteren oder oberen Frequenzband ausgestrahlt werden, mit folgenden Merkmalen:

   - einer Steuerungseinheit (15), und
   - einem Datenbus zur Steuerung mehrerer Teilnehmer/Receiver (13)

   gekennzeichnet durch folgende weitere Merkmale:

   - Der Datenbus umfaßt einen gemeinsamen Multimaster-Datenbus (11'), über welchen eine Datenkommunikation zwischen den anschließbaren Teilnehmern/Receivern (13 und der Steuerungseinheit (15) durchführbar ist zur Steuerung und Zuordnung der von den einzelnen Teilnehmern/Receivern ausgewählten und angeforderten Satellitenprogramme;
   - der gemeinsame Multimaster-Datenbus (11') umfaßt eine gemeinsame Antennenleitung (11), und
   - die Teilnehmer/Receiver (13) sind mit einer Einrichtung zur Erzeugung und Auswertung eines Kollisionsschutz-Signals versehen, welches sicherstellt, daß zu einem bestimmten Zeitpunkt eine Kommunikation mit der Steuerungseinheit (15) nur von Seiten eines einzigen Teilnehmers/Receivers (13) aus durchführbar ist.

2. Satelliten-Kommunikationsanlage nach Anspruch 1, **dadurch gekennzeichnet**, daß die Einrichtung zur Erzeugung und Auswertung eines Kollisionsschutz-Signals so ausfgebaut ist, bzw. derart arbeitet, daß vor der Absendung eines Steuerungssignals zunächst eine dem eigentlichen Steuerungssignal vorgelagerte Kollisionsschutz-Phase durchgeführt wird, in welcher zunächst der Multimaster-Datenbus (11') auf Aktivitäten eines anderen Teilnehmers/Receivers (13) und/oder der Steuereinheit (15) überprüft wird, so daß nur dann, wenn keine Aktivität auf dem Multimaster-Datenbus (11') feststellbar ist, von dem betreffenden Teilnehmer/Receiver (13) eigentliche Steuerungssignale an die Steuerungseinheit (15) abgesendet werden.

3. Satelliten-Kommunikationsanlage nach Anspruch 2, **dadurch gekennzeichnet**, daß die Kollisionsschutz-Phase zumindest dreigegliedert ist und dabei eine erste Busaktivitätsbeobachtungsphase für eine Zeitdauer (t0), in der überprüft wird, ob andere Teilnehmer/Receiver (13) oder die Steuerungseinheit (15) am Multimaster-Datenbus (11') aktiv sind, eine nachfolgende Busanforderungsphase mit einer Zeitdauer (t2), in welcher ein eine Aktivität signalisierendes Signal von dem Teilnehmer/Receiver (13) an den Multimaster-Datenbus (11') abgegeben wird, und eine nachfolgende weitere Busbeaobachtungsphase für eine zweite Zeitdauer (t2) umfaßt, in der kein Signal (11) an den Multimaster-Datenbus (11') abgegeben wird.

4. Satelliten-Kommunikationsanlage nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet**, daß die dem Kollisionschutz dienende Datenübertragung auf dem Multimaster-Bus (11') zur Steuerung der angeschlossenen Teilnehmer/Receiver (13) auf der Basis einer Signal-Umschaltung basiert, wobei eine Kommunikation zwischen einem Teilnehmer/Receiver (13) und der Steuerungseinheit (15) nur dann begonnen werden kann, wenn zunächst auf dem Multimaster-Bus (11') das Vorliegen eines vordefinierten Signals detektiert wurde.

5. Satelliten-Empfangsanlage nach Anspruch 4, **dadurch gekennzeichnet**, daß die Signal-Umschaltung auf der Basis einer Gleichspannungspegel-Umschaltung basiert, wobei eine Kommunikation zwischen einem Teilnehmer/Receiver (13) und der Steuerungseinheit (15) nur dann begonnen werden kann, wenn zunächst auf dem Multimaster-Bus (11') das Vorliegen eines vorderfinierten Gleichspannungspegels detektiert wurde.

6. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet**, daß die angeschlossenen Teilnehmer/Receiver (13) eine Gleichspannungsdetektor-Einrichtung oder Gleichspannungs-Schwellwertdiskriminator umfassen, worüber in Abhängigkeit eines gegenüber einem Schwellwert größeren oder kleineren Gleichspannungssignals der Betriebszustand "gesperrt" oder "betriebsbereit" bei kennzeichnet, daß die dem Kollisionsschutz dienende Datenübertragung auf dem Multimaster-Bus (11') zur Steuerung der angeschlossenen Teilnehmer/Receiver (13) auf der Basis einer Signal-Umschaltung basiert, wobei eine Kommunikation zwischen einem Teilnehmer/Receiver (13) und der Steuerungseinheit (15) nur dann begonnen werden kann, wenn zunächst auf

dem Multimaster-Bus (11') das Vorliegen eines vordefinierten Signals detektiert wurde.

7. Satelliten-Empfangsanlage nach Anspruch 6, **dadurch gekennzeichnet**, daß die Signal-Umschaltung auf der Basis einer Gleichspannungspegel-Umschaltung basiert, wobei eine Kommunikation zwischen einem Teilnehmer/Receiver (13) und der Steuerungseinheit (15) nur dann begonnen werden kann, wenn zunächst auf dem Multimaster-Bus (11') das Vorliegen eines vordefinierten Gleichspannungspegels detektiert wurde.

8. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet**, daß die angeschlossenen Teilnehmer/Receiver (13) eine Gleichspannungsdetektor-Einrichtung oder Gleichspannungs-Schwellwertdiskriminator umfassen, worüber in Abhängigkeit eines gegenüber einem Schwellwert größeren oder kleineren Gleichspannungssignals der Betriebszustand "gesperrt" oder "betriebsbereit" bei dem betreffenden Teilnehmer/Receiver (13) erkennbar ist.

9. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet**, daß die Signalstruktur für Datenaustausch zwischen einem Teilnehmer/Receiver (13) und der Steuerungseinheit (15) grundsätzlich so aufgebaut ist, daß dem eigentlichen Steuerungssignal ein "Header" vorgeschaltet ist, der zumindest drei Phasen umfaßt, nämlich eine erste Busbeobachtungs-Phase für einen Zeitraum (t0), eine nachfolgende Busanforderungsphase für den Zeitraum (t1), und eine erneute nachfolgende weitere Busbeobachtungsphase für einen Zeitraum (t2), wobei in der Busanforderungsphase für den Zeitraum (t1) von dem betreffenden Teilnehmer/Receiver ein Gleichspannersignal an die Antennenleitung (11), d.h. den Bus (11') abgegeben wird, wodurch den anderen angeschlossenen Teilnehmern/Receivern (13) eine Busaktivität angezeigt wird.

10. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet**, daß die Werte für die Busbeobachtungsphase (t_0) für die unterschiedlichen Teilnehmer/Receiver zumindest teilweise unterschiedlich vorgewählt oder voreingestellt sind.

11. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet**, daß bei einer erneuten Zu- oder Anschaltung eines Teilnehmers/Receivers (13) die ihm im Zusammenhang mit einer vorausgegangenen Adreßvergabe zugeordneten Zeiten (t1, t2) für die Busanforderungsphase und/oder die nachfolgende zweite Busaktivitätsüberwachungsphase verändert, vorzugsweise erhöht eingestellt sind.

12. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet**, daß die Zeitphase (t2) für die zweite Busbeobachtungsphase bei allen angeschlossenen Teilnehmern/Receivern (13) kürzer ist als die erste Busbeobachtungsphase mit der Zeit (t0).

13. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 12, **dadurch gekennzeichnet**, daß alle Teilnehmer/Receiver (13) gleiche Werte für die Zeitdauer (t0) für die erste Busbeobachtungsphase eines Signalbefehls aufweisen.

14. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 13, **dadurch gekennzeichnet**, daß die angeschlossenen Teilnehmer/Receiver (13) mittels DiSEqC-Protokolls arbeiten.

15. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 14, **dadurch gekennzeichnet**, daß nach dem Senden eines Befehls durch einen Teilnehmer/Receiver (13) für eine minimale Wartezeit kein weiterer Befehl abgesandt wird.

16. Verfahren zum Betrieb einer Satellitenempfangsanlage nach zumindest einem der Ansprüche 1 bis 15, **dadurch gekennzeichnet**, daß vor der Absendung eines Steuerungssignals, insbesondere eines Andreßanforderungs-Signals oder eines Programmbefehl-Signals von einem Receiver an die Steuerungseinheit (15) zunächst eine dem eigentlichen Steuerungssignal vorgelagerte Kollisionsschutz-Phase durchgeführt wird, in welcher zunächst der Bus (11') auf Aktivitäten eines anderen Teilnehmers/Receivers (13) und/oder des Controllers (15) überprüft wird, so daß nur dann, wenn keine Aktivität auf dem Bus (11') feststellbar ist, von dem betreffenden Teilnehmer/Receiver (13) eigentliche Steuerungssignal an die Steuerungseinheit (15) abgesendet werden.

17. Verfahren nach Anspruch 16, **dadurch gekennzeichnet**, daß die Kollisionsschutz-Phase zumindest dreigliedrig ist, und dabei eine erste Busaktivitätsbeobachtungsphase für eine Zeitdauer (t0), in der überprüft wird, ob andere Teilnehmer/Receiver (13) oder die Steuerungseinheit (15) am Bus (11') aktiv sind, eine nachfolgende Busanforderungsphase mit einer Zeitdauer (t2) durchgeführt wird, in welcher ein eine Aktivität signalisierendes Signal von dem

Teilnehmer/Receiver (13) an den Bus (11') abgegeben wird, und eine nachfolgende weitere Busbeobachtungsphase für eine zweite Zeitdauer (t2) umfaßt, in der kein Signal (11) an den Bus (11') abgegeben wird. daß das Signal, wodurch eine Aktivität auf den Bus (11') signalisiert wird, aus einem Signal, insbesondere einem Gleichspannungssignal (11) besteht.

18. Verfahren nach Anspruch 16 oder 17, **dadurch gekennzeichnet**, daß nach Abgabe des Busanforderungs-Signals der Teilnehmer/Receiver (13) zunächst nochmals in eine kein Signal abgebende Bußbeobachtungsphase umschaltet, um dann lediglich bei nicht beobachteter Aktivität im Bus (11, 11') ein Adreßanforderungs-Signal oder ein Programmbefehl-Signal an den Controller abzugeben.

19. Verfahren nach einem der Ansprüche 16 bis 18, **dadurch gekennzeichnet**, daß das Kollisionsschutz-Prüfverfahren mit seiner Umschaltung zwischen zwei Gleichspannungswerten, vorzugsweise zwischen einem Gleichspannungswert "0" und einem davon abweichenden Gleichspannungswert erfolgt, und daß die Einspeisung eines vordefinierten Gleichspannungswertes durch die anderen angeschlossenen Teilnehmer/Receiver (13) detektierbar und als Busaktivität eines anderen angeschlossenen Teilnehmer/Receivers (13) oder der Steuerungseinheit (15) interpretierbar ist, mit der Folge, daß mit der Abgabe eines eigenen Adreßanforderungs-Signals oder eines Programmbefehl-Signals nicht begonnen oder eine dem Kollisionsschutz dienende Vorphase wieder abgebrochen werden muß.

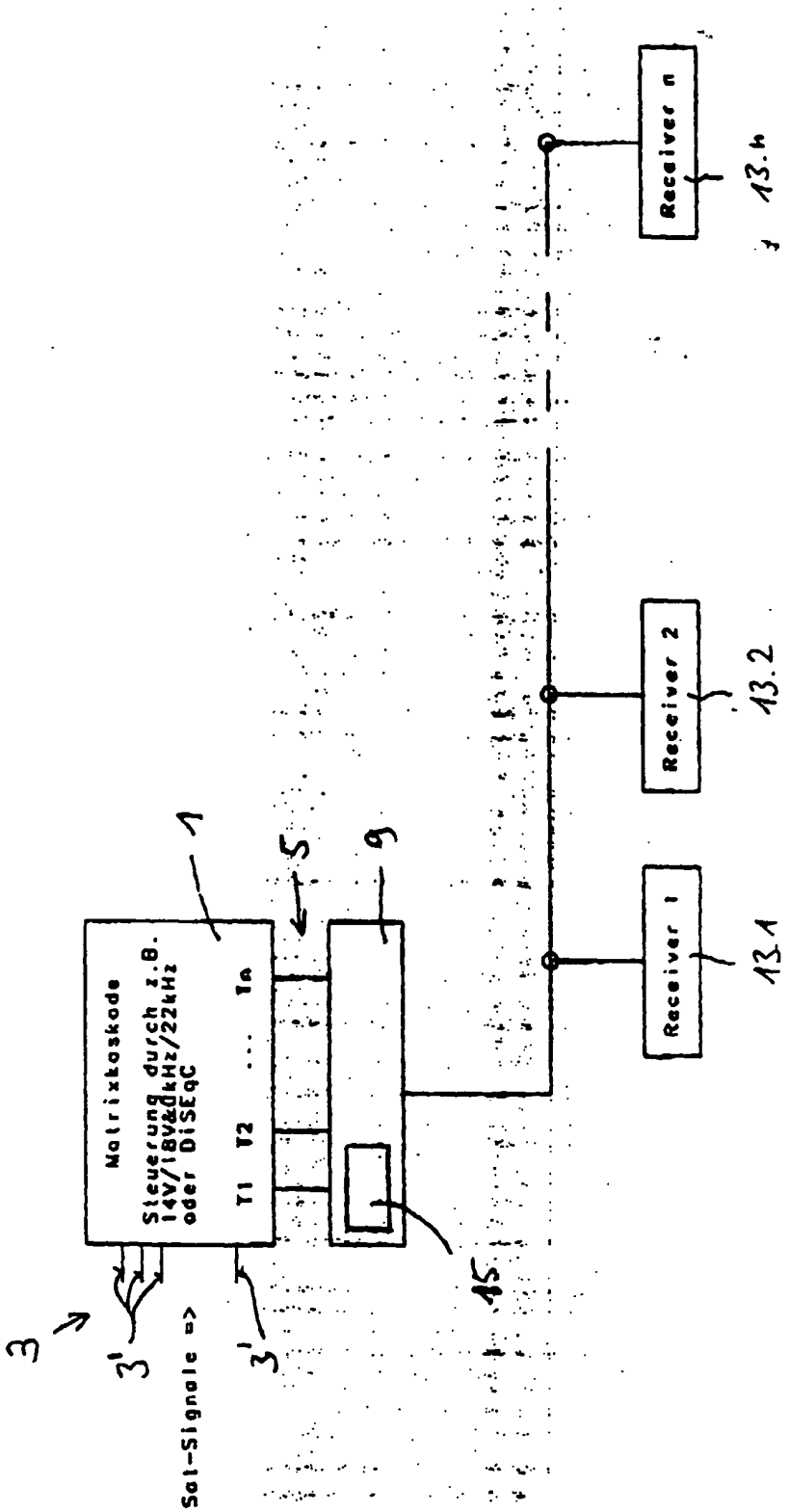

Matrixkoskode
Steuerung durch z.B.
14V/18V&0kHz/22kHz
oder DiSEqC
T1 T2 ... Tn
Sat-Signale =>
3
3'
3'
1
5
9
15
Receiver 1
Receiver 2
Receiver n
13.1
13.2
13.n

Fig. 1

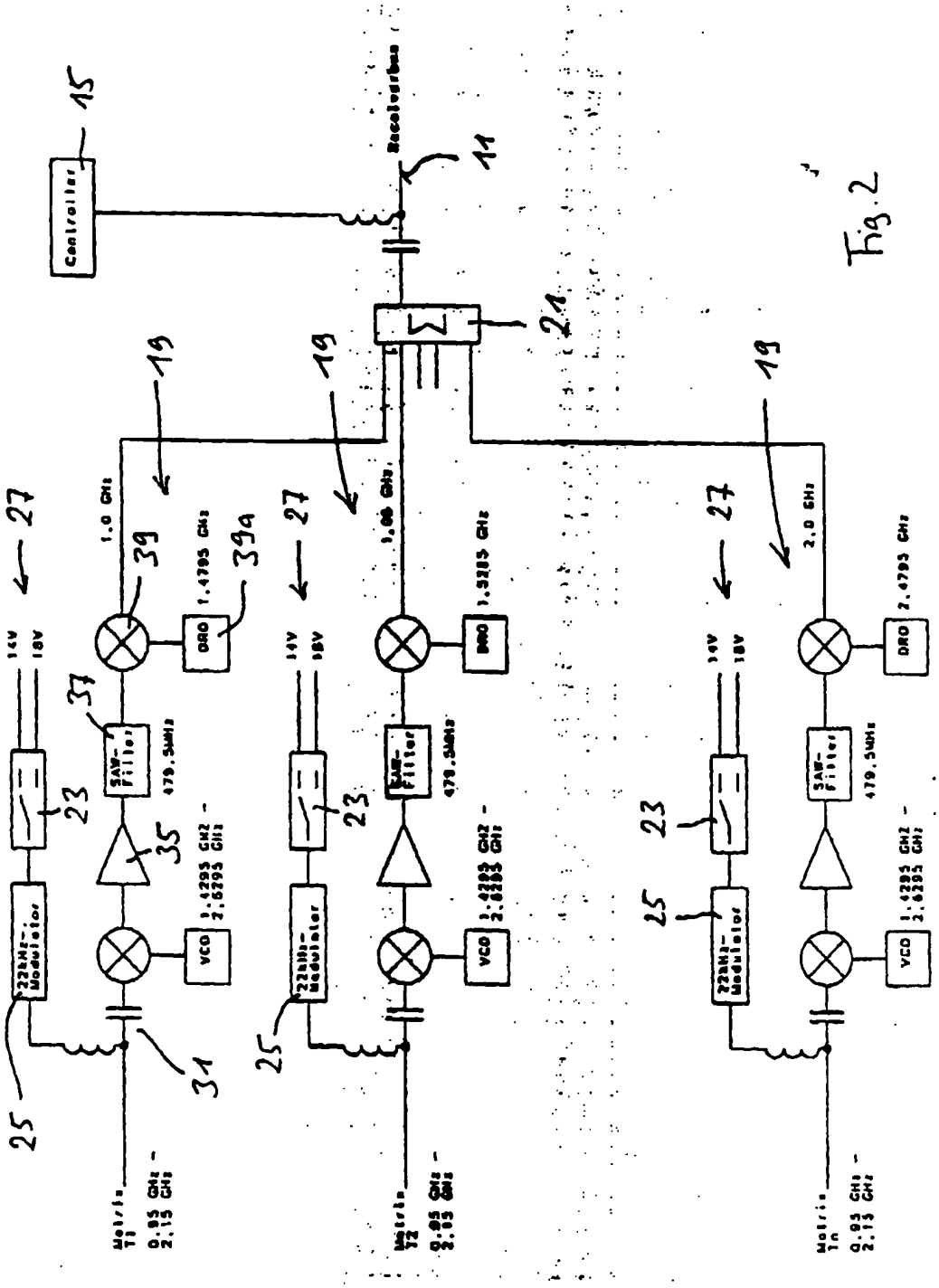

Controller
15
Receiverbus
11
21
19
19
19
27
27
27
1.0 GHz
1.4795 GHz
1.3285 GHz
2.0 GHz
2.4795 GHz
39
39a
37
23
35
31
25
14V
18V
SAW-Filter
479.5MHz
DRO
VCO
22kHz-Modulator
Matrix
0.95 GHz - 2.15 GHz

Fig. 2

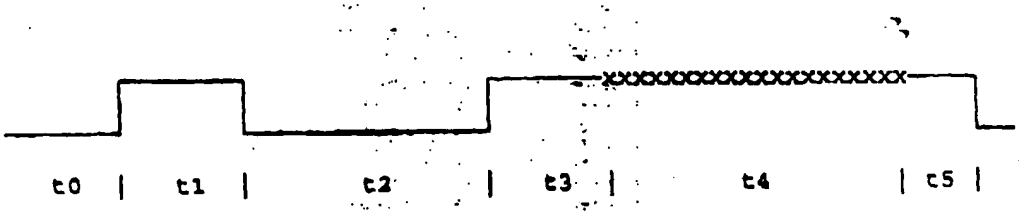


Fig. 3

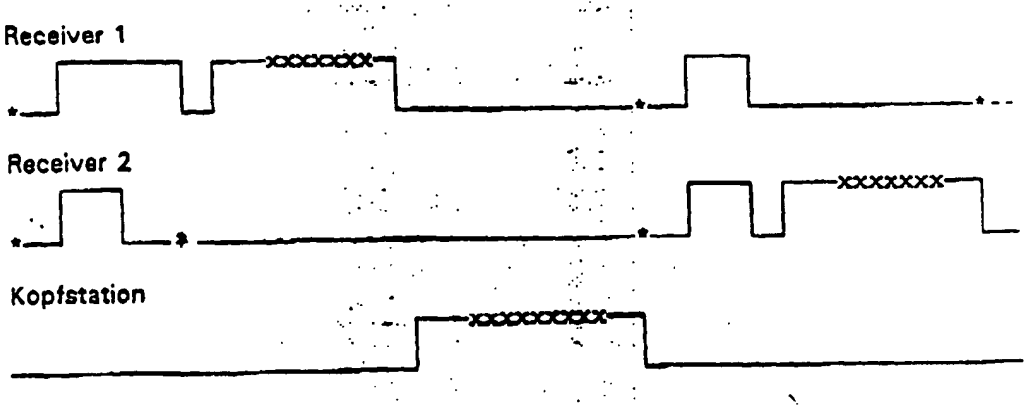


Fig. 4

Europäisches Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung
EP 98 12 2808

EINSCHLÄGIGE DOKUMENTE

Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int.Cl.6)
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Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt

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Title: **EP0757489A2: Satellite receiver with a controllable head end** [German

Derwent Title: Satellite reception system for multi-occupation dwelling - has control facility at each individual subscriber using random distribution method for protecting subscriber privacy [Derwent Record]



Country: **EP** European Patent Office (EPO)

Kind: **A2** Publ. of Application without search report [i] (See also: EP0757489A3, EP0757489B1)

Inventor: **Ilsanker, Anton**;
Flinner, Udo;

Assignee: **Kathrein-Werke KG**
Corporate Tree data: Kathrein-Werke KG (KATHREINWERKE);
News, Profiles, Stocks and More about this company

Published / Filed: **1997-02-05** / 1996-07-16

Application Number: **EP1996000111459**

IPC Code: Advanced: **H03D 7/16**; **H04H 1/00**; **H04N 7/20**;
Core: **H03D 7/00**; more...
IPC-7: **H04N 7/20**;

ECLA Code: **H04H40/20**; H03D7/16B; H04N7/20;

Priority Number: 1995-08-03 **DE1995019528589**

Abstract: Satellite reception system for multi-occupation dwelling The satellite reception system has a controlled head station with a converter (16) employing a number of converter modules (17,18), receiving satellite transmission programmes within a respective reception plane. The outputs of the converter modules are fed to a number of subscribers (45) via an output collector field (41) and signal distribution lines (43). A microcontroller control device (33) controls the local oscillators (21,23) within the converter modules, with the individual subscribers incorporating a control facility for the corresponding reception converter using a random distribution method.

INPADOC Legal Status: Show legal status actions **Buy Now:** Family Legal Status Report

Designated Country: AT CH DE ES FR IT LI

Family: Show 7 known family members

First Claim: Show all claims 1. Satelliten-Empfangsanlage mit steuerbarer Kopfstation mit folgenden Merkmalen:

- - mit einer Umsetzereinheit (16) mit mehreren Umsetzermodulen (17, 18),
- - an den Eingängen (19) der Umsetzermodule (17, 18) stehen die von der Satellitenempfangsanlage empfangenen Programme in einer geeigneten Frequenz-Ebene an,
- - die Ausgänge (39) der Umsetzermodule (17, 18) sind über ein Ausgangs-Sammelfeld (41) und eine nachfolgende Leitung (43) mit mehreren Teilnehmern (45) verbunden
- - die Umsetzereinheit (16) umfaßt ferner eine Steuereinheit (33) mit einem Mikrokontroller (35) zur Ansteuerung der Lokaloszillatoren (21, 23) in den Umsetzermodulen (17) oder zur Ansteuerung der Tuner (55) und/oder Module (61) für die Umsetzermodule (18) im Falle einer Modulationswandlung,

gekennzeichnet durch die folgenden weiteren Merkmale

- - die einzelnen Teilnehmer (45) erhalten spätestens bei Zuschaltung einen beliebigen Empfangsumsetzer (17, 18) und damit dessen Ausgangskanal (39) sowie eine Steuerungsmöglichkeit für diesen Empfangsumsetzer (17, 18) nach einem Zufalls-Verteilverfahren zugeordnet.

Description

Expand description

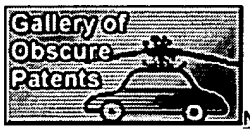
Die Erfindung betrifft eine Satelliten-Empfangsanlage mit einer steuerbaren Kopfstation nach dem Oberbegriff des Anspruches 1.

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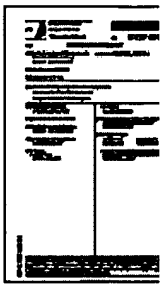
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Title: **EP0757489B1: Satellite receiver with a controllable head end**[German

Derwent Title: Satellite reception system for multi-occupation dwelling - has control facility at each individual subscriber using random distribution method for protecting subscriber privacy [Derwent Record]



Country: **EP** European Patent Office (EPO)

Kind: **B1** Patent [i] (See also: EP0757489A2, EP0757489A3)

Inventor: **Ilsanker, Anton**;
Flinner, Udo;

Assignee: **Kathrein-Werke KG**
Corporate Tree data: Kathrein-Werke KG (KATHREINWERKE);
News, Profiles, Stocks and More about this company

Published / Filed: **2002-03-06** / 1996-07-16

Application Number: **EP1996000111459**

IPC Code: Advanced: **H03D 7/16**; **H04H 1/00**; **H04N 7/20**;
Core: **H03D 7/00**; more...
IPC-7: **H04N 7/10**; H04N 7/20;

ECLA Code: **H04H40/20**; H03D7/16B; H04N7/20;

Priority Number: 1995-08-03 **DE1995019528589**

Abstract: [From equivalent EP0757489A2] Satellite reception system for multi-occupation dwelling The satellite reception system has a controlled head station with a converter (16) employing a number of converter modules (17,18), receiving satellite transmission programmes within a respective reception plane. The outputs of the converter modules are fed to a number of subscribers (45) via an output collector field (41) and signal distribution lines (43). A microcontroller control device (33) controls the local oscillators (21,23) within the converter modules, with the individual subscribers incorporating a control facility for the corresponding reception converter using a random distribution method.

Attorney, Agent or Firm: **Flach, Dieter Rolf Paul, Dipl.-Phys.** ;

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Designated Country: AT CH DE ES FR GB IT LI NL

Family: Show 7 known family members

Claims: Hide claims

1. Satellite receiving system having a controllable head station, with the following features:

- - having a converter unit (16) with a number of converter modules (17, 18),
- - the programs received by the satellite receiving system are applied at a suitable frequency level to the inputs (19) of the converter modules (17, 18),
- - the outputs (39) of the converter modules (17, 18) are connected to a number of subscribers (45) via an output distributor (41) and a downstream line (43),
- - the converter unit (16) furthermore has a control unit (33) with a microcontroller (35) for driving the local oscillators (21, 23) in the converter modules (17), or for driving the tuner (65) and/or modules (61) for the converter modules (18) in the case of modulation conversion,

characterized by the following further features:

- - the individual subscribers (45) are allocated, at the latest on connection, a random reception converter (17, 18) and thus its output channel (39) as well as a control option for this reception converter (17, 18) on the basis of a random distribution method.

2. Satellite receiving system having a controllable head station, with the following features:

- - having a converter unit (16) with a number of converter modules (17, 18),
- - the programs received by the satellite receiving system are applied at a suitable frequency level to the inputs (19) of the converter modules (17, 18),
- - the outputs (39) of the converter modules (17, 18) are connected to a number of subscribers (45) via an output distributor (41) and a downstream line (43),
- - the converter unit (16) furthermore has a control unit (33) with a microcontroller (35) for driving the local oscillators (21, 23) in the converter modules (17), or for driving the tuner (65) and/or modules (61) for the converter modules (18) in the case of modulation conversion, **characterized in that** the individual subscribers (45) are permanently allocated to individual converter modules (17, 18), and **in that** the output channel frequencies are always set differently on the basis of the random principle method, and the receiver-end connecting appliances (46, 47, 49) are tuned thereto.

3. Satellite receiving system according to Claim 1 or 2, **characterized in that** the control unit (33) signals the output channel (39) which is assigned to the individual subscriber (45) for automatic setting of a local oscillator (52) and hence of an associated mixer (53) in the subscriber-end converter (49), in order, at the subscriber-end receiver (47) or at a connected receiving appliance (46), to set a fixed reception channel or a fixed reception frequency independently of the input channel and output channel (19, 39) of the converter modules (17, 18) of the conversion unit (16).

4. Satellite receiving system according to one of Claims 1 to 3, **characterized in that** the controller is initialized by the receiver (45), and the control sequence is governed by the control unit (33) which is integrated in the converter unit (16).

5. Satellite receiving system according to one of Claims 1 to 4, **characterized in that** a subscriber input converter (49) with a mixer (53) and a local oscillator (52) is positioned upstream of the receivers, and is driven via a microcontroller (51).

6. Satellite receiving system according to Claim 5, **characterized in that** the microcontroller (51) in the subscriber input converter (49) is driven via the satellite receiver (47).

7. Satellite receiving system according to Claim 5 or 6, **characterized in that** the microcontroller (51) is driven via an I^2C bus (48), via the satellite receiver (47).

8. Satellite receiving system according to one of Claims 5 to 7, **characterized in that** the subscriber input converter (49) is controlled by means of a remote control, in particular an infrared remote control (54).

9. Satellite receiving system according to one of Claims 1 to 6, **characterized in that** the control unit (33) which is provided in the converter unit (16), that is to say in particular the microcontroller (35) which is integrated in it, is driven directly via the satellite receiver (47) installed at the subscriber end, in particular by means of a DiSEqC control system, or the like.

[German] [French]

Description

Expand description

Die Erfindung betrifft eine Satelliten-Empfangsanlage mit einer steuerbaren Kopfstation nach den Oberbegriffen der Ansprüche 1 oder 2.

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(11) EP 0 757 489 A2

(12) EUROPÄISCHE PATENTANMELDUNG

(43) Veröffentlichungstag:
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(51) Int. Cl.[6]: **H04N 7/20**

(21) Anmeldenummer: **96111459.2**

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(84) Benannte Vertragsstaaten:
AT CH DE ES FR IT LI

(30) Priorität: **03.08.1995 DE 19528589**

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- **Flinner, Udo**
  83026 Rosenheim (DE)

(74) Vertreter: **Flach, Dieter Rolf Paul, Dipl.-Phys. et al**
Patentanwälte
Andrae Flach Haug Kneissl
Bauer Schneider,
Prinzregentenstrasse 24
83022 Rosenheim (DE)

(54) Satelliten-Empfangsanlage mit steuerbarer Kopfstation

(57) Eine Satelliten-Empfangsanlage mit steuerbarer Kopfstation weist die folgenden Merkmale auf

- mit einer Umsetzereinheit (16) mit mehreren Umsetzermodulen (17, 18),
- an den Eingängen (19) der Umsetzermodulen (17, 18) stehen die von der Satellitenempfangsanlage empfangenen Programme vorzugsweise in der Zwischenfrequenz-Ebene an,
- die Ausgänge (39) sind über ein Ausgangs-Sammelfeld (41) und eine nachfolgende Leitung (43) mit mehreren Teilnehmern (45) verbunden
- die Umsetzereinheit (16) umfaßt ferner eine Steuereinheit (33) mit einem Mikrokontroller (35) zur Ansteuerung der Lokaloszillatoren (19, 23) in den Umsetzermodulen (17) oder zur Ansteuerung der Tuner (55) und/oder Module (61) für die Umsetzermodule (18) im Falle einer Modulationswandlung,
- die einzelnen Teilnehmer (45) erhalten spätestens bei Zuschaltung nach einem Zufalls-Verteilverfahren eine Steuerungsmöglichkeit für einen beliebigen Empfangsumsetzer (17, 18) und damit den Ausgangskanal (39) dieses Empfangsumsetzers (17, 18) zugeordnet.

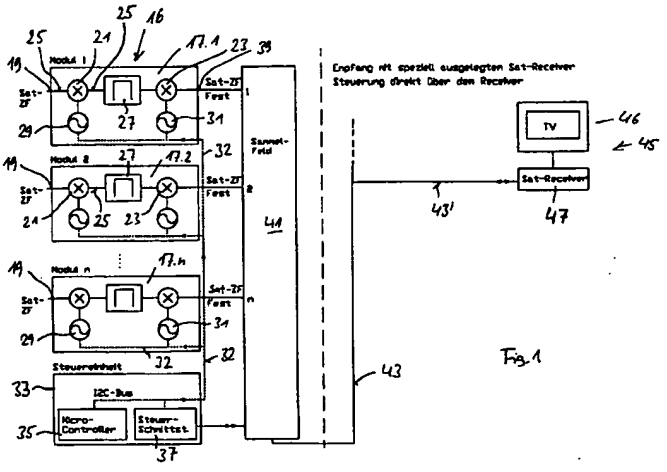


Fig. 1

EP 0 757 489 A2

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Beschreibung

Die Erfindung betrifft eine Satelliten-Empfangsanlage mit einer steuerbaren Kopfstation nach dem Oberbegriff des Anspruches 1.

Grundsätzlich sind Satelliten-Einzelempfangsanlagen und sog. Mehrteilnehmeranlagen zu unterscheiden.

Bei sog. Mehrteilnehmeranlagen wird beispielsweise im Rahmen der Satellitenempfangsanlagen eine Sternverteilung mit Schaltmatrix verwendet, worüber dem einzelnen Teilnehmer kein festgelegtes Programmpaket permanent angeboten wird, sondern worüber jeder Teilnehmer die Möglichkeit erhält, sich sein Programmangebot selbst auszuwählen. D.h. er kann zwischen den in der Regel beiden Polarisationen (oder beispielsweise auch den vier Polarisationen unter entsprechender Berücksichtigung der links und rechts zirkularpolarisierten Wellen) eines Satelliten oder zwischen zwei (oder mehreren) Satellitenempfangsantennen umschalten, um die hierüber ausgestrahlten Programme zu empfangen.

Schließlich sind darüber hinaus auch zur Versorgung mehrerer Teilnehmer Satelliten-Signalaufbereitungen nach Art von Kopfstationen bekannt geworden.

Eine derartige Kopfstation ist beispielsweise aus der Vorveröffentlichung DE-Z „Antennen - für den Satellitenempfang", Thurl/Ilsanker, Franzis Arbeitsbuch, 1991, Seite 83 bis 85 bekannt.

Die dort beschriebene Kopfstation umfaßt beispielsweise sechs Kanalzüge, die eine Programmauswahl aus zwei unterschiedlichen Polarisationen bzw. von zwei Satelliten und die Einspeisung in ein UHF-taugliches Verteilnetz zeigt. Mit dem Eingangssammelfeld wird die freie Beschaltung der Eingänge der Kanalzüge in der Zwischenfrequenz-Ebene ermöglicht, so daß sechs beliebige Programme aus dem gesamten Angebot ausgewählt werden können. Im Ausgangssammelfeld werden die UHF-Kanäle Zusammengefaßt. Die Einstellung der Ein- und Ausgangskanäle erfolgt durch einen Mikroprozessor. Dabei ist die Satellitenkompaktaufbereitung modular aufgebaut, d.h. die Demodulatoren und Modulatoren werden als Einheiten gefertigt, geprüft und dann in das Gerät integriert.

In Abweichung zu der vorstehend erläuterten Kopfstation sind aber grundsätzlich auch sog. „steuerbare Kopfstationen" bekannt geworden, worüber die angeschlossenen Teilnehmer über ihren Receiver oder ein Zusatzmodul bestimmte Programme aus dem angebotenen und empfangenen Programmspektrum auswählen können.

Dazu ist eine Außeneinheit mit einer Antenne und in der Regel einem Konverter (einschließlich einer Polarisationsweiche) vorgesehen, worüber ein oder mehrere Polarisationen oder die von einem oder mehreren Satelliten empfangenen Signale (beispielsweise über ein Multifeed-Speisesystem) einer Umschalteinheit zugeführt werden, die mit entsprechender Anzahl von Eingängen und schaltbaren Ausgängen zumindest in Höhe der Zahl der angeschlossenen Teilnehmerzahl ausgestattet ist.

An diese Ausgänge werden wie bei einer Satelliten-Zwischenfrequenz-Sternverteilung fernsteuerbare Umsetzereinheiten mit fest eingestelltem Ausgangskanal angeschlossen. Jedem angeschlossenen Teilnehmer ist dabei ein bestimmter Ausgangskanal zugeordnet.

Der größte Nachteil dieser fernsteuerbaren Empfangseinheiten ist aber, daß ein wirkungsvoller Schutz der Privatsphäre preisgünstig nicht realisierbar ist. D.h. jeder Nachbar kann bei Kenntnis der Kanaltabelle des Verteilnetzes feststellen, welches Programm vom jeweiligen Teilnehmer eingeschaltet ist. Es versteht sich von selbst, daß dies höchst unerwünscht ist, weshalb derartige Anlagen in der Regel nicht eingesetzt werden, obwohl sie durchaus Vorteile besitzen, wie z. B. der Erhalt der Durchschleifstruktur, Preiswürdigkeit gegenüber kanalselektiver Aufbereitung und volle Programmvielfalt.

Zudem ist eine Gemeinschaftsantennenanlage beispielsweise aus der DE 40 12 657 A1 bekannt geworden. Die Anlage besitzt ein Verteilkabel, dessen Eingang mit den Ausgängen von Umsetzern verbunden ist. Den Umsetzern werden von einer Antenne Träger zugeführt, die mit Fernsehsignalfrequenzen moduliert sind. Jeder Umsetzer erzeugt aus einem wählbaren dieser Träger einen mit dem gleichen Fernsehsignal modulierten neuen Träger mit einer jeweils vorbestimmten Frequenz. Jeder Umsetzer und seine vorbestimmte Frequenz ist jeweils einem von mehreren Ausgängen des Verteilkabels zugeordnet. Bei dem Ausgang steht ein Fernsteuersender, der im betreffenden Umsetzer die Wahl des von der Antenne zugeführten Trägers steuert. Die Anlage benötigt nur so viele Umsetzer und muß über das Verteilkabel nur so viele neue Träger mit verschiedenen vorbestimmten Frequenzen übertragen, wie Ausgänge am Verteilkabel vorhanden sind. Trotzdem können an jedem der Ausgänge alle Fernsehsignale gewählt werden, mit denen die von der Antenne zugeführten Träger moduliert sind.

Schließlich ist aus der DE 93 06 499 U1 eine Schaltungsanordnung und eine Vorrichtung zum Betreiben einer Antennenempfangsvorrichtung mit wenigstens einer Empfangsantenne bekannt geworden, deren Antennenausgangssignale jeweils mehreren Empfangsteilnehmern über eine Verteilleitung einer Gemeinschafts-/Hausempfangsanlage zu geleitet werden. Dabei ist ferner vorgesehen, daß wenigstens ein ausgewählter Kanal in Abhängigkeit eines teilnehmerspezifischen Wählsignals auf die Verteilleitung schaltbar ist.

Demgegenüber ist es Aufgabe der vorliegenden Erfindung, eine verbesserte Satellitenempfangsanlage mit einer steuerbaren Kopfstation zu schaffen, die auf günstige Weise einen Schutz der Privatsphäre erlaubt. Mit anderen Worten soll gewährleistet werden, daß andere angeschlossene Teilnehmer sich nicht darüber informieren können, welche Programme andere ange-

schlossene Teilnehmer aktuell empfangen und zugeschaltet haben.

Die Aufgabe wird erfindungsgemäß entsprechend der im Anspruch 1 oder im Anspruch 2 angegebenen Merkmale gelöst.

In der vorliegenden Erfindung wird eine einfache Methode geschaffen, mittels der ein preiswerter Schutz der Privatsphäre ermöglicht wird. Dabei werden erfindungsgemäß alle Vorteile einer fernsteuerbaren Empfangseinheit beibehalten.

Das erfindungsgemäße Verfahren geht dabei davon aus, daß die einzelnen Empfangskanäle für die zugeschalteten Teilnehmer nach einem Zufallsverfahren (Random) zugeordnet werden. Andere angeschlossene Teilnehmer im Haus können dabei zwar feststellen, welche Programme insgesamt mittels der Empfangseinheiten empfangen werden, nicht aber, welcher Teilnehmer welches Programm aktuell eingeschaltet hat und sieht. Bei jedem Einschalten wird dem Teilnehmer im wahlfreien Zugriff ein Kanal zugewiesen und sein Empfangsgerät automatisch auf den entsprechenden Empfangskanal eingestellt oder zumindest eine Information abgegeben, die die Einstellung ermöglicht. Da mit jedem Einschalten eine neue Berechtigung vergeben werden kann, ist es für einen anderen Teilnehmer praktisch nicht möglich, die Kanalzuordnung der übrigen Teilnehmer festzustellen.

Zudem ist es in einer bevorzugten Ausführungsform der Erfindung ferner möglich zu gewährleisten, daß außer der fehlenden Zuordnung nur die selbstgewählte und eingestellte Kanalauswahl ein brauchbares Bild oder einen brauchbaren Radioempfang liefert.

Die Erfindung wird nachfolgend anhand von Ausführungsbeispielen näher erläutert. Dabei zeigen im einzelnen:

Figur 1 : einen schematischen Schaltplan einer erfindungsgemäßen Ausführungsform mit einer Ansteuerung durch einen Receiver ohne weitere Zusatzeinrichtung;

Figur 2 : eine der erfindungsgemäßen Umsetzereinheit vorgeschaltete Satellitenempfangsanlage;

Figur 3 : ein Figur 1 entsprechendes Ausführungsbeispiel, bei welchem die Ansteuerung mittels eines dem Receiver vorgeschalteten Umsetzers (Modem) mittels eines I^2C-Busses erfolgt;

Figur 4 : ein zu Figur 1 und 3 abgewandeltes Ausführungsbeispiel, bei welchem die Ansteuerung mittels eines dem Receiver vorgeschalteten und mittels einer Fernbedienung bedienbaren Umsetzers erfolgt;

Figur 5 : eine entsprechende Schaltungsanordnung mit Verteilung im VHF-/UHF-Bereich, welche der in Figur 2 wiedergegebenen Schaltungsanordnung nachgeschaltet ist.

Figur 2 zeigt eine der erfindungsgemäßen Umsetzereinheit vorgeschaltete Satellitenempfangsanlage mit einem einer Satellitenantenne zugeordneten Speisesystem 3, eine diesem nachgeschaltete Polarisationsweiche 5 sowie beispielsweise zwei Konverterschaltungen 7 (LNB, LNC etc.) in dem jeweiligen Empfangszwetg zum Empfang der vertikalen wie horizontalen Polarisationen.

Die beiden Ausgänge der beiden Zweige zum Empfang der vertikalen wie horizontalen Polarisationen stehen mit Eingängen 9 einer Umschalteinheit 11 in Verbindung.

Sollen beispielsweise auch zusätzlich noch links oder rechts zirkularpolarisierte Wellen empfangen werden, so werden unter Berücksichtigung der hierfür üblichen Eingangsschaltungen an der Umschalteinheit 11 vier Eingänge 9 vorgesehen sein, nämlich zum Empfang einmal der vertikal, der horizontal, der links und der rechts polarisierten Wellen. Ebenso könnte die Zahl der Eingänge an der Umschalteinheit 11 zunehmen, wenn beispielsweise Programme von verschiedenen Satelliten über mehrere Satellitenantennen oder beispielsweise von einem Multifeed-Speisesystem empfangen werden sollen.

Bei der Umschalteinheit 11 handelt es sich um eine X:Y-Umschalteinheit, wobei „X" die Zahl der Eingänge und „Y" die Zahl der Ausgänge betrifft, die zumindest der Zahl der angeschlossenen Teilnehmer entspricht.

An die in Figur 2 gezeigten Ausgänge 13 wird die bei einer Satelliten-Zwischenfrequenz-Sternverteilung fernsteuerbare Umsetzereinheit 16 (fernsteuerbare Kopfstation 16) mit fest eingestellten Ausgangskanälen angeschlossen, wie dies anhand von Figur 1 gezeigt ist. D.h. jeder Eingang 19 der in Figur 1 gezeigten Umsetzereinheiten 17 ist mit der Umschalteinheit 11 gemäß Figur 2 verbunden.

Die Umsetzereinheit 16 umfaßt danach also n-Umsetzer-Module 17, die jeweils einen ersten Mischer 21 und einen zweiten Mischer 23 mit einem in der Empfangsleitung 25 dazwischen angeordneten Filter 27 (SAW-Filter). Der erste bzw. zweite Mischer 21, 23 wird jeweils über einen Lokaloszillator (PLL) 29 bzw. 31 angesteuert.

Die Steuerung erfolgt über einen Daten- oder Steuerungsbus 32, und zwar mittels einer Steuereinheit 33, die über einen Mikrocontroller 35, also einen Mikroprozessor, sowie beispielsweise eine entsprechende Steuerschnittstelle 37 verfügt.

Den Ausgängen 39 der Umsetzermodule 17 ist ein sog. Sammelfeld 41 nachgeschaltet, worüber die über die einzelnen Umsetzermodule 17 empfangenen Signale auf eine gemeinsame Übertragungsleitung 43 zu den einzelnen angeschlossenen Teilnehmern 45 übertragen werden. In Figur 1 ist lediglich einer der an einer von der Übertragungsleitung 43 abzweigenden

Zweigleitung 43' angeschlossene Teilnehmer 45 mit einem Satellitenreceiver 45 gezeigt.

Über die oben erwähnte Steuereinheit 33 wird letztlich auch der Datenaustausch zwischen den angeschlossenen Teilnehmern 45 und der Empfangseinheit gemäß Figur 2 (also den Konvertern etc.) sowie die Umsetzereinheiten 17 einschließlich der Umschalteinheit 11 u. a. auch zur Auswahl der Polarisationen gesteuert, wobei der betreffende, dem einzelnen Teilnehmer zugeteilte Ausgangskanal dann dem Teilnehmer auch übermittelt wird.

Nachfolgend wird auf die Funktionsweise näher eingegangen. Wird davon ausgegangen, daß alle Teilnehmer 45 abgeschaltet sind, so kann die Funktionsweise derart sein, daß beim Einschalten eines Empfängers 47, also der in Figur 1 gezeigten Konverter, über den Mikroprozessor oder -controller 35 allen Teilnehmern oder zumindest dem aktuell zugeschalteten Teilnehmer nach dem Zufallsprinzip ein bestimmter Ausgangskanal 39, also ein bestimmtes Umsetzmodul 17 der n-Module 17 zugewiesen wird.

Würde beispielsweise der in Figur 1 gezeigte angeschlossene Teilnehmer 45 seinen Fernseher 46 zuschalten, so könnte ihm über den Mikroprozessor das Umsetzermodul 17.2 zugeordnet werden.

Dabei können die Umsetzermodule 17, d.h. deren Lokaloszillatoren, so eingestellt sein, daß die einzelnen Module entsprechend der Bandbreite der Filter 27 die teilnehmerseitig ausgewählten Programme in folgende Kanäle bzw. Kanalbreiten in das Sammelfeld einspeisen:

Modul 17.1:	950 - 980 MHz
Modul 17.2:	990 - 1.020 MHz
Modul 17.3:	1.030 - 1.060 MHz
u.s.w.	
Modul 17.n:	1.550 - 1.580 MHz

Wird also beispielsweise davon ausgegangen, daß an den Eingängen 19 der Umsetzermodule 17 in der Zwischenfrequenz (ZF)-Ebene die von den Satelliten empfangenen Programme in einem Frequenzband von 950 MHz bis 2.050 MHz anstehen, und der erwähnte Teilnehmer 45 nunmehr ein Satellitenprogramm empfangen will, welches in der ZF-Ebene in dem Kanal von 1.250 MHz bis 1.280 MHz ansteht, so wird der erste Lokaloszillator 29 auf eine Frequenz von 1.743,25 MHz und der zweite Lokaloszillator 31 auf eine Mischerfrequenz von 1.483,25 MHz eingestellt, so daß unter Berücksichtigung des Filters 27 nunmehr am Ausgang 39 das so ausgewählte Programm mit der bezüglich des Moduls 17.2 fest eingestellten Satelliten-Zwischenfrequenz (SatZF) von 990 bis 1.020 MHz in das Sammelfeld 41 eingespeist wird.

Über den Satelliten-Receiver 47 vorgewählt und damit letztlich über die Steuereinheit 33 gesteuert, wird also der jeweilige Receiver nach dem Zufallsprinzip einem stets anderen Modul zugeschaltet - im erläuterten Ausführungsbeispiel das Umsetzermodul 17.2 - so eingestellt, daß das receiverseitig ausgewählte Programm in die in diesem Modul fest eingestellte Ausgangs-Satelliten-Zwischenfrequenz von beispielsweise 990 bis 1.020 MHz umgesetzt wird.

Schaltet sich ein nächster Teilnehmer ein, so wird diesem ebenfalls wieder nach dem Zufallsprinzip über den Mikroprozessor 35 ein nächstes der n vorgesehenen Umsetzermodule 17 zugeordnet.

Da gleichzeitig über den Mikroprozessor 35 die entsprechenden Daten auch an den Receiver übermittelt werden, kann über diesen Receiver stets nur die über das ihm zugeordnete Umsetzermodul 17 eingestellte Programm empfangen werden. Rückschlüsse, welche Teilnehmer welche weiteren Programme empfangen, d.h. eine Zuordnung, welcher Teilnehmer welches Programm empfängt, ist nicht möglich.

Bei Satelliten-Receivern 47 (Empfängern) mit zugeordneten Empfängerumsetzern werden also die Lokaloszillatoren 29, 31 über die Steuereinheit 33 automatisch eingestellt und somit die Zuordnung von gesteuertem und empfangenem Kanal hergestellt.

Unabhängig von dem vorstehend erläuterten Randomverfahren muß die dem Zufallsprinzip unterliegende Zuordnung der einzelnen Übertragungskanäle an die einzelnen Teilnehmer nicht zwingend zum Zeitpunkt des Einschaltens gestartet werden. Ein günstiger Zeitpunkt liegt beispielsweise dann vor, wenn alle Teilnehmer abgeschaltet sind. Eine Zufallsvergabe kann aber auch stets dann durchgeführt werden, wenn sich ein neuer Teilnehmer zuschaltet, wobei dann aus der Gruppe der einzelnen Teilnehmer noch nicht zugeordneten Umsetzermodulen 17 entsprechend dem Zufallsprinzip ein nächstes Umsetzermodul 17 dem jeweils nächsten zugeschalteten Teilnehmer zugeordnet wird.

In einer alternativen Ausführungsform ist es aber auch möglich, daß die einzelnen Teilnehmer 45 einer festen, stets gleichbleibenden Umsetzereinheit zugeordnet bleiben, beispielsweise der in Figur 1 dargestellte Teilnehmer 45 (Satellitenreceiver 47) stets dem Umsetzermodul 17.2 zugeordnet ist und bleibt. In diesem Falle könnten nach dem Zufallsprinzip über die Steuereinheit 33, d.h. den Mikroprozessor 35, gesteuert die Lokaloszillatoren 29, 31 automatisch so angesteuert werden, daß die Ausgangskanäle nach dem Zufallsprinzip beispielsweise auf die vorstehend wiedergegebenen Ausgangskanal-Breiten nicht fest eingestellt, sondern jeweils nach dem Zufallsprinzip unterschiedlich eingestellt werden. Auch in diesem Falle ist es anderen angeschlossenen Teilnehmern nicht möglich festzustellen, welcher Teilnehmer gegenwärtig welche Programme empfängt.

In dem geschilderten Ausführungsbeispiel gemäß Figur 1 und 2 erfolgt keine Modulationswandlung, sondern lediglich eine Umsetzung der ausgewählten Ein-

gangskanäle in einem fest definierten Ausgangskanal. Die Orientierung über die eingestellten Programme wird durch den Satelliten-Receiver 47 vorgenommen, wenn dieser entsprechend wie in Figur 1 schematisch dargestellt ist, ausgerüstet ist. Receiver 45 mit entsprechender Ausrüstung können die Steuerung im Zusammenspiel mit der Steuereinheit 33 ohne eine Zusatzeinrichtung vornehmen. Neuartige Steuerungssysteme wie DiSEqC sind hier sehr gut geeignet.

Andernfalls kommt eine Schaltung gemäß Figur 3 in Betracht, bei welcher die Einstellung der Programme beispielsweise mittels eines dem Receiver 47 vorgeschalteten Modems 49 (Umsetzer 49) möglich ist, wobei die Ansteuerung des Modems 49 vom Satelliten-Receiver 47 über einen I^2C-Bus 48 erfolgen kann.

Gemäß dem Ausführungsbeispiel nach Figur 3 ist vorgesehen, daß dabei das Modem 49 eine interne Steuerschnittstelle 50 umfaßt, worüber über die Leitung 43' und die Übertragungsleitung 43 die Datenkommunikation mit der in der steuerbaren Kopfstelle 16 vorgesehenen Steuereinheit 33 erfolgt. Ferner umfaßt das Modem 49 gemäß Figur 3 einen Mikrokontroller 51, der einen in dem Modem 51 integrierten Lokaloszillator (PLL) 52 ansteuert, der wiederum den im Modem 50 integrierten Mischer 53 ansteuert, worüber das jeweils ausgewählte Programm auf die für den Empfang des Satellitenprogramms geeignete UHF-/VHF-Empfangsfrequenz umgesetzt wird.

Ist der Receiver 47 nicht entsprechend wie in Figur 3 ausgestaltet, so kommt eine Ansteuerung des erwähnten Modems 49 - wie in Figur 4 dargestellt ist - mittels einer Fernbedienung 54 in Betracht.

Durch das jeweilige Modem 49 erfolgt also dann die Umsetzung der Satelliten-Zwischenfrequenz auf die für den Fernsehempfang geeignete UHF-/VHF-Empfangsfrequenz.

Der in Figur 4 erläuterte Umsetzer 49 umfaßt im Falle einer Fernbedienung beispielsweise noch eine LED-Anzeige 55 und einen Infrarot-Detektor 56, worüber angezeigt wird, wenn die Fernbedienung 54 aktiviert ist.

Alternativ zu den erläuterten Ausführungsbeispielen ist es gemäß Figur 5 aber auch möglich, daß eine Verteilung bereits im VHF-/UHF-Bereich erfolgt.

Die in dem Ausführungsbeispiel gemäß Figur 5 gezeigte Umsetzereinheit oder fernsteuerbare Kopfstation 16 umfaßt vier Umsetzermodule 18.1 bis 18.n, an deren Eingängen 19 ebenfalls wieder die Satelliten-Zwischenfrequenz ansteht.

Die Umsetzermodule 18 umfassen danach aber jeweils eingangsseitig einen Tuner 65 und einen Video-Zweig 57 sowie einen Audio-Zweig 59 zur Umsetzung der Bild- und der Tonsignale.

Der Video-Zweig 57 und der Audio-Zweig 59 sind ausgangsseitig mit einem Modem 61 verbunden, in welchem eine Umsetzung von der Satelliten-Zwischenfrequenz in den VHF-/VHF-Frequenzbereich erfolgt.

Die Ausgänge 39 dieser Umsetzermodule 18 können nunmehr so eingestellt sein, daß an den einzelnen Ausgängen der Module folgende Frequenzen anstehen:

Modul 18.1:	230 - 260 MHz
Modul 18.2:	270 - 300 MHz
Modul 18.4:	310 - 370 MHz
u.s.w.	
Modul 18.n:	830 - 860 MHz

Ansonsten erfolgt die Steuerung wie anhand von Figur 3 erläutert, wonach die in den VHF-/UHF-Bereich umgesetzten und von den einzelnen Teilnehmern ausgewählten empfangenen Programme wiederum über ein Sammelfeld 41 und eine nachgeschaltete Übertragungsleitung 43 mit davon abzweigenden Zweigleitungen 43' den einzelnen Empfänger 45 gegebenenfalls unter Zuvorschaltung eines Modems 49 übertragen werden.

Bei dem Ausführungsbeispiel gemäß Figur 5 wird also in Abweichung zu den Ausführungsbeispielen gemäß Figur 1 oder 3 und 4 eine Modulationsumwandlung in den VHF-/UHF-Bereich vorgenommen. Dadurch kann die Installation unverändert bleiben, wobei auch die Steckdosen nicht getauscht werden müssen. Ein Umsetzer beim Teilnehmer übernimmt die Umsetzung in einen festen Satelliten-Zwischenfrequenz-Kanal und die Signalisierung und Modemfunktion für die Fernsteuerung der Empfangskanäle. Die Einstellung der richtigen Ausgangsfrequenz wird automatisch vorgenommen, wobei die Lokaloszillator-Frequenz des Umsetzers durch den Controller der Umsetzereinheit ferngesteuert wird. Die Teilnehmerreceiver werden für alle Programmplätze auf die gleiche Satelliten-Frequenz eingestellt. Dadurch ändert sich an den Programmauswahlgewohnheiten der Teilnehmer nichts, die vorprogrammierten Programmzuordnungen bleiben erhalten, wobei die OSD-Einblendungen weiterhin stimmen.

Aus den oben erläuterten Ausführungsbeispielen geht hervor, daß die nachfolgend auch als Teilnehmereingangsumsetzer bezeichneten Modems 49 je nach Anwendung und Ausstattung einen Infrarotempfänger, einen Anschluß für einen I^2C-Bus 48 und/oder eine Empfangseinheit für DiSEqC-Signale, eine LED-Anzeige 55 zur Anzeige der eingestellten Programme bzw. für die Signalisierung des Empfangskanals umfassen. Ein Mikroprozessor 51 übernimmt die Synchronisation des notwendigen Datentransports für die Lokaloszillatoren 52 bei den Teilnehmereingangs-Umsetzern 49 und die Signalisierung beim Einschalten des Empfängers (Sat-Receiver 47) zum Starten des nach dem Zufallsprinzip arbeitenden „Random-Verfahrens" in den Haupt- oder Umsetzereinheiten, die allgemein auch als Kopfstation 16 bezeichnet werden. Bei Teilnehmer-Eingangsumsetzern 49 mit Infrarotempfän-

ger können durch Umschalten des Befehlssatzes verschiedene Receivertypen berücksichtigt werden. Hier muß speziell auf unterschiedliche Toggelfunktionen Rücksicht genommen werden. Der Befehlssatz eines solchen Empfängerumsetzers hat natürlich einen eingeschränkten Befehlsvorrat.

Im Zusammenspiel insbesondere mit den erwähnten empfängerseitigen Umsetzern 49 sind Receiver 47 zu verwenden, die entsprechend ausgestattet sind. Receiver, die mit DiSEqC ausgerüstet sind, können prinzipiell Umsetzer 49 steuern, wenn der Satelliten-Receiver 47 die vollen DiSEqC-Möglichkeiten unterstützt. Bei Steuerungssystemen DiSEqC ist es z. B. vorgesehen, die Lokaloszillator-Frequenz der Konverter - die in diesem Falle natürlich ebenfalls mit dem DiSEqC-Steuerungssystem ausgerüstet sein müssen - an den Satelliten-Empfänger 47 zu melden und den Empfänger 47 dann automatisch entsprechend der Lokaloszillator-Frequenz einzustellen. Bei einem Empfänger 47 mit entsprechender Ausstattung braucht man bei Verteilung in der ersten Satelliten-Zwischenfrequenz (1. Sat-ZF) kein Eingangsmodem bzw. keinen Eingangsumsetzer 47, wie die in dem Ausführungsbeispiel anhand von Figur 1 dargestellt ist, und hat trotzdem den vollen Bedienungskomfort.

Ferner sind Satelliten-Empfänger 47 bekannt, die einen Data-I/O-Eingang aufweisen. Bei entsprechender Ausgestaltung der Software des Empfängers 47 kann dieser Data-I/O-Eingang zur Steuerung des Umsetzers 47 bzw. der Umsetzereinheit 16 verwendet werden. Die Notwendigkeit einer zusätzlichen Fernbedienung entfällt. Der Empfänger 47 kann mit dem Umsetzer, d.h. dem Modem 47, Daten austauschen. Schließlich ist auch eine Änderung der Lokaloszillator-Frequenzeintragung beim Empfänger 47 möglich. Die Einstellung der notwendigen Frequenz beim Empfänger 47 würde dann automatisch erfolgen.

Schließlich ist aber auch die Verteilung zusätzlicher terrestischer Programme möglich. Werden beispielsweise UHF-Frequenzen für Übertragungen terrestischer Programme bei dem Ausführungsbeispiel gemäß Figur 5 benötigt, so kann man die entsprechenden Kanäle der FM-Verteilung sperren.

Der Vollständigkeit halber wird auch angemerkt, daß ein gutes Bild bzw. ein guter Ton nur in den Ausführungsbeispielen erzielbar ist, in denen ein teilnehmerseitiger Umsetzer 49 vorgesehen ist. Mit anderen Worten liefert also nur die selbstgewählte und eingestellte Kanalauswahl ein brauchbares Bild und einen brauchbaren Radioempfang. Auch dadurch wird das erfindungsgemäße Konzept unterstützt, wonach andere angeschlossene Teilnehmer nicht feststellen können, welche Programme andere angeschlossene Teilnehmer gerade empfangen.

Abschließend wird noch angemerkt, daß es sich bei dem vorstehend erläuterten Steuerungssystem DiSEqC um ein an sich bekanntes Steuerungssystem "Digital Satellite Equipment Control", also ein digitales Satellitenempfangs-Gerätesteuerungssystem, handelt.

Patentansprüche

1. Satelliten-Empfangsanlage mit steuerbarer Kopfstation mit folgenden Merkmalen:

   - mit einer Umsetzereinheit (16) mit mehreren Umsetzermodulen (17, 18),
   - an den Eingängen (19) der Umsetzermodule (17, 18) stehen die von der Satellitenempfangsanlage empfangenen Programme in einer geeigneten Frequenz-Ebene an,
   - die Ausgänge (39) der Umsetzermodule (17, 18) sind über ein Ausgangs-Sammelfeld (41) und eine nachfolgende Leitung (43) mit mehreren Teilnehmern (45) verbunden
   - die Umsetzereinheit (16) umfaßt ferner eine Steuereinheit (33) mit einem Mikrokontroller (35) zur Ansteuerung der Lokaloszillatoren (21, 23) in den Umsetzermodulen (17) oder zur Ansteuerung der Tuner (55) und/oder Module (61) für die Umsetzermodule (18) im Falle einer Modulationswandlung,

   gekennzeichnet durch die folgenden weiteren Merkmale

   - die einzelnen Teilnehmer (45) erhalten spätestens bei Zuschaltung einen beliebigen Empfangsumsetzer (17, 18) und damit dessen Ausgangskanal (39) sowie eine Steuerungsmöglichkeit für diesen Empfangsumsetzer (17, 18) nach einem Zufalls-Verteilverfahren zugeordnet.

2. Satelliten-Empfangsanlage mit steuerbarer Kopfstation mit folgenden Merkmalen:

   - mit einer Umsetzereinheit (16) mit mehreren Umsetzermodulen (17, 18),
   - an den Eingängen (19) der Umsetzermodule (17, 18) stehen die von der Satellitenempfangsanlage empfangenen Programme in einer geeigneten Frequenz-Ebene an,
   - die Ausgänge (39) der Umsetzermodule (17, 18) sind über ein Ausgangs-Sammelfeld (41) und eine nachfolgende Leitung (43) mit mehreren Teilnehmern (45) verbunden
   - die Umsetzereinheit (16) umfaßt ferner eine Steuereinheit (33) mit einem Mikrokontroller (35) zur Ansteuerung der Lokaloszillatoren (21, 23) in den Umsetzermodulen (17) oder zur Ansteuerung der Tuner (55) und/oder Module (61) für die Umsetzermodule (18) im Falle einer Modulationswandlung, **dadurch gekennzeichnet**, daß die einzelnen Teilnehmer (45) einzelnen Umsetzermodulen (17, 18) fest zugeordnet sind, und daß nach dem Zufallsprinzip-Verfahren die Ausgangskanal-Frequenzen stets unterschiedlich eingestellt und die

empfängerseitigen Anschlußgeräte (46, 47, 49) hierauf abgestimmt werden.

3. Satelliten-Empfangsanlage nach Anspruch 1 oder 2, **dadurch gekennzeichnet**, daß die Steuereinheit (33) den dem einzelnen Teilnehmer (45) zugewiesenen Ausgangskanal (39) zur automatischen Einstellung eines Lokaloszillators (52) und damit eines zugehörigen Mischers (53) beim teilnehmerseitigen Umsetzer (49) meldet, um am teilnehmerseitigen Receiver (47) oder einem angeschlossenen Empfangsgerät (46) einen festen Empfangskanal bzw. eine feste Empfangsfrequenz unabhängig vom Eingangskanal- und Ausgangskanal (19, 39) der Umsetzermodule (17, 18) der Umsetzeinheit (16) einzustellen.

4. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet**, daß die Steuerung durch die Empfänger (45) initialisiert und der Ablauf der Steuerung mittels der in der Umsetzereinheit (16) integrierten Steuereinheit (33) erfolgt.

5. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet**, daß den Empfängern ein Teilnehmer-Eingangsumsetzer (49) mit einem Mischer (53) und einem Lokaloszillator (52) vorgeschaltet ist, der über einen Mikro-Kontroller (51) angesteuert wird.

6. Satelliten-Empfangsanlage nach Anspruch 5, **dadurch gekennzeichnet**, daß der Mikro-Kontroller (51) in dem Teilnehmer-Eingangsumsetzer (49) über den Satelliten-Receiver (47) angesteuert wird.

7. Satelliten-Empfangsanlage nach Anspruch 5 oder 6, **dadurch gekennzeichnet**, daß die Ansteuerung des Mikro-Kontrollers (51) über den Satelliten-Receiver (47) über einen I^2C-Bus (48) durchgeführt wird.

8. Satelliten-Empfangsanlage nach einem der Ansprüche 5 bis 7, **dadurch gekennzeichnet**, daß die Steuerung des Teilnehmer-Eingangsumsetzers (49) mittels einer Fernbedienung, insbesondere einer Infrarot-Fernbedienung (54) durchgeführt wird.

9. Satelliten-Empfangsanlage nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet**, daß die Ansteuerung der in der Umsetzereinheit (16) vorgesehenen Steuereinheit (33), d.h. insbesondere des darin integrierten Mikro-Kontrollers (35) direkt über den teilnehmerseitig installierten Satelliten-Receiver (47) durchgeführt wird, insbesondere mittels eines Steuerungssystems DiSEqC oder dergleichen.

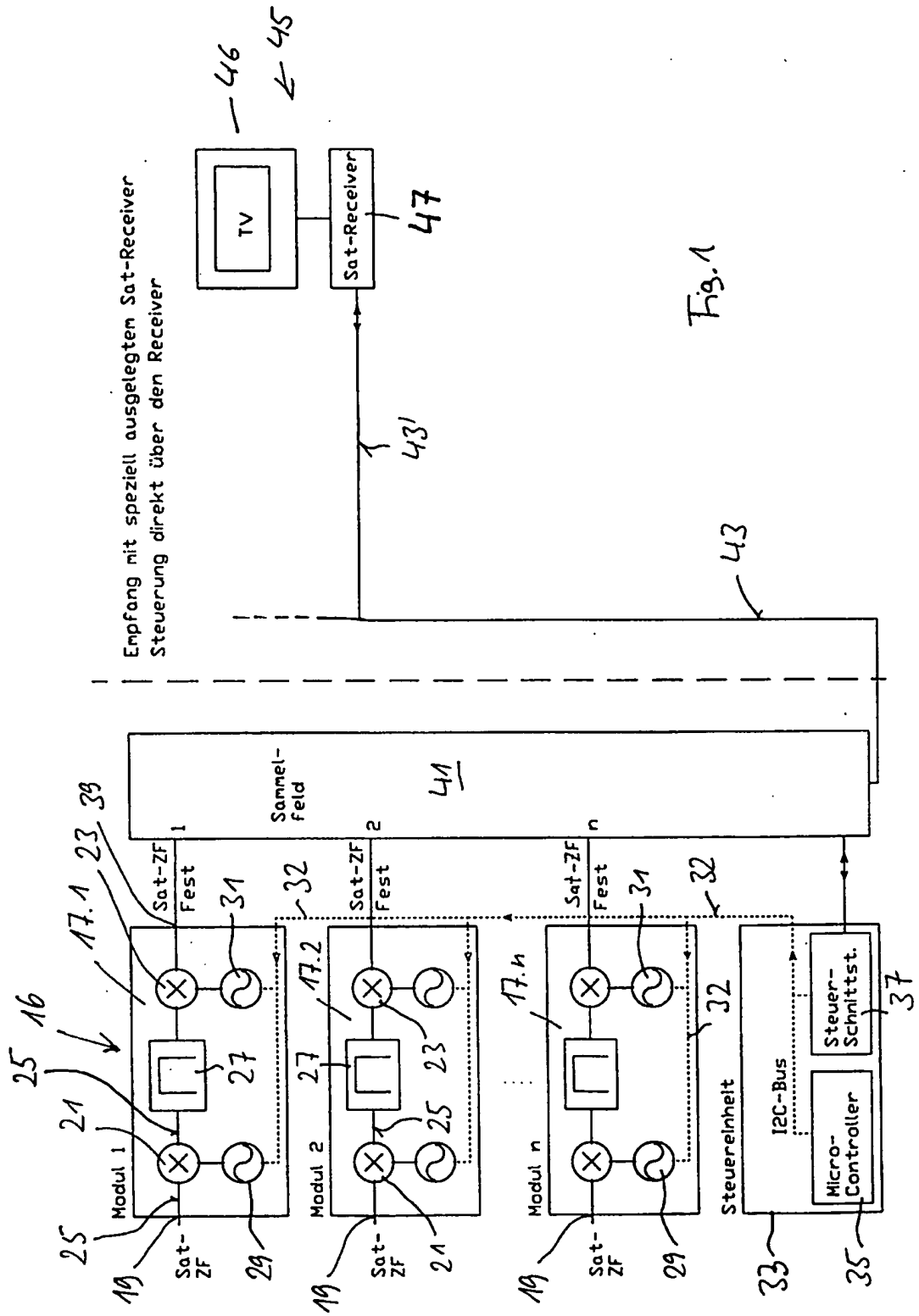

Empfang mit speziell ausgelegtem Sat-Receiver
Steuerung direkt über den Receiver
TV
Sat-Receiver
46
45
47
43'
43
41
Sammel-feld
Sat-ZF Fest
1
2
n
Modul 1
Modul 2
Modul n
Steuereinheit
I2C-Bus
Micro-Controller
Steuer-Schnittst.
Sat-ZF
16
17.1
17.2
17.n
19
21
23
25
27
29
31
32
33
35
37
38

Fig. 1

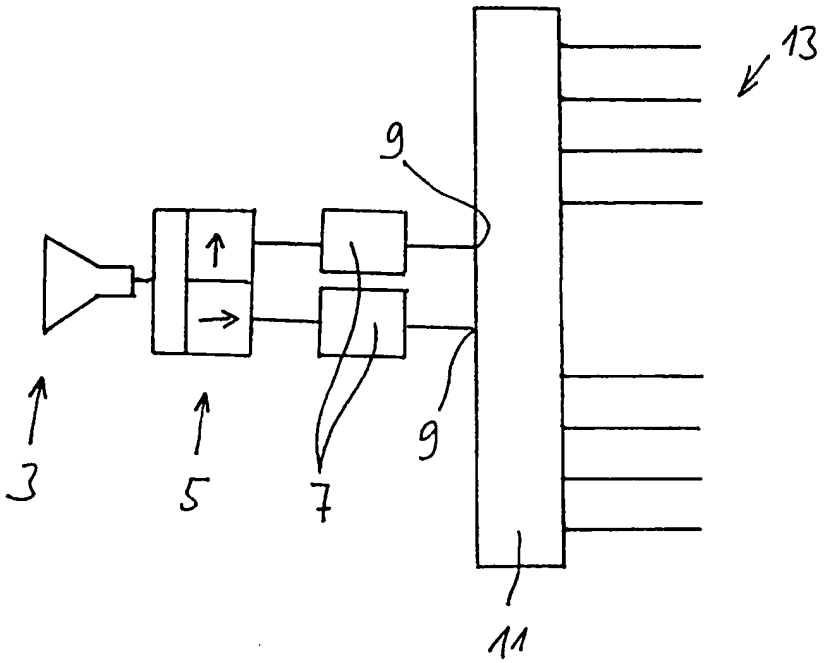


Fig.2

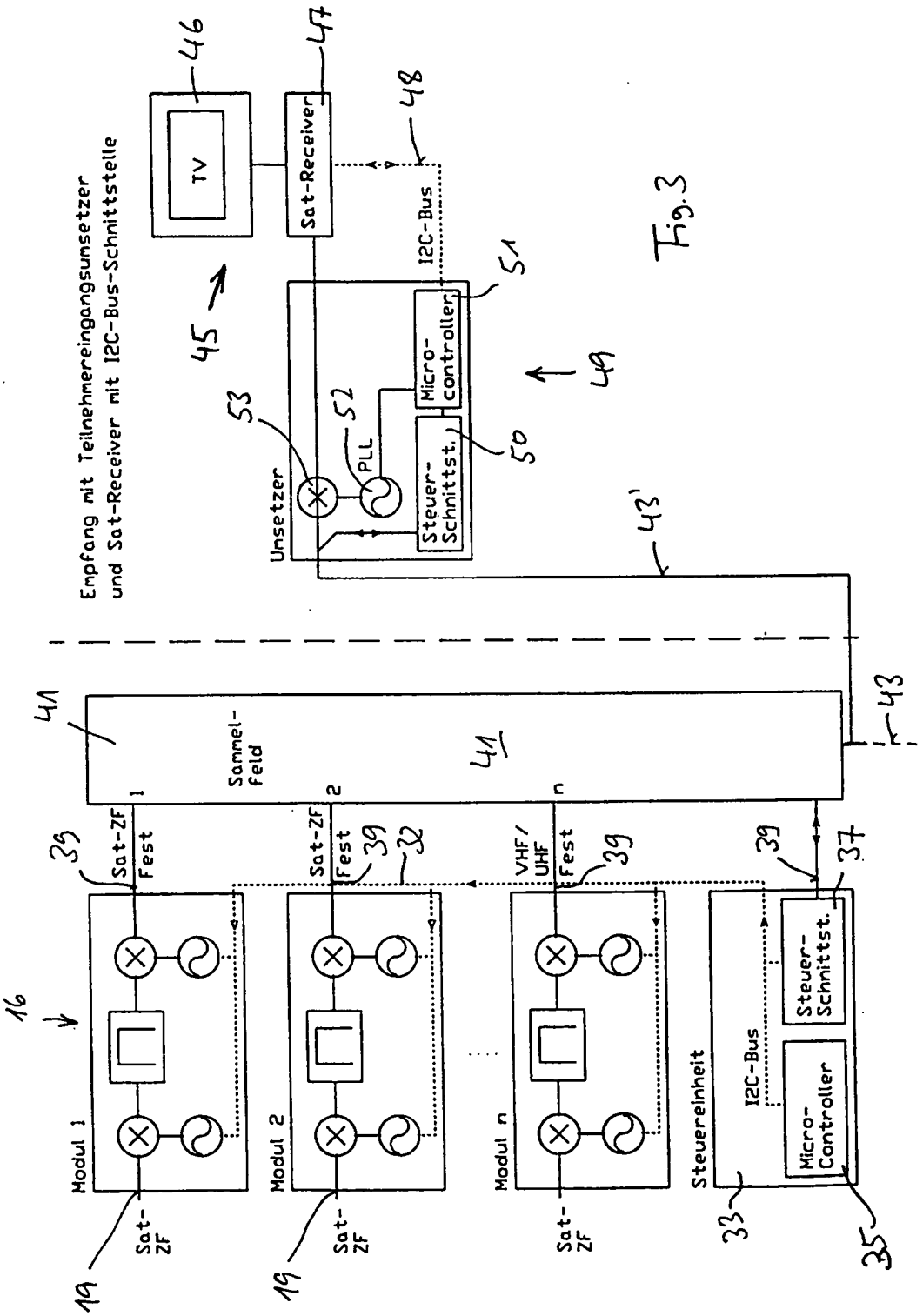

Empfang mit Teilnehmereingangsumsetzer
und Sat-Receiver mit I2C-Bus-Schnittstelle
TV
Sat-Receiver
I2C-Bus
Micro-controller
Steuer-Schnittst.
PLL
Unsetzer
Sammel-Feld
Sat-ZF
Fest
VHF/UHF
Modul 1
Modul 2
Modul n
Steuereinheit
Micro-Controller
Steuer-Schnittst.
I2C-Bus
Sat-ZF

Fig.3

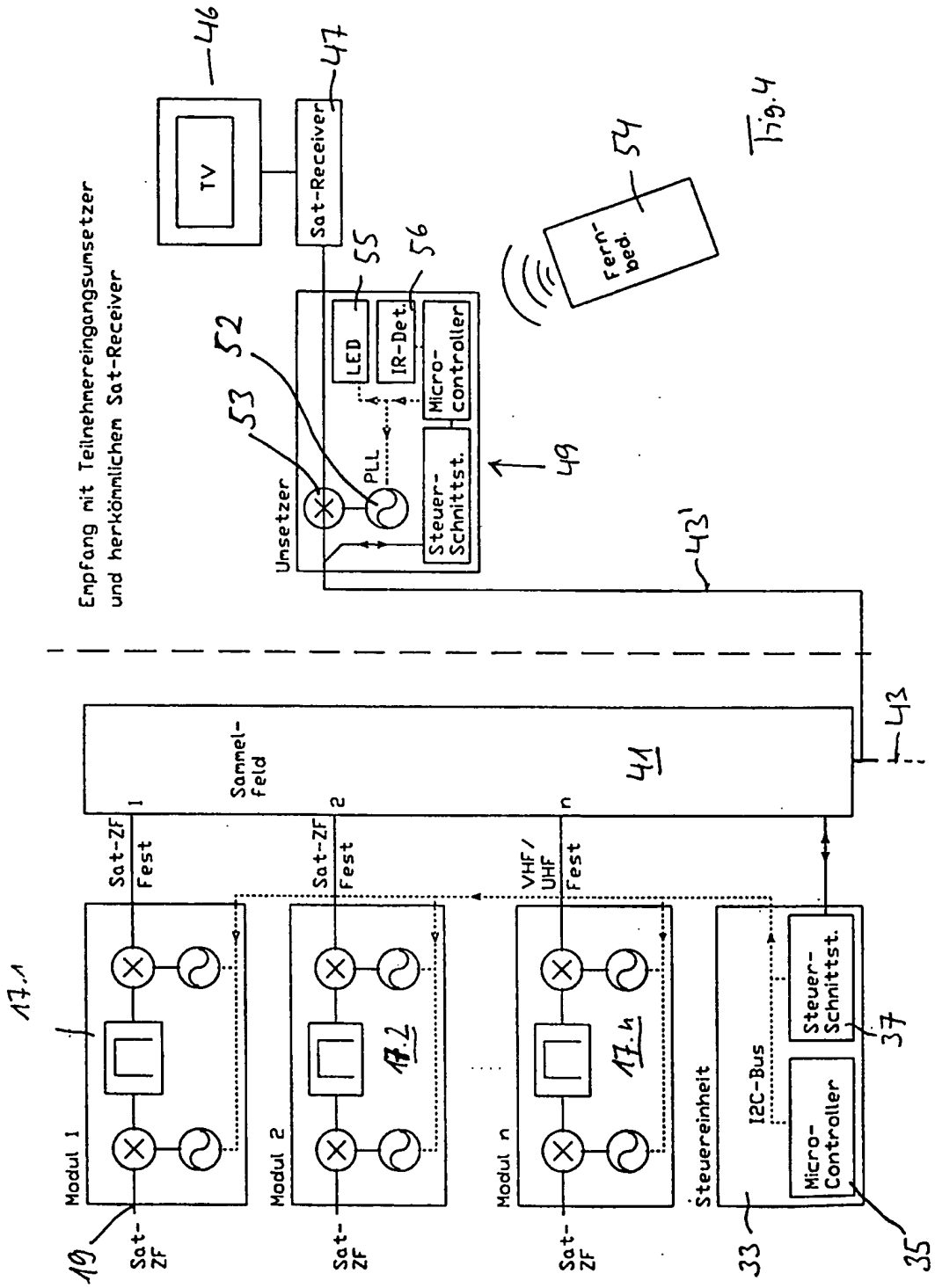

Empfang mit Teilnehmereingangsumsetzer
und herkömmlichem Sat-Receiver
TV
46
Sat-Receiver
47
54
Fern-bed.
55
56
LED
IR-Det.
Micro-controller
52
53
PLL
Unsetzer
Steuer-Schnittst.
49
43'
43
Sammel-feld
41
Sat-ZF
Fest
1
2
n
VHF/UHF
Modul 1
Modul 2
Modul n
17.1
17.2
17.n
19
Sat-ZF
Steuereinheit
I2C-Bus
Micro-Controller
Steuer-Schnittst.
33
35
37

Fig. 4

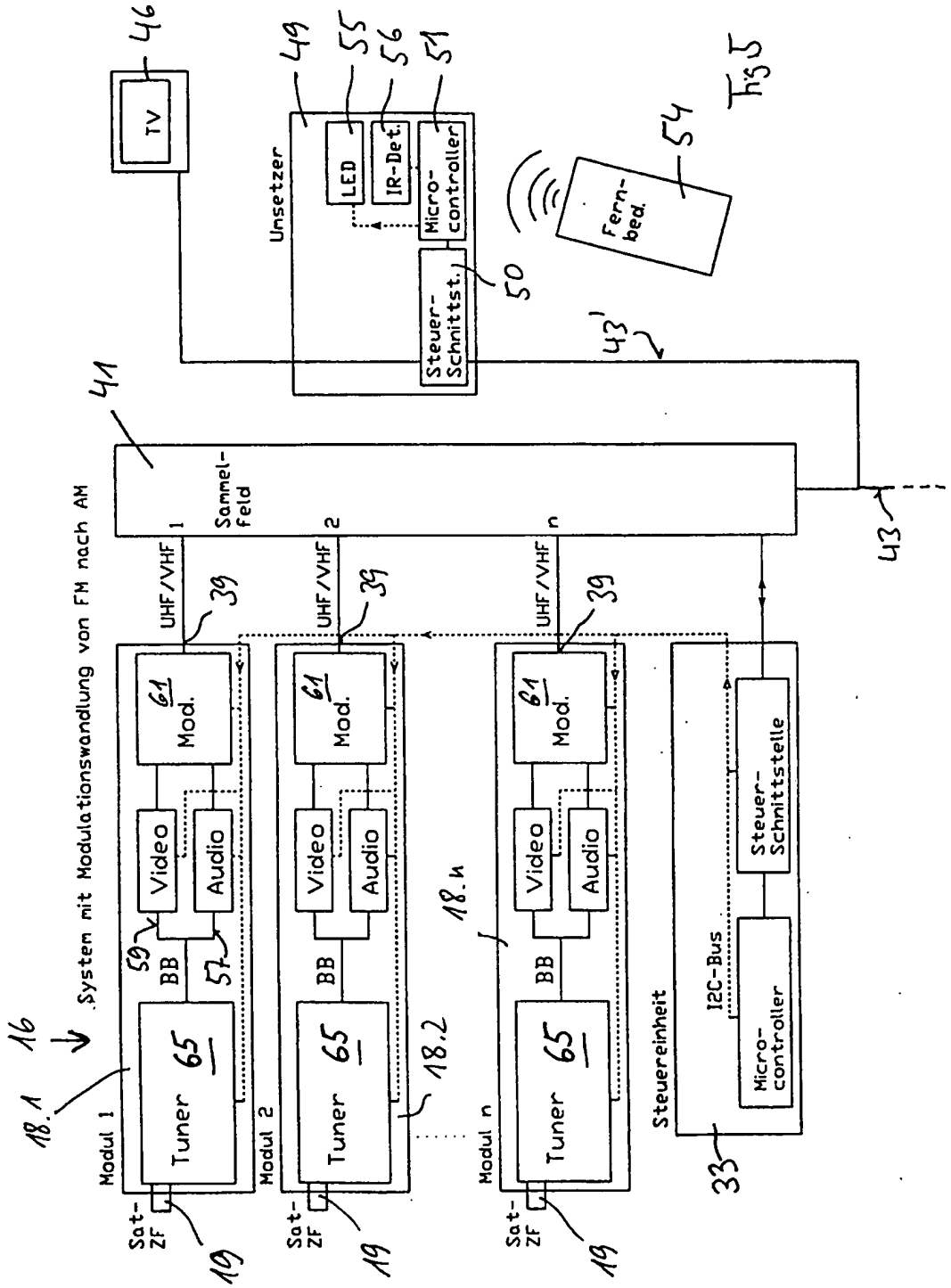

System mit Modulationswandlung von FM nach AM
16
18.1
18.2
18.n
Modul 1
Modul 2
Modul n
Tuner 65
BB
Video
Audio
Mod. 61
UHF/VHF
Sat-ZF
19
39
57
59
Sammel-Feld
41
43
43'
Steuereinheit
I2C-Bus
Micro-controller
Steuer-Schnittstelle
33
Unsetzer
LED
IR-Det.
Micro-controller
Steuer-Schnittst.
50
49
55
56
51
Fern-bed.
54
TV
46

Fig 5

EXHIBIT O

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THOMSON CONSUMER ELECTRONICS

10330 N. Meridian Street

Indianapolis, IN 46290

980-04087-100

RCA

DIRECTV® Receiver with UltimateTV® Service

SETUP GUIDE



DIRECTV.

ultimateTV.

SAFETY

WARNING
To reduce risk of fire or shock hazard, do not expose this receiver to rain or moisture.

WARNING: RISK OF ELECTRIC SHOCK. DO NOT OPEN.
TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.


This symbol indicates "dangerous voltage" inside the product that presents a risk of electric shock or personal injury.


This symbol indicates important instructions accompanying the product.

CAUTIONS
Do not stack electronic components or other objects on top of the Digital Satellite Receiver. The slots on top of the receiver must be left uncovered to allow proper airflow to the unit. Blocking the airflow to the unit could impair performance or damage your receiver and other components.

Do not stack the digital satellite receiver on top of a "hot component" such as an audio power amplifier.

FCC Regulations state that unauthorized changes or modifications to this equipment may void the user's authority to operate it.

NOTE TO CABLE TV INSTALLER
This reminder is provided to call your attention to article 820-40 of the National Electrical Code (Section 54 of the Canadian Electrical Code, Part 1) which provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building as close to the point of cable entry as practical.

NOTE TO SATELLITE DISH INSTALLER
This reminder is provided to call your attention to articles 810 and 820 of the 1999 National Electrical Code. Refer to article 810, in particular to 810-1 and 810-15, for required grounding of the metal structure of the Dish Antenna. Refer also to the 810-2 which, by reference to article 820, requires that the satellite dish coaxial cable shield be connected to the grounding system of the building as close to the point of cable entry as practical.

IMPORTANT NOTICE
This device incorporates an anticopy process technology that is protected by U.S. patents and other intellectual property rights. The anticopy process is licensed for non-commercial, home use only. Reverse engineering or disassembly is prohibited.

CARE AND CLEANING
Use a soft cloth or dusting attachment of your vacuum cleaner to dust your digital satellite receiver. Remove dust from the ventilation holes on the top and bottom.

Plastic surfaces are easily scratched and can be marred by alcohol and various solvents. Avoid excessive use of oil-based furniture polishes since the materials used in the cabinet will accumulate more dust. A non-abrasive, anti-static cleaner/ polisher is recommended.

SÉCURITÉ

ATTENTION
Pour réduire les risques d'incendie ou d'électrocution, ne pas exposer ce récepteur à la pluie ou à l'humidité.

ATTENTION: POUR RÉDUIRE LE RISQUE DE DÉCHARGE ÉLECTRIQUE, NE PAS RETIRER LE COUVERCLE (NI L'ARRIÈRE). AUCUNE PIÈCE RÉPARABLE PAR L'UTILISATEUR À L'INTÉRIEUR. CONFIER L'ENTRETIEN AU PERSONNEL QUALIFIÉ.


Ce symbole signifie que la tension à l'intérieur du produit est suffisamment grande pour présenter un risque de décharge électrique ou de blessure.


Ce symbole signifie que des directives importantes accompagnent le produit.

PRÉCAUTIONS
Ne pas empiler de composants électroniques ou tout autre objet sur le récepteur numérique. Les fentes sur le dessus du récepteur doivent rester découvertes afin de permettre une bonne aération de l'appareil. En bloquant ces prises d'aération, vous pourriez compromettre le rendement de votre récepteur et d'autres composants ou encore les endommager.

Ne pas placer le récepteur numérique par dessus un "composant chaud", tel qu'un amplificateur de puissance audio.

Les règlements du FCC stipulent que tout changement ou modification non autorisé apporté à cet appareil peut annuler le droit de l'utilisateur à le faire fonctionner.

REMARQUE À L'INTENTION DE L'INSTALLATEUR DU SERVICE DE CÂBLODISTRIBUTION:
Ce rappel a pour but d'attirer votre attention sur l'article 820-40 du Code national de l'électricité (Section 54 du Code canadien de l'électricité, Partie 1) qui fournit les lignes directrices en matière de mise à la terre et qui précise notamment que la mise à la terre du câble doit être reliée au dispositif principal de mise à la terre de l'immeuble, aussi près que possible du point d'entrée du câble.

REMARQUE À L'INTENTION DE L'INSTALLATEUR DE L'ANTENNE PARABOLIQUE ORIENTABLE:
Ce rappel a pour but d'attirer votre attention sur les articles 810 et 820 du Code national de l'électricité 1999. Reportez-vous à l'article 810, en particulier à 810-1 et 810-15, pour connaître les exigences en matière de mise à la terre de la structure métallique de l'antenne parabolique. Reportez-vous aussi à l'article 810-2 qui, par renvoi à l'article 820, requiert que le blindage du câble coaxial de l'antenne parabolique orientable soit relié au dispositif principal de mise à la terre de l'immeuble, aussi près que possible du point d'entrée du câble.

AVIS IMPORTANT:
Cet appareil comporte une technologie de procédé anticopie brevetée aux États-Unis et protégée par d'autres droits de propriété intellectuelle. La licence d'utilisation du procédé anticopie permet une utilisation non commerciale, à domicile seulement. La rétroconception (ou désassemblage) est interdite.

ENTRETIEN ET NETTOYAGE
Utiliser un chiffon doux ou la brosse à épousseter de votre aspirateur pour épousseter votre récepteur numérique. Retirer la poussière des prises d'aération sur le dessus et en dessous de l'appareil.

Les surfaces en plastique s'égratignent facilement; l'alcool et divers solvants peuvent en altérer le fini. Éviter d'utiliser trop souvent des encaustiques à base d'huile nettoyer, car les éléments à l'intérieur du récepteur attireront davantage la poussière. Un produit nettoyant non abrasif et antistatique est recommandé.

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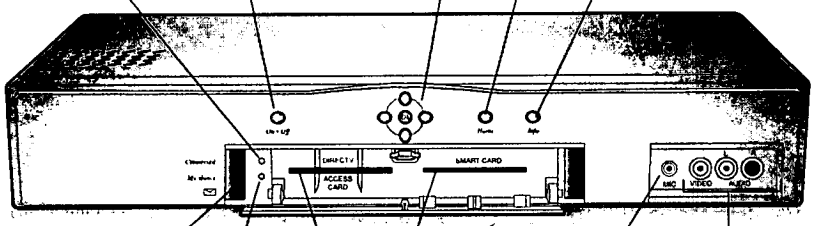
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WELCOME

This guide shows you how to set up your RCA®-DIRECTV™ Receiver with UltimateTV® Service for the best picture and sound quality on your television. An additional *User Guide* shows you how to use the TV and Internet features you can access using your receiver.

Before you follow the instructions here, your receiver should be connected to a satellite dish antenna. For instructions on installing the satellite dish antenna, see the *Satellite Dish Antenna Installer's Guide* that came with your antenna.

The following illustrations show the front and back panels of your receiver, with connectors and controls labeled. Refer to these illustrations if you need help identifying a part or a connector during the setup process.



Connected light
Yellow light indicates that you are connected to the WebTV® Network Service.

Navigation buttons
Press the directional buttons to move the on-screen selection rectangle; press OK to activate your selection.

Home button
Press to display TV Home, your starting point for enhanced TV features. Press to display Web Home, if you are connected to the WebTV® Service.

On/Off button/Power light
Press to turn receiver on or off. Green light indicates that the receiver is on.

Info button
Press to display information about the current show.

Message light
Red light indicates that you have e-mail waiting to be read.

My Shows light
Blue light indicates that something has been recorded.

Smart Card slots
The slot on the left is for your DIRECTV Access Card; the slot on the right is for an optional card. To access the card slots, press the front panel on the receiver until it pops open, as shown here.

Microphone Input
Connect an optional microphone here.

Audio/Video Inputs
Connect an optional audio/video source.

In from Antenna
Connect to a broadcast TV antenna or cable TV connection if you wish to watch off-air or cable channels when the receiver is turned off.

Channel Select
Set this switch to the channel for signal output.

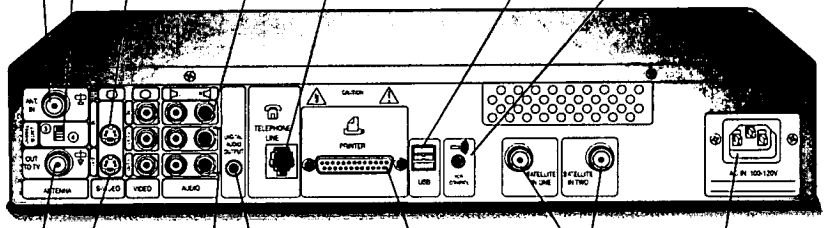
Audio/Video Inputs
Connect an optional audio/video source.

Universal Serial Bus
Connect an optional USB device such as a keyboard.

S-Video Input
Connect a video device for high-quality video input.

Telephone line
Connect the receiver to a phone line.

VCR Control
Use the receiver to control your VCR.



S-Video Out
Connect to a TV that supports S-Video.

Digital Audio Output
Connect an optional digital audio device.

Printer
Connect a printer to the receiver.

Satellite Inputs
Connect the receiver to the satellite dish antenna.

AC Input
Plug the power cord in here.

Out to TV
Connect the receiver to the TV.

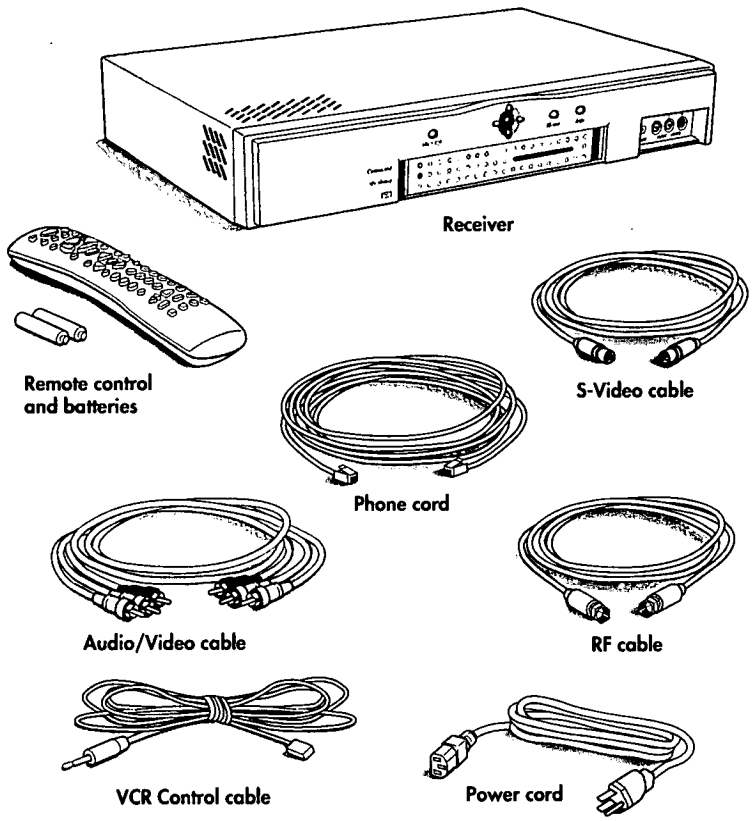
Audio/Video Out
Use OUT1 to connect the receiver to the TV. Use OUT2 to connect an optional device such as a VCR.

UNPACK

The following step-by-step instructions will show you how to connect your receiver to your TV, and to a VCR if you have one. The setup shown here will give you the best picture and sound quality.

Don't worry if you've never set up video equipment before; this guide clearly illustrates each step that's needed to set up your system. **Please follow the step-by-step instructions carefully.**

Start by unpacking your box. You'll find the following cables and accessories:



SAFETY PRECAUTIONS

Before you connect any cables, you should be aware of the following precautions.

Protect your devices from power surges

- Do not plug any power cords into the wall outlet until all devices are connected. If devices are plugged in, unplug them before connecting any cables.
- Always turn off the receiver, TV, and other devices before you connect or disconnect any cables.

Position cables correctly

- Insert all cable plugs firmly into their jacks.
- Make sure all antennas and cables are properly grounded.

Protect your components from overheating

- Do not stack electronic components or other objects on top of the receiver. The slots on top of the receiver must be left uncovered to allow proper airflow. Blocking the airflow could impair performance or damage your receiver and other components.
- Do not place the receiver on top of a "hot component" such as an audio power amplifier.
- Do not block ventilation holes in any devices, including ventilation holes on the sides. Make sure air can circulate freely.

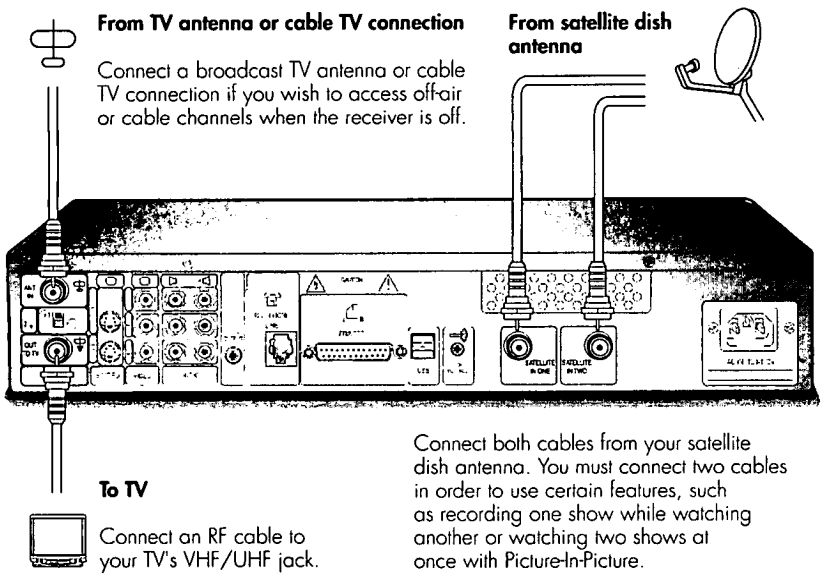
BASIC CONNECTION

This section assumes you've already installed your satellite dish antenna, or have had it installed by a professional. See the *Satellite Dish Antenna Installer's Guide* that came with your antenna for instructions on installing the antenna. If the satellite dish antenna was installed for you, check the back of your receiver and make sure the cable connections match the illustration below. If you installed the satellite dish antenna yourself, follow these steps to connect your receiver to the satellite dish antenna, TV, and, optionally, to a broadcast TV antenna or cable TV connection.

To connect the satellite dish antenna to the receiver:

- **Connect one RF cable (type RG-6) from the satellite dish antenna's LNB output to the receiver's SATELLITE IN ONE jack. Connect a second RF cable from the satellite dish antenna's second LNB output to the receiver's SATELLITE IN TWO jack.**

NOTE *You can watch TV if you connect only one cable between the satellite dish antenna and the receiver, but you must connect both cables to use features that require both of the receiver's tuners (viewing two shows at once with Picture-In-Picture or recording one show while watching another, for example).*



If you already have a broadcast TV antenna or cable TV hookup that you wish to continue using when the receiver is turned off, you can connect the cable from that broadcast source to the receiver.

To connect the receiver to a broadcast TV antenna or cable TV connection:

- **Connect the cable from your broadcast TV antenna or cable TV connection to the receiver's ANT IN jack.**

For a good-quality picture and mono sound on your TV, you should connect the receiver and TV with the supplied RF cable. Later in this guide you'll learn how to use additional cables (if your TV supports them) to provide better picture quality and stereo sound.

To connect the receiver to the TV:

- **Connect one end of the supplied RF cable to the TV's VHF/UHF jack, and the other end to the receiver's OUT TO TV jack.** (See the illustration on page 13.)

Now that your equipment is connected, you need to follow some on-screen instructions to point your satellite dish antenna to the proper position to send digital signals to your receiver. Read the instructions on the following pages, and refer to the *Satellite Dish Antenna Installer's Guide* if you need additional information.

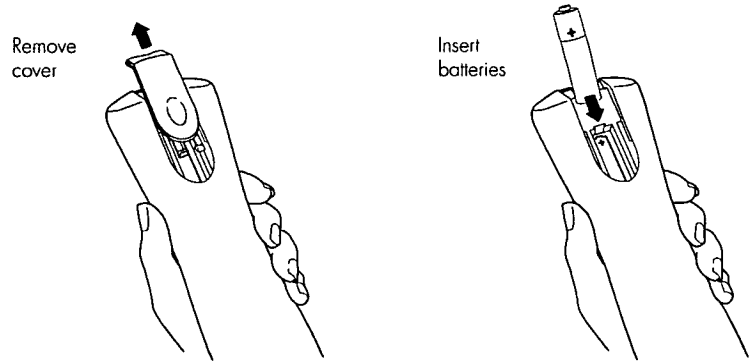
INSERT THE BATTERIES

To insert the batteries in the remote control:

■ **Remove the panel on the back of the remote control and insert the two supplied batteries into the battery compartment.** Be sure to match the + and – marks on the batteries with the + and – marks inside the battery compartment. Replace the panel.

If you have an optional wireless keyboard, **insert batteries into the keyboard's battery compartment.** Be sure to match the + and – marks on the batteries with the + and – marks inside the battery compartment. (While you can use your remote control to access all the features provided by your RCA®-DIRECTV™ Receiver with UltimateTV® Service, it's recommended that you purchase an RCA wireless keyboard if you intend to use features that require a lot of typing, such as writing e-mail, participating in chat rooms, or searching for TV programs. For information on purchasing a wireless keyboard, consult your local RCA retailer or use the accessories order form on page 53 of this guide.)

NOTE *Initially, you can use the remote control that came with your receiver to control only the receiver and most RCA, GE, and ProScan televisions and VCRs. Follow the instructions in the "Programming the Remote Control" section of this guide (page 37) to program your remote to control additional devices.*



DISH POINTING

When you installed your satellite dish antenna, you adjusted the position of the dish to optimize the signal level available for the receiver's tuners. See the *Satellite Dish Antenna Installer's Guide* for details on installing and positioning the dish.

Now you're ready to position the satellite dish antenna using a set of on-screen instructions.

To position the satellite dish antenna:

1 **Point the remote control at the receiver and press the remote's DIRECTV button. Using your TV's remote control, turn on your TV.** (See page 37 for information about using the receiver's remote to control your TV.)

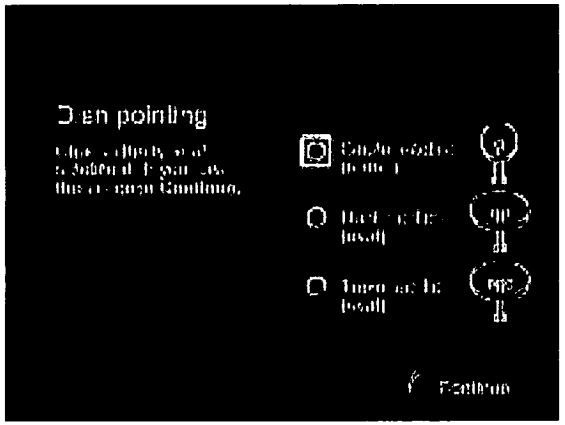
The receiver and TV turn on, and a Welcome screen appears on the TV.



2 **Press the remote control's OK button and you'll see some introductory screens that show you how to use the remote control and the on-screen keyboard.**

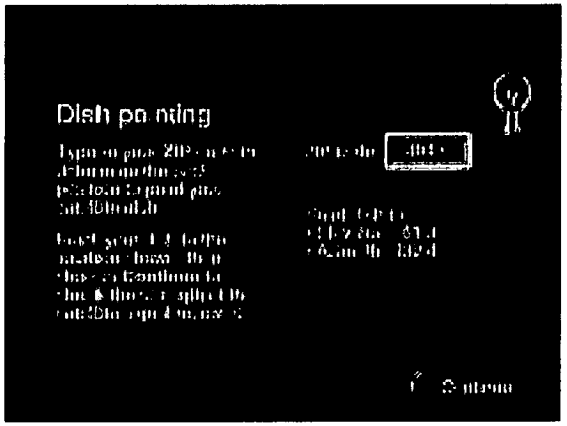
NOTE *You can access the Dish Pointing screens at any time by selecting* ***Settings*** *from TV Home (see page 34 for a description of TV Home), then selecting* ***Hooking up****.*

Following the introductory screens, the Dish Pointing screen appears:



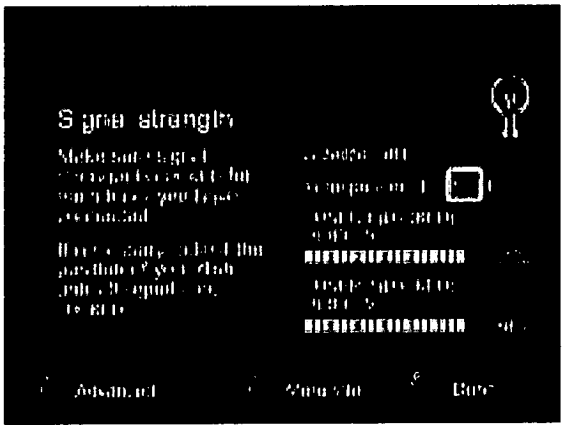
3 **Move the yellow box to the type of satellite dish antenna you have, then press the remote control's OK button to select that type.** A red dot appears next to your selection. (The illustrations here may vary slightly from what you see on your screen, depending on what type of satellite dish antenna you have.)

4 **Move the yellow box to Continue, then press the remote's OK button.** A second Dish Pointing screen appears:



5 **Use the remote control's number buttons to enter your ZIP code.** (If you make a mistake, press the remote's **OK** button and use the on-screen keyboard to correct the ZIP code.)

6 **Move the yellow box to Continue, then press the remote's OK button.** The Signal Strength screen appears. This screen reports the satellite signal level for the selected transponder and satellite.



7 **Look at the signal meter for each tuner, indicated by a green bar.**

The words "LOCKED" and "DIRECTV" appear next to TUNER 1 and TUNER 2 when a stable signal is received.

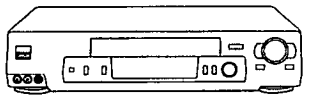
8 When your satellite dish antenna is positioned correctly, select **Done** and press **OK** to continue with the on-screen instructions, which will instruct you to sign up for DIRECTV® programming.

NOTE *To sign up for DIRECTV® programming, your DIRECTV Access Card must be inserted in the receiver's lefthand card slot, which is labeled "DIRECTV ACCESS CARD." To check the card, press the receiver's front-panel door until it pops open. (See the illustration on page 2.)*

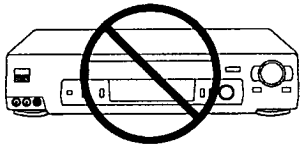
SETUP

This section assumes that your satellite dish antenna has been installed and that your TV is connected to the RCA®-DIRECTV™ Receiver with UltimateTV® Service with an RF cable, the most basic connection. The RF cable connection will provide basic video and audio, but picture and sound quality will be better if you follow the steps on the next few pages. Although your setup may differ slightly from the illustrations here, it should look similar. (Look at the illustrations on pages 2 through 4 if you have trouble identifying a cable or connector.)

WILL YOU BE INCLUDING A VCR?



YES **If you have a VCR, skip to STEP 1 on page 16 now.**



NO **If you *do not* have a VCR, continue to STEP A on page 13 now.**

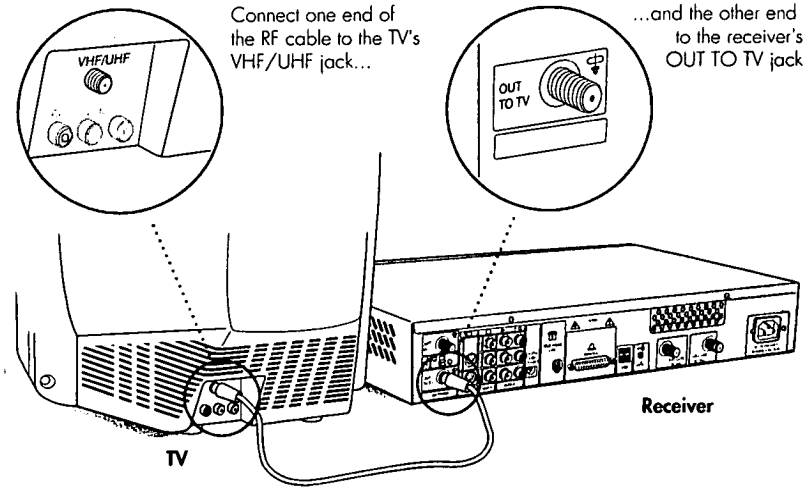
CONNECT THE RECEIVER AND TV (NO VCR)

IMPORTANT *COMPLETE STEPS A THROUGH C IF YOU DO NOT HAVE A VCR, then complete Steps 9 and10 (beginning on page 25). If you wish to include a VCR in your setup, follow Steps 1 through 10 (beginning on page 16) instead.*

When your satellite dish antenna was installed, your TV and receiver should have been connected with an RF cable. Make sure that one end of an RF cable is connected to your TV's **VHF/UHF** jack, and the other end to the receiver's **OUT TO TV** jack, as shown in Step A below.

If the RF cable is not already connected, follow these steps.

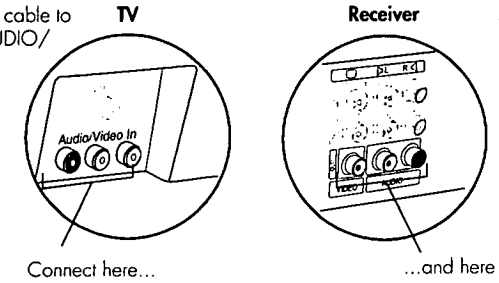
STEP A CONNECT THE TV AND RECEIVER WITH AN RF CABLE



1 **Connect one end of the supplied RF cable to your TV's VHF/UHF jack.** (This jack might be labeled VHF/UHF IN, ANT, ANT IN, IN FROM ANT, CABLE IN, or something similar.)

STEP B CONNECT THE TV AND RECEIVER USING A/V CABLES

If your TV has A/V Input jacks, connect one end of the A/V cable to the TV's AUDIO/VIDEO IN jacks.

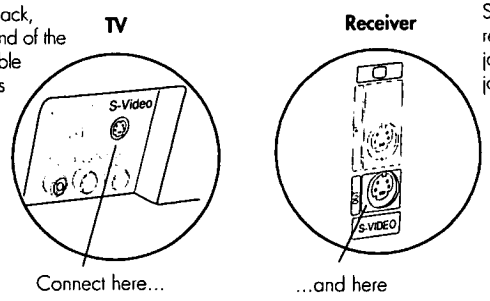


Connect the other end to the receiver's AUDIO/VIDEO OUT1 jacks (the bottom row of jacks).

2 **Connect the other end of the RF cable to the receiver's OUT TO TV jack.**

STEP C CONNECT THE S-VIDEO CABLE

If your TV has an S-Video In jack, plug one end of the S-Video cable into the TV's S-Video IN jack.



Plug the other end of the S-Video cable into the receiver's S-VIDEO OUT jack (the bottom S-Video jack).

PROCEED NOW TO STEP 9 (PAGE 25)

1 **Look on the back of your TV and see if it has an S-Video In jack.**



S-Video provides superior quality video, but not all TVs support S-Video. Don't worry; your system should work fine without the S-Video cable. **If your TV does not have an S-Video jack, continue now to Step 9 on page 25.**

2 If your TV has an S-Video In jack, **connect one end of the supplied S-Video cable to the TV's S-VIDEO IN jack.**

3 **Connect the other end of the S-Video cable to the receiver's S-VIDEO OUT jack.**

That's it! You're finished with this part. Continue now to Step 9 (page 25).

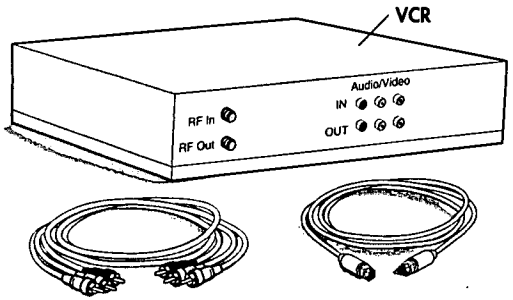
CONNECT THE RECEIVER, TV, AND VCR

IMPORTANT *COMPLETE STEPS 1 THROUGH 10 IF YOU HAVE A VCR. If you do not have a VCR, follow the instructions in STEPS A through C (beginning on page 13), then complete Steps 9 and10 (beginning on page 25).*

Although your receiver lets you record and play back hours of TV programs, you may wish to keep your existing VCR connected so you can watch videotapes you rent or purchase or record programs onto tape for your video collection. (When you record digital video on your receiver, older material might eventually be erased from the receiver's hard drive to make room for newly recorded material. If you want a permanent copy of a program, you should record it on your VCR.) If you have a VCR, follow the steps 1 through 10 to connect it to your receiver. (You must complete all the steps.)

NOTE *The instructions here require a second RF cable and A/V cable, in addition to the cables that came with your receiver. If your VCR is set up, you probably already have these cables. If you need additional cables, you can purchase them at an electronics store.*

STEP 1 DISCONNECT ALL CABLES FROM YOUR VCR



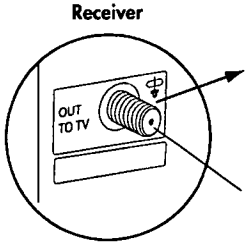
Audio/Video cable **RF cable**

■ **Before you begin, disconnect the A/V and RF cables from your VCR.**

It might seem strange to disconnect cables that are already connected, but in the following steps you'll need to connect the cables in different places. The connection process will be much easier if you disconnect the cables now.

STEP 2 DISCONNECT THE RF CABLE FROM THE RECEIVER

Disconnect the RF cable from the receiver's OUT TO TV jack (if it's already connected there). Leave the other end of the cable connected to the TV (if it's already connected there).



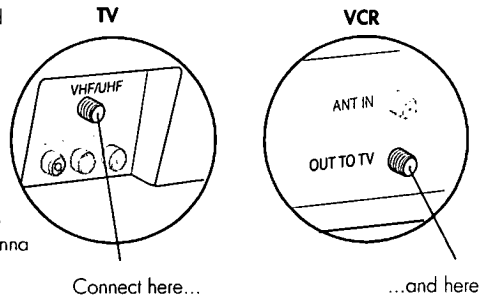
■ When your satellite dish antenna was installed, one end of an RF cable should have been connected to the receiver's **OUT TO TV** jack. **Disconnect the RF cable from the receiver now.**

NOTE *Make sure your cable or off-air antenna is still connected to the satellite receiver's ANT IN jack.*

STEP 3 CONNECT THE TV AND VCR WITH AN RF CABLE

Connect one end of an RF cable to the TV's VHF/UHF jack.

(This cable might already be connected to the TV from when the satellite dish antenna was installed.)

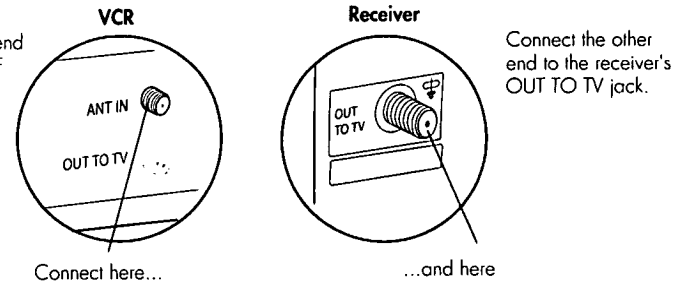


Connect the other end to the VCR's OUT TO TV (RF OUT) jack.

1. **Connect one end of the supplied RF cable to the TV's VHF/UHF jack.** (This jack might be labeled VHF/UHF IN, ANT, ANT IN, IN FROM ANT, CABLE IN, or something similar.) This cable might have been connected when your satellite dish antenna was installed.
2. **Connect the other end of the RF cable to the VCR's OUT TO TV jack.** (This jack might be labeled RF OUT.)

STEP 4 CONNECT THE VCR AND THE RECEIVER WITH A SECOND RF CABLE

Connect one end of a second RF cable to the VCR's ANT IN (RF IN) jack.

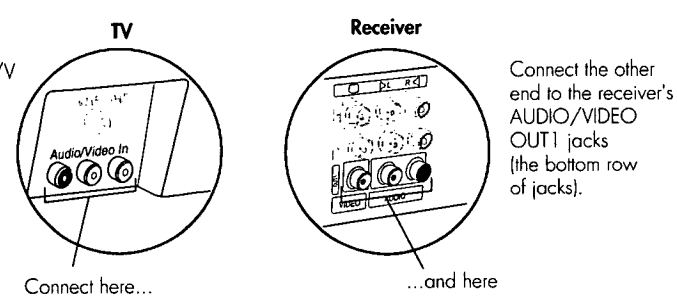


Connect the other end to the receiver's OUT TO TV jack.

1. **Connect one end of a second RF cable to the VCR's IN FROM ANT jack.** (This jack might be labeled RF IN, IN, or something similar.)
2. **Connect the other end of the second RF cable to the receiver's OUT TO TV jack.**

STEP 5 CONNECT THE TV AND RECEIVER WITH AN A/V CABLE

If your TV has A/V inputs, connect one end of the supplied A/V cable to the TV's AV IN jacks.



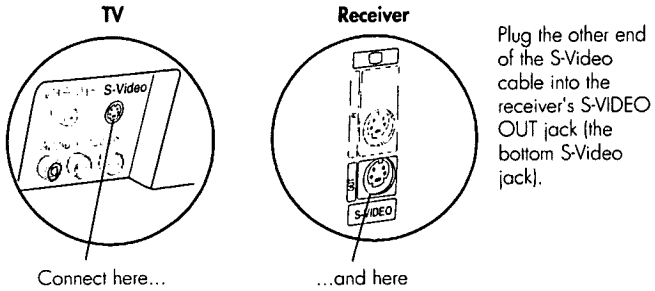
Connect the other end to the receiver's AUDIO/VIDEO OUT1 jacks (the bottom row of jacks).

1 **Connect one end of the supplied audio/video (A/V) cable—the cable with the red, white, and yellow ends—to the TV's Audio/Video In jacks.** The set of jacks will be labeled A/V IN, AUDIO/VIDEO IN, VIDEO 1 INPUT, or something similar. (Sometimes Audio/Video In jacks are located on the front of a TV; you might have to open a panel to see them.) If your TV has a yellow jack with only one other jack beside it, connect just the yellow and white cable-ends; leave the red cable-end unconnected.

2 **Connect the other end of the A/V cable to the receiver's AUDIO/VIDEO OUT jacks** (*the bottom row of jacks*, labeled OUT1). Match the yellow cable-end to the yellow jack, the white cable-end to the white jack, and the red cable-end to the red jack.

STEP 6 CONNECT THE S-VIDEO CABLE

If your TV supports S-Video, plug one end of the S-Video cable into the TV's S-Video In jack.



Plug the other end of the S-Video cable into the receiver's S-VIDEO OUT jack (the bottom S-Video jack).

1 **Look on the back of your TV and see if it has an S-Video In jack.**



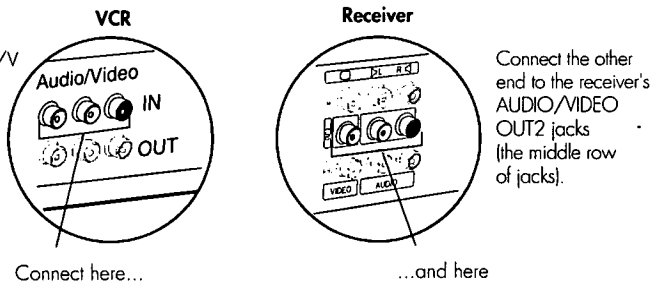
S-Video provides superior quality video, but not all TVs support S-Video. Don't worry; your system should work fine without the S-Video cable. **If your TV does not have an S-Video jack, continue now to Step 7.**

2 If your TV has an S-Video In jack, **connect one end of the supplied S-Video cable to the TV's S-VIDEO IN jack.**

3 **Connect the other end of the S-Video cable to the receiver's S-VIDEO OUT jack.**

Continue now to Step 7.

STEP 7 CONNECT THE VCR AND RECEIVER WITH AN A/V CABLE



1 **Connect one end of a second A/V cable to the VCR's AUDIO/VIDEO IN jacks.** (These jacks might be labeled LINE IN, LINE IN 1, or something similar.)

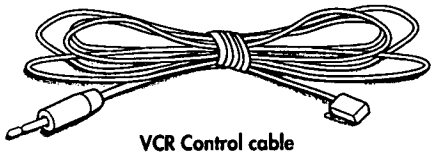
2 **Connect the other end of the second A/V cable to the receiver's second set of AUDIO/VIDEO OUT jacks** (the middle row of jacks, labeled OUT2). Match red to red, white to white, and yellow to yellow. If your VCR has a yellow jack with only one other jack beside it, connect just the yellow and white cable-ends; leave the red cable-end unconnected.

Continue now to Step 8.

CONNECT AND POSITION THE VCR CONTROL CABLE

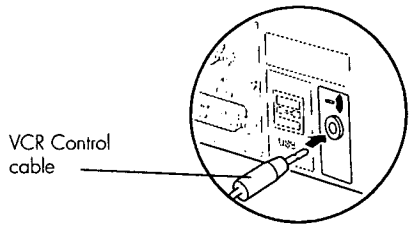
STEP 8 CONNECT THE VCR CONTROL CABLE

Follow the instructions here only if you have connected a VCR to your TV and receiver.

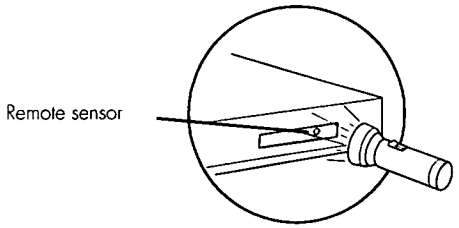


VCR Control cable

The VCR Control cable sends signals from your receiver to your VCR, allowing the receiver to instruct the VCR to record shows.



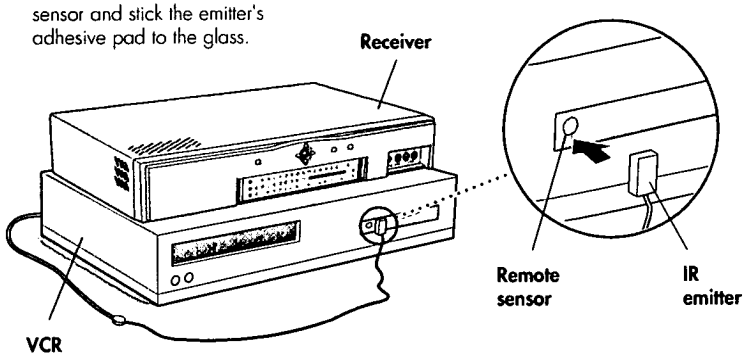
1 **Plug the VCR Control cable into the receiver's VCR CONTROL jack.**



2 **Locate the remote sensor on your VCR.** Remote sensors are usually hidden behind a pane of tinted glass or plastic. To find the sensor, shine a flashlight at the tinted panel on the front of your VCR. You'll see the sensor, which is a small, reflective dot.

CONNECT THE VCR CONTROL CABLE – *continued*

Place the VCR Control cable's IR emitter over the VCR's remote sensor and stick the emitter's adhesive pad to the glass.



3 Remove the protective strip from the IR emitter (the small, rectangular piece on the end of the VCR Control cable) to expose the adhesive pad. **Position the IR emitter over the VCR's remote sensor and press firmly to stick it onto the glass or plastic pane with the adhesive pad.**

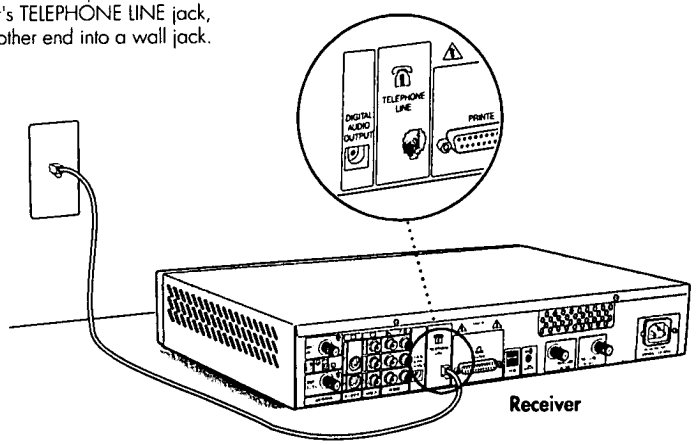
Once your system is set up, you will need to follow some on-screen instructions to make the receiver communicate with your VCR. See the *User Guide* for these instructions.

Now, continue to Step 9.

CONNECT THE PHONE CORD

STEP 9 CONNECT THE PHONE CORD

Connect one end of the phone cord to the receiver's TELEPHONE LINE jack, and plug the other end into a wall jack.



When your satellite dish antenna was installed, a phone cord might have already been connected. If no phone cord is connected, follow the instructions below.

1 **Plug one end of the supplied phone cord into the receiver's TELEPHONE LINE jack.**

2 **Plug the other end of the phone cord into a nearby telephone wall jack.**

CONNECT THE PHONE CORD – *continued*

The receiver uses a telephone line for a number of purposes:

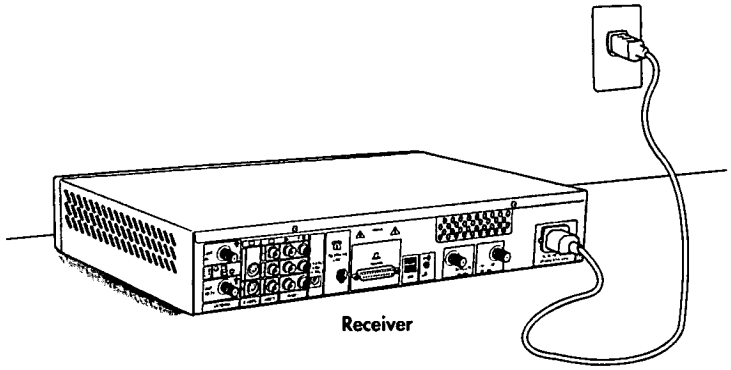
- to connect to the World Wide Web if you use the WebTV® Service features
- to periodically update your DIRECTV Access Card
- to enable other features and services, depending on your receiver's capabilities

NOTE *If you already have a telephone cord plugged into the wall jack, you may wish to purchase a telephone splitter, a device that lets you plug two phone cords into a single telephone wall jack.*

Now, continue to Step10.

PLUG IN THE POWER CORD

STEP 10 PLUG IN THE POWER CORD



You're nearly finished with the setup. It's time to plug in the power cord.

To plug in the power cord:

1. **Plug the supplied AC power cord into the receiver's AC IN jack.**
2. **Plug the other end of the power cord into a grounded electrical outlet.**
3. **Plug the TV's power cord into a grounded electrical outlet. Plug in the VCR's power cord if you included a VCR in your setup.**

That's it! You have connected everything you'll need to take advantage of the capabilities of your receiver. Take a look at the illustration on page 28 (setup with no VCR) or page 29 (setup with VCR) to make sure your cables are connected properly.

COMPLETED SETUP (NO VCR)

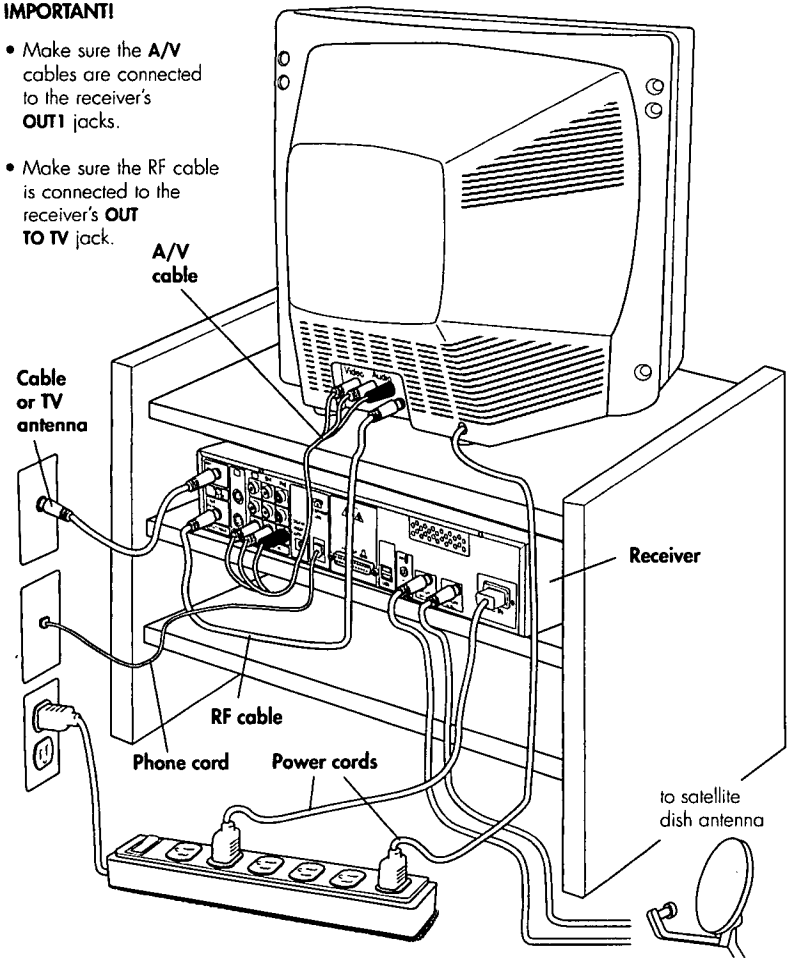
When you've completed all the steps, your system should look like this. Use this illustration to check your connections.

Depending on your TV or other equipment in your system, your setup might look a bit different. However, this illustration shows the basic connections you'll need for a successful setup. (S-Video is not shown here.)

NOTE *Don't worry if you have a few cables left over. Many setups don't use every cable provided.*

IMPORTANT!

- Make sure the **A/V** cables are connected to the receiver's **OUT1** jacks.
- Make sure the RF cable is connected to the receiver's **OUT TO TV** jack.



COMPLETED SETUP (WITH VCR)

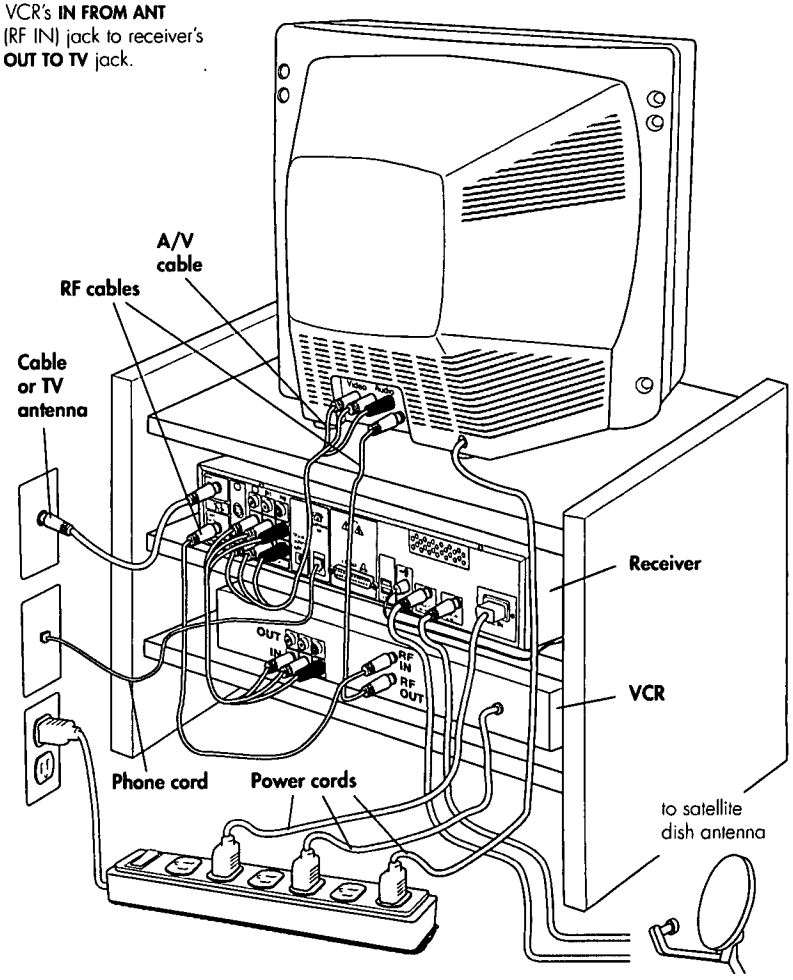
IMPORTANT:

Make sure the A/V cables are connected as follows:

- TV's **AUDIO/VIDEO IN** jacks to receiver's **AUDIO/VIDEO OUT1** jacks.
- VCR's **AUDIO/VIDEO IN** jacks to receiver's **AUDIO/VIDEO OUT2** jacks.

Make sure the RF cables are connected as follows:

- TV's **VHF/UHF** jack to VCR's **OUT TO TV** (RF OUT) jack.
- VCR's **IN FROM ANT** (RF IN) jack to receiver's **OUT TO TV** jack.



TURN ON THE RECEIVER

Once you've successfully connected all your components, you're ready to turn on your RCA®-DIRECTV™ Receiver with UltimateTV® Service and start watching TV. Once you subscribe to DIRECTV® programming and the UltimateTV® Service, you'll be ready to start watching and recording DIRECTV® programming as well.

For now, you'll turn on your receiver and TV and make sure you see the TV Home screen (described in the following section) on your TV.

TURN ON YOUR RECEIVER

1. **Using your TV's remote control, turn on your TV.** You might see static at first, but don't worry. Keep going.

2. **Turn on the receiver by pressing the DIRECTV button on your remote control.** (The remote control is illustrated on page 36.) Be sure to point the remote control at the receiver, not the TV.

IMPORTANT *To control the receiver with the remote, you must press the remote's* ***DIRECTV*** *button.*

The green power light on the front of the receiver will glow, indicating that the receiver is turned on.

3. **Tune your TV to the correct channel or video input to view the TV Home screen.** (TV Home is described in detail in the *User Guide*.)

If you connected the receiver to your TV using only an RF cable (no A/V cables), use your TV's remote control (not the receiver's remote control) or the Channel Up/Down buttons on the front of the TV to tune the TV to channel 3 or 4. Set the **CHANNEL SELECT** switch on the back of the receiver to the same channel as the TV.

or

If you connected the receiver to your TV using A/V cables, press the **TV/Video** button on your TV's remote control (not the receiver's remote control) or on the front of the TV until you see the *TV Home* screen. (This button might be labeled INPUT or something similar.)

If you don't see the *TV Home* or *Welcome* screen, check the troubleshooting tips on the following pages.

TROUBLESHOOTING

Refer to these tips if you're having problems.

IF YOUR REMOTE CONTROL DOES NOT SEEM TO WORK:

- Make sure the batteries are properly installed and are not worn down (press a button and see if the light near the top of the remote glows).
- Make sure you are pointing the remote control at the receiver, not at your TV or another device.
- Press the **DIRECTV** button on the remote control to make sure it's communicating with the receiver, instead of with another device.

IF YOU DON'T SEE THE *TV HOME* OR *WELCOME* SCREEN ON YOUR TV:

- Make sure the receiver's green power light is illuminated. (A blinking green light means the receiver is turning off. If the green light is blinking, wait until it stops and then press the **DIRECTV** button on the remote to turn the receiver back on.)
- Press the **TV/Video** button on your TV's remote control or on the front of your TV until the TV Home screen appears. (A Welcome screen appears if this is the first time you've turned on the receiver.)
- Make sure the DIRECTV Access Card is inserted in the receiver's lefthand card slot, the slot labeled "DIRECTV ACCESS CARD." To check the card, press the front-panel door on the receiver until it pops open. (See the illustration on page 2.)
- Press the **Antenna** button on the receiver's remote control.
- If you've connected your TV to the receiver with just an RF cable, tune the TV to channel 3 or 4. Set the **CHANNEL SELECT** switch on the back of the receiver to the same channel as the TV.
- If you've included a VCR in your setup, make sure you've connected an RF cable between the **VCR's ANT IN** jack and the receiver's **OUT TO TV** jack.

IF, AFTER TRYING ALL OF THE ABOVE, YOU STILL DON'T SEE THE *TV HOME* SCREEN, RECHECK YOUR CONNECTIONS:

- Check that the power cord, telephone cable, and all other cables are securely plugged into their respective jacks and outlets.
- Make sure that you have connected output jacks to input jacks. For example, an A/V cable plugged into the **Audio/Video In** jacks on your TV must connect to the **A/V OUT** jacks on the receiver. If you plug the connectors into the receiver's **A/V IN** jacks, the connection will not work. Simply matching the red, white, and yellow colors will not necessarily produce the right connection.

IF THE RECEIVER DOES NOT TURN ON:

- Make sure the receiver is plugged in. (Make sure the wall receptacle is "live" by plugging in another item, such as a lamp, to see if it turns on.)
- Unplug the receiver and wait five minutes, then plug it in again.

IF THE RECEIVER TURNS OFF WHILE IN USE:

- An electronic protection circuit may have been activated because of a power surge. Wait 30 seconds, then turn on the receiver. If this happens often, the voltage in your house may be abnormally high or low.

IF THE RECEIVER TURNS ON OR CHANGES CHANNELS UNEXPECTEDLY:

- A recording you scheduled may be beginning or ending.

IF THE VCR TURNS ON UNEXPECTEDLY:

- A recording you scheduled may be beginning.

IF YOU'RE WATCHING TV AND GET A PICTURE BUT NO SOUND:

- Make sure the volume on your TV is turned up. Use your TV's remote control or the **Volume** button on the front of the TV.
- Check to make sure you have plugged the audio cable-ends (the red and white ends of the A/V cable) into the correct audio input jacks on your TV. (The jacks will be labeled **A/V IN, AUDIO/VIDEO IN, VIDEO 1 INPUT**, or something similar.) If you connect the audio connectors from the receiver to audio outputs on your TV, you will not get sound. (Audio output jacks will be labeled **A/V OUT, AUDIO/VIDEO OUT,** or something similar.)

IF YOU'RE STILL HAVING PROBLEMS

If you're experiencing problems with your receiver and none of the previous troubleshooting tips helps, you may want to run a system test, which runs a basic diagnostics check on your system. You should run the system test several times before concluding there's a problem. Occasional fluctuations in the phone line or satellite signal can create temporary false readings.

(You must be able to see the TV Home screen in order to run this test.)

1. From the *TV Home* screen, select **Settings** and press **OK**.
2. From the *Settings* screen that appears, select **System test** and press **OK**.
3. Select **Run Test** and press **OK**.

If your system does not pass the test, check your system's cables, satellite dish pointing (see the following troubleshooting tip), phone connection, and access card.

FINE-TUNING THE SIGNAL

If you installed the satellite dish antenna yourself, you have already used the on-screen interactive setup to find the dish-pointing coordinates, acquire and fine-tune the signal, and run a system test.

To run the interactive setup again:

1. From the *TV Home* screen, select **Settings** and press **OK**.
2. In the *Settings* screen that appears, select **Hooking up** and press **OK**.
3. Follow the on-screen instructions to check your dish pointing. See the *Satellite Antenna Installer'* that came with your satellite dish antenna if you need further information.

IF YOU STILL NEED HELP

If you continue to experience problems with your system, call 1-866-508-9661.

WATCHING TV

Once you've set up your equipment and tuned to the TV Home page, you're ready to move on to the *User Guide*, which tells you how to use the features of your RCA®-DIRECTV™ Receiver with UltimateTV® Service.

Meanwhile, you might want to use your system to watch TV or play a tape in your VCR. Here's how.

To watch DIRECTV® programming:

1. Make sure your TV is tuned to the correct input channel for the receiver: Channel 3 or 4 if the receiver and TV are connected with just an RF cable, or VIDEO 1 if they are connected with A/V cables.

2. Use the receiver's remote control to turn on your receiver (press the **DIRECTV** button), and your TV's remote control to turn on the TV.

   The *TV Home* screen appears. (A *Welcome* screen appears if this is the first time you've turned on your system. Take the on-screen tour to learn about DIRECTV® programming and the UltimateTV® Service, then call the number on your screen to subscribe.)



3. Use your receiver's remote control (not your TV's remote control) to tune to the channel you want to watch.

4. The program will appear in a small window within the TV Home screen. To zoom the TV picture in TV Home to full-screen size, use the remote's arrow buttons to place the yellow selection box around the picture, then press **OK**. (Optionally, you can simply press the remote's **CLEAR** button.)

To play a tape with your VCR:

1. Make sure your VCR is tuned to the correct input channel for the receiver: Channel 3 or 4 if the receiver and VCR are connected with just an RF cable, or LINE 1 or 2 if they are connected with A/V cables.

2. Use your TV's remote control to turn on the TV and tune it to channel 3 or 4. (Make sure the CHANNEL switch on the back of the VCR is set to the same channel as the TV: either 3 or 4).

3. Turn on the VCR and insert a tape.

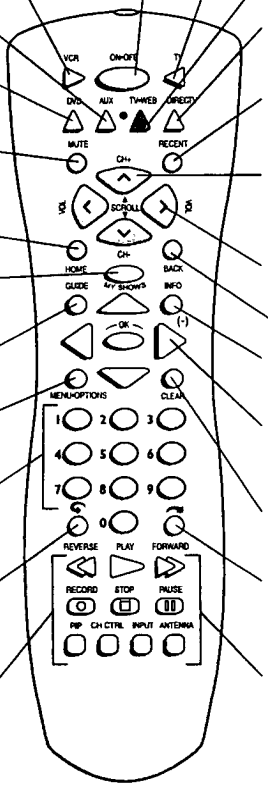
4. Press the **PLAY** button on your VCR's remote control or the **PLAY** button on the front of the VCR to play the tape.

NOTE *For now, you should use the remote control that came with your VCR to play tapes on the VCR. For instructions on programming the receiver's remote to control your VCR, see the section that begins on page 37 of this guide.*

To record a program on your VCR:

For information on instructing the receiver to record programs on your VCR, see the User Guide.

REMOTE CONTROL



VCR
When programmed, tells the remote to control the VCR.

AUX
Can be programmed to control a second TV, VCR, or other device.

DVD
When programmed, tells the remote to control the DVD player.

MUTE
When programmed, mutes the TV volume.

HOME
Takes you to the TV Home screen.

MY SHOWS
Takes you to the My Shows screen.

GUIDE
Displays the program guide. Press again to cycle through custom guides.

MENU·OPTIONS
Displays or hides an options panel.

Number buttons
Enter a channel number. (Or type numbers in a text-entry box.)

Instant Replay
Jumps back 7 seconds and replays video.

REVERSE
Rewinds recorded video.

PLAY
Plays recorded video.

FORWARD
Fast-forwards recorded video.

RECORD
Records a live program or a selected program in the Guide.

STOP
Stops the current recording session or stops playback of a recording.

ON·OFF
Turns the receiver or other device on or off.

TV
When programmed, tells the remote to control the TV.

TV·WEB
Switches between TV and Web view.

DIRECTV
Tells the remote to control the receiver. Turns the receiver on.

RECENT
Displays a list of the last Web screens viewed. (For information on using this button when watching TV, see the on-screen Help.)

CH +/CH -
Moves up or down one channel when watching TV. Scrolls the Guide up or down one screen at a time.

VOL </VOL >
Turns TV volume down or up.

BACK
Takes you to the last screen you viewed.

INFO
Displays info about a show or Web page.

Arrows/OK
Move the yellow box to select an item on the screen. OK confirms your selection.

CLEAR
Returns you to full-screen TV.

Jump Ahead
Jumps ahead 30 seconds in recorded video.

PAUSE
Pauses live or recorded video.

PIP
Displays or hides Picture-In-Picture window.

CH CTRL
Switches focus between the PIP and full-screen view.

INPUT
When controlling the TV, toggles through available video input sources.

ANTENNA
Toggles video signal source on OUT TO TV jack between satellite signals and off-air antenna.

PROGRAMMING THE REMOTE CONTROL

So far, you've been using the remote control to send commands to your RCA®-DIRECTV™ Receiver with UltimateTV® Service. This section shows you how to program the remote to control other devices as well.

You can program the universal remote to control most brands of remote-controllable VCRs and TVs. The remote control is already programmed to control most RCA, GE, or PROSCAN devices. If you have another brand of TV, VCR, or DVD player, follow the instructions here to program your remote to control that device.

First, you must determine whether you need to program the universal remote control.

To find out if you need to program the remote:

1. Turn on your TV, VCR, or DVD player.
2. Point the remote at the device you want to control and press the appropriate button (**TV, DVD,** or **VCR**) on the remote.
3. Press the remote's **ON·OFF** button or **CH+** button and see if the device responds.

If it does not respond, you need to program the remote.

When you program the remote, you can automatically search for the necessary code, or you can use the list of codes on page 40 of this guide to manually enter the code.

To automatically find the appropriate remote code:

1. Turn on the TV, VCR, or DVD player you want to control.
2. Press and hold the remote button you want to program (**TV, DVD,** or **VCR**).
3. While holding the button, press and hold the remote's **ON·OFF** button. Hold both buttons until the light on the remote turns on, then release both buttons.

NOTE *If you want to exit the automatic code search without programming any devices, press the remote's* **CLEAR** *button until the light turns off.*

4. Point the remote at the TV, VCR, or DVD player and press and release the remote's **PLAY** button.

5 Wait five seconds or until the remote's light stops flashing.

The remote is searching for the correct code to program.

If, after five seconds, the device you want to control does not turn off, press and release **PLAY** again to tell the remote to search the next set of codes.

Continue pressing and releasing **PLAY** until the device turns off or you have searched through all the codes. If the device does not turn off after you press **PLAY** 20 times, which searches all available codes, then the remote can't control that device.

If the device you want to control does turn off, follow these steps:

1 Press and release the remote's **REVERSE** button, then wait two seconds. Repeat this step until the device turns back on.

2 To finish, press and hold the remote's **STOP** button until the remote's light turns off.

NOTE *You can control a second TV, VCR, or other device using the remote's **AUX** button. To use the **AUX** button you must manually enter the appropriate code, as described in the following section.*

To manually enter the remote code:

1 Turn on the device you want to control.

2 Using the "Remote Codes" table beginning on page 40, look up the brand and code number(s) for the device.

3 Press and hold the appropriate button: **TV, VCR, DVD,** or **AUX.**

4 Using the remote's number buttons, enter the device's code from the "Remote Codes" table.

5 Release the device button (**TV,** etc.), then press the remote's **ON·OFF** button and see if the device responds. If it doesn't respond, try pressing **ON·OFF** again.

6 If you get no response, repeat these steps using the next code for your brand, until the device responds to the remote's commands.

To control a device with the remote:

1 Press the appropriate button on the remote (**TV, VCR, DIRECTV,** or **AUX**) to control that device with the remote.

IMPORTANT *To control the receiver with the remote, you must first press the remote's **DIRECTV** button.*

2 Press the remote's **ON·OFF** button to turn on the device.

3 Use the remote control buttons that apply to that device.

If the remote control doesn't work:

- Make sure you're pointing the remote control at the device you wish to control. For example, to control the receiver, point the remote at the receiver, not at the TV, VCR, or other device.
- Make sure you've pressed the correct button on the remote (**TV, VCR, DIRECTV,** or **AUX**) to control the device.
- Something might be between the remote and the remote sensor on the receiver. Make sure there's a clear path between the remote and the receiver.
- Make sure the batteries are correctly installed in the remote, and that they are not weak or dead. (Note that if you remove the batteries, you may have to reprogram the remote to operate other devices. See "Programming the Remote Control" on page 37 for instructions.)
- If none of the above solutions works, you might need to drain the remote's microprocessor. Remove the batteries and press the number 1 button for at least 60 seconds. Release the 1 button, replace the batteries, and reprogram the remote to control other devices if necessary. (See "Programming the Remote Control" page 37 for instructions.)

TV

Abex	1172
Admiral	1001, 1173
Adventura	1174
Aiko	1016
Akai	1002
Alleron	1046
Amtron	1038
Anam National	1003, 1038
AOC	1004, 1005, 1006, 1007, 1175, 1176
Audiovox	1038
Belcor	1004
Bell & Howell	1001, 1083, 1162
Bradford	1038
Brokwood	1004
Candle	1004, 1006, 1008, 1174
Capehart	1175
Celebrity	1002
Centurion	1009
Citizen	1004, 1006, 1008, 1016, 1038, 1105, 1171, 1174, 1177
Clairtone	1176
Colortyme	1004, 1006
Concerto	1004, 1006
Contec/Cony	1012, 1013, 1014, 1038, 1176
Craig	1038
Crown	1038, 1171
Curtis Mathes	1000, 1004, 1006, 1015, 1105, 1162, 1171
CXC	1038
Daewoo	1004, 1005, 1006, 1016, 1017, 1018, 1127, 1171
Daytron	1004, 1006, 1171
Dimensia	1000
Dumont	1004, 1151
Dynatech	1178
Electroband	1002, 1176
Electrohome	1003, 1004, 1006, 1019, 1022
Emerson	1004, 1006, 1012, 1014, 1023, 1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031, 1032, 1033, 1034, 1035, 1036, 1037, 1038, 1039, 1041, 1042, 1043, 1044, 1046, 1047, 1123, 1124, 1162, 1171, 1176, 1177, 1179, 1191
Envision	1004, 1006
Fisher	1048, 1049, 1050, 1051, 1162, 1180
Fujitso	1046
Funai	1038, 1046
Futuretec	1038
GE	1000, 1003, 1004, 1006, 1022, 1052, 1054, 1055, 1087, 1164, 1165, 1166, 1167, 1168, 1181
Gibralter	1004, 1151
Goldstar	1004, 1005, 1006, 1012, 1019, 1056, 1057, 1058, 1155, 1156, 1171, 1172
Grundy	1038, 1046, 1171
Hallmark	1004, 1006
Harvard	1038
Hitachi	1004, 1006, 1012, 1013, 1059, 1060, 1061, 1135, 1136, 1137, 1138, 1139, 1140, 1141, 1142, 1143, 1144, 1145, 1146, 1148, 1150, 1179
IMA	1038
Infinity	1062
Janeil	1174
JBL	1062
JCB	1002
JC Penney	1000, 1004, 1005, 1006, 1008, 1022, 1052, 1054, 1058, 1063, 1064, 1072, 1087, 1105, 1128, 1171, 1172, 1181
Jensen	1004, 1006
JVC	1012, 1013, 1054, 1060, 1065, 1066, 1067, 1089, 1157, 1158, 1159, 1182
Kawasho	1002, 1004, 1006
Kaypani	1175
Kenwood	1004, 1006, 1019
Kloss Novabeam	1068, 1069, 1174, 1183
KTV	1038, 1070, 1171, 1176, 1177
Loewe	1062
Logik	1083
Luxman	1004, 1006
LXI	1000, 1006, 1049, 1062, 1071, 1072, 1073, 1162, 1181

Magnavox	1004, 1006, 1008, 1019, 1062, 1068, 1069, 1074, 1075, 1076, 1077, 1088, 1089, 1131, 1130, 1132, 1133, 1134, 1183, 1184
Majestic	1083
Marants	1062
Marantz	1004, 1006, 1062, 1078
Megatron	1006, 1059
MEI	1176
Memorex	1001, 1006, 1082, 1083, 1162
MGA	1004, 1005, 1006, 1019, 1022, 1051, 1079, 1080, 1082
Midland	1054, 1151, 1171, 1172, 1181
Minutz	1052
Mitsubishi	1004, 1005, 1006, 1019, 1022, 1051, 1079, 1080, 1081, 1082, 1083, 1125
Montgomery Ward	1083
Motorola	1003, 1173
MTC	1004, 1005, 1006, 1105, 1176, 1178
Multitech	1038, 1178
Multivision	1084
NAD	1006, 1071, 1072, 1185
NEC	1003, 1004, 1005, 1006, 1089
Nikko	1006, 1016
NTC	1016
Onwa	1038
Optimus	1185
Optonica	1095, 1173
Orion	1035, 1191
Panasonic	1003, 1054, 1062, 1170
Philco	1003, 1004, 1005, 1006, 1008, 1012, 1019, 1062, 1068, 1069, 1074, 1075, 1077, 1183, 1184
Philips	1003, 1004, 1008, 1012, 1019, 1062, 1068, 1069, 1074, 1075, 1076, 1086, 1087, 1088, 1089
Pilot	1004, 1171
Pioneer	1004, 1006, 1090, 1091, 1092, 1179, 1185
Portland	1004, 1005, 1006, 1016, 1171
Price Club	1105
Prism	1054
PROSCAN	1000, 1181
Proton	1004, 1006, 1012, 1093, 1175
Pulsar	1151
Pulser	1004
Quasar	1003, 1054, 1070, 1094
Radio Shack/Realistic	1000, 1004, 1006, 1012, 1038, 1049, 1095, 1162, 1171, 1172
RCA	1000, 1003, 1004, 1005, 1006, 1007, 1019, 1096, 1098, 1099, 1100, 1101, 1102, 1103, 1129, 1179, 1181, 1187, 1188, 1190, 1198, 1199
Rhapsody	1176
Runco	1151
Sampo	1004, 1006, 1171, 1172, 1175
Samsung	1004, 1005, 1006, 1012, 1015, 1019, 1104, 1105, 1106, 1171, 1172
Samsux	1171
Sansui	1191
Sanyo	1004, 1048, 1049, 1050, 1080, 1107, 1108, 1162, 1180, 1189
Scotch	1006
Scott	1004, 1006, 1012, 1024, 1035, 1038, 1046
Sears	1000, 1004, 1006, 1013, 1019, 1046, 1048, 1049, 1050, 1051, 1066, 1071, 1072, 1109, 1110, 1162, 1180, 1181, 1189
Sharp	1004, 1006, 1012, 1029, 1095, 1111, 1112, 1113, 1122, 1171, 1173
Shogun	1004
Signature	1001, 1083, 1115
Simpson	1008
Sonic	1176
Sony	1002
Soundesign	1004, 1006, 1008, 1038, 1046
Squareview	1189
SSS	1004, 1038
Starlite	1038

Supre-macy	1174
Supreme	1002
Sylvania	1004, 1006, 1008, 1019, 1062, 1068, 1069, 1074, 1075, 1076, 1077, 1088, 1116, 1161, 1183, 1184
Symphonic	1033, 1038, 1189
Tandy	1173
Tatung	1003, 1178
Technics	1054
Techwood	1004, 1006, 1054
Teknika	1004, 1005, 1006, 1008, 1012, 1013, 1016, 1038, 1046, 1076, 1082, 1083, 1105, 1170, 1171
Telecaption	1117
TMK	1004, 1006
Toshiba	1049, 1071, 1072, 1089, 1105, 1109, 1117, 1118, 1160, 1162
Totevision	1171
Universal	1052, 1087
Victor	1066, 1182
Vidtech	1004, 1005, 1006
Viking	1174
Wards	1000, 1001, 1004, 1005, 1006, 1019, 1024, 1033, 1046, 1052, 1062, 1068, 1069, 1074, 1075, 1076, 1083, 1087, 1088, 1095, 1119, 1120, 1184
Yamaha	1004, 1005, 1006, 1019
Zenith	1004, 1083, 1151, 1152, 1153, 1154

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Admiral	0006, 0079, 2131
Adventura	2026
Aiko	2027
Aiwa	0015, 2002, 2026
Akai	0003, 0017, 0022, 0023, 0063, 0066, 2003, 2004, 2005, 2007, 2008, 2111, 2112, 2113
American High	2021
Asha	2013
Audio Dynamics	0014, 0016, 2009, 2010
Audiovox	2014
Bell & Howell	0002, 2011
Beaumark	2013
Broksonic	0010, 2012, 2025
Calix	2014
Candle	0007, 0009, 0013, 0044, 0045, 0046, 0052,2013, 2014, 2015, 2016, 2017, 2018, 2019
Canon	0008, 0053, 2021, 2022, 2114
Capehart	0001, 2020, 2110
Carver	2062
CCE	2027, 2061
Citizen	0007, 0009, 0013, 0044, 0045, 0046, 0052, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2027
Colortyme	0014, 2009
Colt	2061
Craig	0007, 0012, 2013, 2014, 2023, 2061
Curtis Mathes	0000, 0007, 0008, 0014, 0015, 0044, 0046, 0053, 0064, 0067, 2000, 2002, 2009, 2013, 2016, 2018, 2021, 2022, 2024, 2115
Cybernex	2013
Daewoo	0013, 0045, 0052, 0076, 2015, 2017, 2019, 2025, 2026, 2027, 2028, 2110
Daytron	2110
dbx	0014, 0016, 2009, 2010
Dimensia	0000, 2000
Dynatech	0015, 2002, 2026
Electrohome	0027, 2014, 2029
Electrophonic	2014
Emerson	0008, 0009, 0010, 0013, 0015, 0020, 0023, 0027, 0034, 0041, 0042, 0047, 0049, 0057, 0062, 0065, 0067, 0068, 0070, 2002, 2012, 2014, 2015, 2021, 2024, 2025, 2026, 2029, 2030, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2044, 2045, 2047, 2065, 2105, 2113, 2116, 2117, 2130
Fisher	0002, 0012, 0018, 0019, 0043, 0048, 0058, 2011, 2023, 2048, 2049, 2050, 2051, 2052, 2118
Fuji	2021, 2119
Funai	0015, 2002, 2026

Garrard	2026
GE	0000, 0007, 0008, 0032, 0037, 0053, 2000, 2001, 2013, 2021, 2022, 2053, 2115, 2120
Goldstar	0009, 0014, 0046, 0060, 2009, 2014, 2018, 2054, 2121
Gradiente	2026
Harley Davidson	2026
Harman Kardon	0014, 2009
Harwood	2061
Headquarter	2011
Hitachi	0005, 0015, 0035, 0036, 2002, 2055, 2056, 2057, 2107, 2111, 2120, 2122
HI-Q	2023
Instant Replay	0008, 2021
JCL	0008, 2021
JC Penney	0002, 0005, 0007, 0008, 0014, 0016, 0030, 0035, 0051, 0053, 2009, 2010, 2011, 2013, 2014, 2021, 2022, 2055, 2056, 2058, 2059, 2060, 2107, 2118
Jensen	2055, 2056, 2111
JVC	0002, 0014, 0016, 0030, 0046, 0074, 2009, 2010, 2011, 2018, 2058, 2111, 2123
Kenwood	0002, 0014, 0016, 0030, 0044, 0046, 2009, 2010, 2011, 2016, 2018, 2058, 2111, 2123
KLH	0073, 2061
Kodak	2014, 2021
Lloyd's	0015, 2002, 2026
Logik	0031, 2061
LXI	2014
Magnavox	0008, 0029, 0053, 0056, 2021, 2022, 2062, 2063, 2104, 2108, 2124
Magnin	2013
Marantz	0002, 0008, 0014, 0016, 0029, 0030, 0044, 0046, 0061, 2009, 2010, 2011, 2016, 2018, 2021, 2058, 2062, 2064
Marta	0009, 2014
Masushita	2021
MEI	0008, 2021
Memorex	0008, 0009, 0012, 0015, 2002, 2011, 2013, 2014, 2021, 2023, 2026, 2104, 2131
MGA	0004, 0027, 2029, 2065, 2113
MGN Technology	2013
Midland	0032, 2053
Minolta	0005, 0035, 2055, 2056, 2107
Mitsubishi	0004, 0005, 0027, 0035, 0040, 2029, 2055, 2056, 2065, 2066, 2067, 2069, 2070, 2071, 2072, 2073, 2074, 2106, 2113, 2123
Montgomery Ward	0006, 2075, 2131
Motorola	2021, 2131
MTC	0007, 0015, 2002, 2013, 2026
Multitech	0007, 0015, 0031, 0032, 2002, 2013, 2016, 2026, 2053, 2061
NEC	0002, 0014, 0016, 0030, 0044, 0046, 0059, 0061, 0064, 2009, 2010, 2011, 2016, 2018, 2058, 2064, 2076, 2078, 2079, 2111, 2123
Nikko	2014
Noblex	2013
Olympus	2021
Optimus	2014, 2131
Optonica	2096
Orion	2035
Panasonic	0008, 0053, 0075, 0077, 2021, 2022, 2109, 2125, 2126, 2127
Pentax	0005, 0035, 0044, 2016, 2055, 2056, 2107, 2120
Pentex Research +	0046, 2018
Philco	0008, 0029, 0053, 0056, 2021, 2022, 2062, 2063
Philips	0008, 0029, 2021, 2062, 2096, 2124
Pilot	2014
Pioneer	0005, 0016, 0050, 2010, 2055, 2080, 2081, 2123
Portland	0044, 0045, 0052, 2016, 2017, 2019, 2110
PROSCAN	0000, 2000, 2001
Protec	2061
Pulsar	2104
Quarter	2011
Quartz	0002, 2011
Quasar	0008, 0053, 2021, 2022, 2125

RCA	0000, 0005, 0007, 0008 0028, 0035, 0037, 0054, 0069, 2000 2001, 2003, 2013, 2021, 2055, 2056 2082, 2083, 2084, 2085, 2086, 2087 2088, 2089, 2090, 2091, 2107, 2115 2120, 2125
Radio Shack	0002, 0006, 0008, 0009 0012, 0015, 0019, 0027, 0043, 0053 2002, 2011, 2013, 2014, 2021, 2022 2023, 2026, 2029, 2049, 2050, 2096 2131
Realistic	0002, 0006, 0008, 0009 0012, 0015, 0019, 0027, 0043, 0053 2002, 2011, 2013, 2014, 2021, 2022 2023, 2026, 2029, 2049, 2050, 2096 2131
Radix	2014
Randex	2014
Ricoh	2128
Runco	2104
Samsung	0007, 0013, 0022, 0032 0042, 2005, 2013, 2015, 2033, 2053 2112
Sanky	2104, 2131
Sansui	0016, 0071, 2010, 2092 2111, 2123
Sanyo	0002, 0012, 2011, 2013 2023
Scott	0004, 0013, 0041, 0049 0068, 2012, 2015, 2025 2032, 2035, 2038 2065, 2093, 2116
Sears	0002, 0005, 0009, 0012 0018, 0019, 0035, 0043, 0048, 2011 2014, 2021, 2023, 2048, 2049, 2050 2051, 2055, 2056, 2107, 2118
Sharp	0006, 0024, 0027, 0039 0045, 2002, 2017, 2029, 2094, 2095 2096, 2131
Shintom	0017, 0026, 0031, 0055 2004, 2056, 2061, 2098
Shogun	2013
Signature	0015, 2002, 2131
Singer	2021, 2061, 2128
Sony	0017, 0026, 0038, 2002 2004, 2098, 2099, 2119, 2128
STS	2021, 21072021, 2107
Sylvania	0008, 0015, 0029, 0053 0056, 2002, 2021, 2022, 2026, 2062 2063, 2065, 2124
Symphonic	0015, 2002, 2026
Tandy	0002, 0015, 2002, 2011
Tashiko	0009, 2014
Tatung	0030, 2058, 2111
Teac	0015, 0030, 0069, 2002 2026, 2058, 2085, 2111
Technics	0008, 2021, 2109
Teknika	0008, 0009, 0015, 0021 2002, 2014, 2021, 2026, 2100, 2129
TMK	0067, 2013, 2024, 2047
Toshiba	0005, 0013, 0019, 0048 0049, 2015, 2049, 2051, 2055, 2065 2093, 2116
Totevision	0007, 0009, 2013, 2014
Unitech	0007, 2013
Vector Research	0014, 0016, 0044, 2009 2010, 2015, 2016
Victor	0016, 2010
Video Concepts	0014, 0016, 0044, 2009 2010, 2015, 2016, 2113
Videosonic	0007, 2013
Wards	0005, 0006, 0007, 0008 0009, 0012, 0013, 0015, 0025, 0027 0031, 0035, 2002, 2013, 2014, 2015 2021, 2023, 2026, 2029, 2055, 2056 2061, 2096, 2101, 2102, 2103, 2107 2116, 2131
XR-1000	2021, 2026, 2061
Yamaha	0002, 0014, 0016, 0030 0046, 2009, 2010, 2011, 2018, 2058 2111
Zenith	0011, 0017, 0026, 0072 0079, 2004, 2098, 2104, 2119, 2128

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ABC	5002, 5003, 5004, 5005 5006, 5007, 5053
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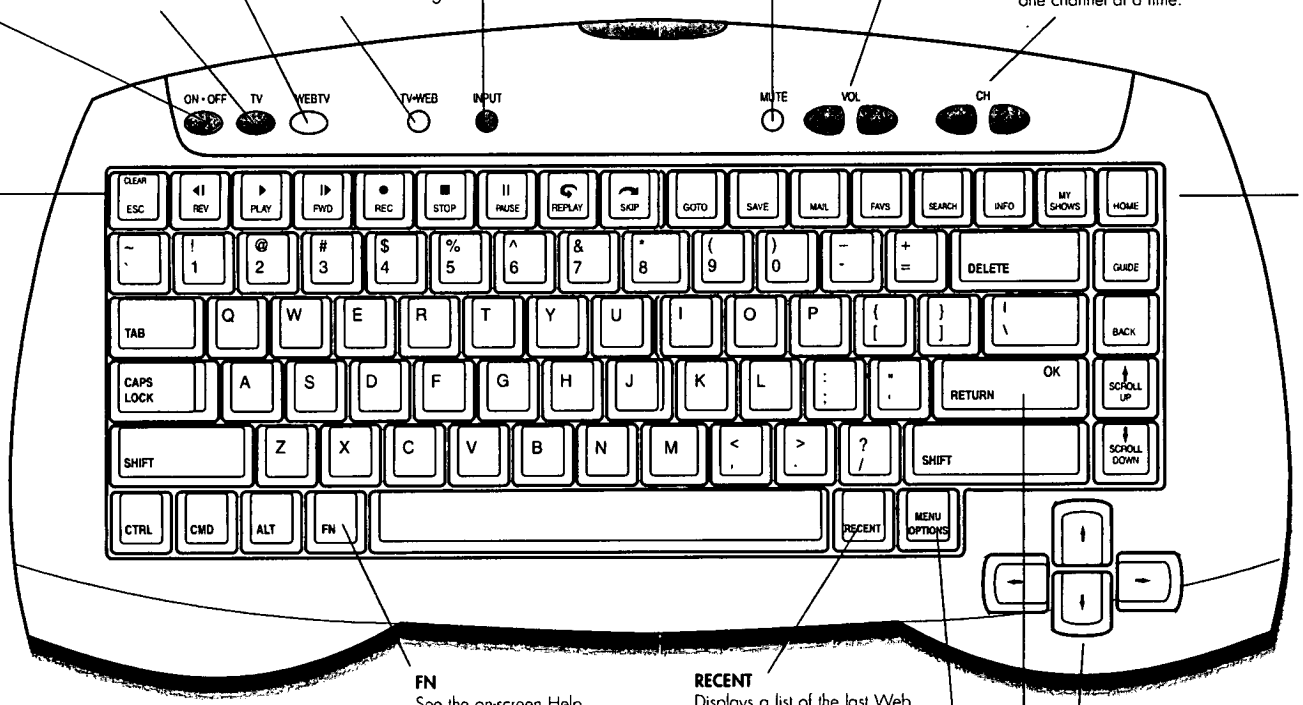
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(For RCA and Dimensia brands only)

AM/FM	4003
Aux	4004
Phono	4005
CD	4007
Tape	4006

OPTIONAL KEYBOARD



WEBTV
Turns the receiver or other device on. Tells the keyboard to control the receiver.

INPUT
Scrolls through available video input sources.

MUTE
When programmed, mutes the TV volume.

VOL -/VOL +
Turns TV volume down or up.

CH -/CH +
Moves down or up one channel at a time.

ON·OFF
Turns the receiver or TV on or off.

TV
Tells the keyboard to control the TV.

TV·WEB
Switches between TV and Web viewing.

REV
Reverses recorded video.

PLAY
Plays recorded video.

FORWARD
Fast-forwards recorded video.

REC
Records a live program or a selected program in the Guide.

STOP
Stops the current recording session or stops playback of a recording.

PAUSE
Pauses live or recorded video.

REPLAY
Jumps back 7 seconds and replays video.

SKIP
Jumps ahead 30 seconds in recorded video.

GOTO
Go to a Web page by typing its address.

SAVE
Saves a Web page in your Favorites folder.

MAIL
Lets you send and receive e-mail.

FAVS
In the Web world, displays a list of favorite places.

SEARCH
Search the Web or TV listings.

INFO
Displays info about a TV show or Web page.

MY SHOWS
Displays the My Shows screen.

HOME
Takes you to the TV Home or Web Home screen.

GUIDE
Displays the program guide. Press again to cycle through custom guides.

BACK
Takes you to the last screen you viewed.

SCROLL UP/SCROLL DOWN
Scrolls one screen at a time.

FN
See the on-screen Help for information on using this key.

RECENT
Displays a list of the last Web screens viewed. (For information on using **RECENT** when watching TV, see the on-screen Help.)

Arrows
Move the yellow box to highlight an item on the screen.

MENU/OPTIONS
Displays an options panel.

RETURN/OK
Selects the item highlighted by the yellow selection box.

NOTE *Initially, you can use the keyboard to control only the receiver and most RCA, GE, and ProScan televisions and VCRs. To program your keyboard to control additional devices, follow the instructions in the manual that accompanies your keyboard.*

For information on ordering the RCA Wireless Keyboard, see page 53 of this guide.

WARRANTY

RCA®-DIRECTV™ RECEIVER WITH ULTIMATETV® SERVICE LIMITED WARRANTY

What your warranty covers:

- Any defect in materials or workmanship.

For how long after your purchase:

- 90 days - Unit exchange, which includes parts and labor.
- 91 days to 1 year - Unit exchange, which includes parts only; you pay the labor.
- The warranty for rental units begins with the first rental or 45 days from date of shipment to the rental firm, whichever comes first.

What we will do:

- **During the initial 90 days:**
  The unit that is defective will be exchanged for a new, or at our option, refurbished unit.
- **After the 90 days and within one year:**
  We will charge you a flat exchange cost to replace a defective receiver. This charge covers the labor cost for its repair.

How you get service:

- Call 1-866-508-9661 and have your unit's date of purchase and model/serial number ready. The model/serial number information is on the back of your receiver.
- An RCA representative will troubleshoot your problem over the phone.
- If the representative determines that you should receive a replacement receiver you will be provided with a Return Authorization (RA) number and the location of a nearby exchange point if one exists. No returns will be accepted without the RA number.
- If the representative determines that your antenna/dish is defective, and was included with your model, they will arrange for its repair or replacement.

Option I:

1. Provide your Discover, MasterCard or Visa account number and expiration date to your phone representative. This is for security purposes only and your account will not be charged at this time.
2. We will send you a replacement unit.
3. If you return the unit to us within 14 days from the date you were provided a RA number, only items not covered by warranty will be charged to your account. If your unit is not received within 14 days, the current suggested retail value of the receiver will be charged to your credit card. This amount will be credited, less a $10 handling fee, if the unit is subsequently received.
4. Ship your defective unit back to us using the replacement unit's carton. Shipping instructions will be included on the carton along with your RA number, which will allow you to easily ship the unit back to us. Make sure you insure your shipment in case of damage or loss. Include with the shipment:
   - Evidence of purchase date such as a bill of sale.
   - A brief note describing your receiver problem.
   - Your name, address and phone number.

Option II:

1. For a fee of $10.00, we will send a replacement unit to our exchange point.
2. The exchange location will notify you of its arrival.
3. Take your unit and evidence of purchase date, such as a bill of sale, to the exchange location and you will be provided the new or refurbished unit. Please retain all accessories such as the remote control hand unit.
4. If the repairs are covered by your warranty, you will not be billed.

Thomson assumes no responsibility for warranty shipments from the customer to the factory if not shipped in the manner prescribed by Thomson.

To receive a replacement receiver after we have received your unit:

- Write the RA number on the outside of the carton used to return the unit. Make sure you insure your shipment in case of damage or loss.
- Carefully pack the unit using the original box and packing material if possible. Please retain all accessories that were included with your unit such as the remote control hand unit.
- Include with the shipment:
  1. Evidence of purchase date such as a bill of sale.
  2. A brief note describing your receiver problem.
  3. Your name, address and phone number.
- The representative will advise the addressor to mail a cashier's check or money order for payment if there are any out of warranty labor or parts charges, and you elect not to use your credit card.
- After we receive your product, a new or refurbished unit will be shipped to you.

What your warranty does not cover:

- Acts of nature, such as but not limited to lightning damage.
- Adjustment of customer controls.
- Damage from misuse or neglect.
- A unit that has been modified or incorporated into other products or is used for institutional or other commercial purposes.
- Batteries.
- Units purchased, serviced or operated outside the continental U.S.A. and Alaska.
- For units intended for use in Alaska or for models that contain only a receiver, this warranty does not cover installation or the dish antenna. It only covers the receiver.
- Loss of programming.
- Installation.
- Shipping damage if the unit was not packed and shipped in the manner prescribed by Thomson.
- Storage fees may be charged by the exchange point if you fail to pick up the replacement unit in a timely manner.

Product Registration:

- Please complete and mail the Product Registration Card packed with your product. It will make it easier to contact you should it ever be necessary. The return of the card is not required for warranty coverage.

How state law relates to warranty:

- This warranty gives you specific legal rights and you may have other rights that vary from state to state.

If you purchased your product outside the United States:

- This warranty does not apply. See your dealer for warranty information.

FCC REGULATIONS

FCC REGULATIONS

Your digital receiver is registered with the Federal Communications Commission and is in compliance with parts 15B and 68, FCC Rules and Regulations.

1. Notification to the Local Telephone Company.

On the back of this equipment is a label indicating among other information, the FCC Registration number and Ringer Equivalence Number (REN) for the equipment. You must, upon request, provide this information to your telephone company.

The REN is useful to determine the number of devices you may connect to your telephone line and still have all these devices ring when your telephone number is called. In most (but not all) areas, the sum of the RENs of all devices connected to one line should not exceed 5. To be certain of the number of devices you may connect to your line as determined by the REN, you should contact your local telephone company.

NOTE *This equipment may not be used on coin service provided by the telephone company. Party lines are subject to state tariffs, and therefore you may not be able to use your own telephone equipment if you are on a party line. Check with your local telephone company. Notice must be given to the telephone company upon permanent disconnection of your equipment from your line.*

2. Rights of the Telephone Company.

Should your equipment cause trouble on your line which may harm the telephone network, the telephone company shall, where practicable, notify you that temporary discontinuance of service may be required. Where prior notice is not practicable and the circumstances warrant such action, the telephone company may temporarily discontinue service immediately. In case of such temporary discontinuance, the telephone company must:

(1) promptly notify you of such temporary discontinuance

(2) afford you the opportunity to correct the situation and

(3) inform you of your right to bring a complaint to the Commission pursuant to procedures set forth in Subpart E of Part 68, FCC Rules and Regulations.

The telephone company may make changes in its communications facilities, equipment, operations of procedures where such action is required in the operation of its business and not inconsistent with FCC Rules and Regulations. If these changes are expected to affect the use or performance of your telephone equipment, the telephone company must give you adequate notice, in writing, to allow you to maintain uninterrupted service.

RADIO INTERFERENCE

This equipment has been type tested and found to comply with the limits for a Class B Digital Device in accordance with the specifications in Part 15 of FCC Rules. These rules are designed to provide reasonable protection against radio and television interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television reception (which you can determine by turning the equipment off and on), try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna (that is, the antenna for radio or television that is "receiving" the interference).
- Change the position of the receiver with respect to the radio or television equipment that is receiving interference.
- Move the receiver away from equipment receiving interference.
- Plug the receiver into a different wall outlet so the receiver and equipment receiving interference are on different branch circuits.

If these measures do not eliminate interference, please consult your dealer or an experienced radio/television technician for additional suggestions. Also, the Federal Communications Commission has prepared a helpful booklet, "How To Identify and Resolve Radio/TV Interference Problems". This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402. Please specify stock number 004-000-00345-4 when ordering copies.

ACCESSORIES



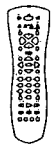
RG-6 Coaxial Burial Cable with weatherproof "F" connectors comes in a variety of lengths.



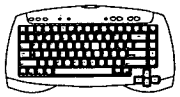
S-Video Cable comes in 12 foot lengths.



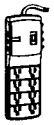
Self-Installer's Kit contains cable and hardware needed to install the dish and connect the system.



Remote Control replaces a lost remote. Or, order a second remote for convenience.



Wireless Keyboard allows you to type Web addresses, TV Search phrases, e-mail messages, etc.



Eight outlet surge protection for cable TV, satellite systems, and other electronics. Comes with a $50,000 equipment guarantee.

ORDER FORM

DESCRIPTION	PART NO.	PRICE	QTY.	TOTAL
RG-6 Coaxial Cable				
12 feet	D912	$12.95		
25 feet	D925	$15.95		
75 feet	D975	$24.95		
S-Video Cable 12 feet	D913	$11.95		
Weatherproof "F" Connector (2)	D905	$5.95		
Optical/SPDIF Cable (3 ft.)	DV3	$15.95		
Optical/SPDIF Cable (6 ft.)	DV6	$19.95		
Self-Installer's Kit	DKIT96	$69.95		
Remote control CRK76WA1	240968	$32.85		
Surge Protector	SCTV160	$49.95		
Wireless Keyboard	WKB10WB1	$49.95		

Total Merchandise ..... $

Sales Tax ..... $

We are required by law to collect the appropriate sales tax for each individual state, country, and locality to which the merchandise is being sent.

Shipping, Handling, and Insurance ..... $ 5.00

TOTAL AMOUNT ENCLOSED ..... $

Use VISA, MasterCard, or Discover preferably.
Money order or check must be in U.S. currency only.
No COD or cash.

All accessories are subject to availablity.
Prices are subject to change without notice.

(OVER) ⟶

detach here

Charge your order on your VISA, MasterCard, or Discover Card by filling in below

USE YOUR CREDIT CARD

IMPORTANT: Copy complete account number from your VISA card

VISA

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

My card expires: ☐☐ ☐☐

IMPORTANT: Copy complete account number from your MasterCard

MasterCard

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Copy Number above your name on MasterCard ☐☐☐☐ My card expires: ☐☐ ☐☐

IMPORTANT: Copy complete account number from your Discover Card

DISCOVER

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

My card expires: ☐☐ ☐☐

AUTHORIZED SIGNATURE

(Credit card order will not be processed without signature)

Prices are subject to change without notice.

Print or type your name and address clearly.

A complete and correct order will save you days of waiting.

Name: _____

Street: _____

_____ Apt: _____

City: _____

State: _____ Zip: _____

Daytime Phone Number: _____

Please make sure that both sides of this form have been filled out completely.

- Allow 4 weeks for delivery.
- All accessories are subject to availability.
- Prices are subject to change.

detach here

PLACING AN ORDER

To place an order by phone, have your Visa, MasterCard, or Discover Card ready and call the toll-free number listed below. Use this number only to place an order for accessory items listed on this order form.

1-800-338-0376

To place your order by mail, detach and mail the completed order form with credit card information, money order, or check in US currency (made payable to Thomson Consumer Electronics, Inc.) to the following address:

Video Accessories
PO Box 8419
Ronks, PA 17573

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Patent Assignment Abstract of Title

Total Assignments: 1

Application #: 10289011 **Filing Dt:** 11/06/2002 **Patent #:** 7130576 **Issue Dt:** 10/31/2006

PCT #: NONE **Publication #:** NONE **Pub Dt:**

Inventors: Itzhak Gurantz, Ladd El Wardani, Michael Landry

Title: SIGNAL SELECTOR AND COMBINER FOR BROADBAND CONTENT DISTRIBUTION

Assignment: 1

Reel/Frame:	Received:	Recorded:	Mailed:	Pages:
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Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignors: GURANTZ, ITZHAK **Exec Dt:** 12/19/2002

WARDANI, LADD EL **Exec Dt:** 12/19/2002

LANDRY, MICHAEL **Exec Dt:** 12/19/2002

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SAN DIEGO, CA 92130

Search Results as of: 12/28/2006 07:24 AM

If you have any comments or questions concerning the data displayed, contact PRD / Assignments at 571-272-3350.
Web interface last modified: July 26, 2006 v.1.10

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Requester's Name and Address: RF Magic
10182 Telesis Court, Suite 400
San Diego, CA 92121

Patent Number: 7130576 Request Receipt Date: 122006

Control Number:90008389
Date Mailed: 011007

NOTICE OF FAILURE TO COMPLY WITH *EX PARTE* REEXAMINATION REQUEST FILING REQUIREMENTS (37 CFR 1.510(c))

The Central Reexamination Unit (CRU) in the United States Patent and Trademark Office (USPTO) has received a request for *ex parte* reexamination. The request cannot be processed, because the below-identified filing date requirements for an *ex parte* reexamination request have not been satisfied. If a fully compliant response is not received within 30 days of the mailing date of this notice, the request will be treated as a prior art citation under 37 CFR 1.501 or closed from public view, at the Office's option. A **filing date** will **NOT** be assigned to the request until the deficiencies noted below are corrected (37 CFR 1.510(d)):

The following items required by **37 CFR 1.510(a) and (b)** are missing:

☐ 1. The *ex parte s* reexamination filing fee under 37 CFR 1.20(c)(1) – see attached Form PTO-2057.

☐ 2. An identification of the patent by its patent number, and of every claim of the patent for which reexamination is requested.

☐ 3. A citation of the patents and printed publications that are presented to raise a substantial new question of patentability.

☒ 4. A statement pointing out each substantial new question of patentability based on the cited patents & printed publications, and a detailed explanation of the pertinency and manner of applying the patents & printed publications to every claim for which reexamination is requested.

☐ 5. A legible copy of every patent or printed publication (other than U.S. patents or U.S. patent publications) relied upon or referred to in (3) and (4) above, accompanied by an English language translation of all the necessary and pertinent parts of any non-English language document.

☐ 6. A legible copy of the entire patent including the front face, drawings, and specification/claims (in **double** column format) for which reexamination is requested, and a legible copy of any disclaimer, certificate of correction, or reexamination certificate issued in the patent. All copies must have each page plainly written on only one side of a sheet of paper.

☐ 7. A certification by the third party requester that a copy of the request has been served in its entirety on the patent owner at the address provided for in 37 CFR 1.33(c). The name and address of the party served must be indicated. If service was not possible, a duplicate copy of the request must be supplied to the Office.

☐ 8. Other:

☐ Explanation of above item(s): See Attachment.

Any written correspondence in response to this notice must include a submission pursuant to the attached instructions. **The instructions for a detailed explanation for an *ex parte* reexamination request differ from those for an *inter partes* reexamination request.** Any written correspondence in response to this notice should be mailed to the Central Reexamination Unit (CRU), ATTN: "Box *Ex Parte* Reexam" at the USPTO address indicated at the top of this notice. Any "replacement documents" may be facsimile transmitted to the CRU at the FAX number indicated below. A REPLACEMENT STATEMENT AND EXPLANATION UNDER 37 CFR 1.510(b)(1) and (2) MAY NOT BE FACSIMILE TRANSMITTED.

James R. Matthews

Legal Instruments Examiner, Central Reexamination Unit
(571) 272- 6274 ; FAX No. (571) 273-9900

cc: Patent Owner's Name and Address: Michhael W. Landry
5098 Seachese Street
San Diego, CA 92130

INSTRUCTIONS TO NOTICE OF FAILURE TO COMPLY WITH *EX PARTE* REEXAMINATION REQUEST FILING REQUIREMENTS (37 CFR 1.510(c))

HOW TO REPLY TO THIS NOTICE

Any written correspondence in response to this notice must include either a **replacement document**, or, **if item #4 is checked and/or it is otherwise specifically required by the Office, a paper containing a replacement statement and explanation under 37 CFR 1.510(b)(1) and (2)** that either replaces the originally-filed statement and explanation or provides a previously missing statement and explanation. A replacement document either replaces an originally-filed document, or provides a previously missing document, that contains part(s) of the request other than the statement and explanation as set forth in 37 CFR 1.510(b)(1) and (2). For example, a replacement to the originally-filed listing of cited patents and printed publications, PTO/SB/08 (formerly designated as PTO-1449) or its equivalent, is a replacement document.

If a paper containing a replacement statement and explanation, or a replacement document (other than a replacement certificate of service), is submitted by a third party requester, it must be **accompanied by a certification that a copy of the replacement statement and explanation under 37 CFR 1.510(b)(1) and (2), or that a copy of the replacement document, has been served** in its entirety on the patent owner at the address provided for in 37 CFR 1.33(c). The name and address of the party served must be indicated. If service was not possible, a duplicate copy of the replacement statement and explanation (or replacement document) must be supplied to the Office.

REPLACEMENT STATEMENT AND EXPLANATION UNDER 37 CFR 1.510(b)(1) and (2) (ITEM #4 IS CHECKED)

The **statement and explanation under 37 CFR 1.510(b)(1) and (2)** (see item #4) must discuss **EVERY patent or printed publication cited in the information disclosure statement** in at least one proposed rejection or statement identifying a substantial new question of patentability (SNQ), AND in a corresponding detailed explanation (see the below discussion). Furthermore, **EVERY claim for which reexamination is requested** must be discussed in at least one proposed rejection or statement identifying an SNQ and in the corresponding detailed explanation. If item #4 is missing or incomplete, a paper containing a **replacement statement and explanation under 37 CFR 1.510(b)(1) and (2) is required.**

A paper containing a replacement statement and explanation under 37 CFR 1.510(b)(1) and (2) may NOT be facsimile transmitted. It must be received by first class mail or by USPS Express Mail.

If an originally-filed information disclosure statement cites patents or printed publications that are NOT discussed in at least one proposed rejection or statement identifying an SNQ AND in the corresponding detailed explanation **in the originally-filed request**, the requester must file either (a) a **replacement document, i.e., a replacement PTO/SB/08 (former PTO-1449)** or its equivalent, listing **ONLY** those patents and printed publications that are so discussed, or (b) a paper containing a **replacement statement and explanation under 37 CFR 1.510(b)(1) and (2).** If the first option is chosen, the replacement PTO/SB/08 or its equivalent should include a cover letter expressly withdrawing from the request any previously cited references that are being omitted by the replacement PTO/SB/08 or its equivalent. The requester may, if desired, file both a replacement PTO/SB/08 or its equivalent and a paper containing a replacement statement and explanation, if the replacement statement and explanation discusses EVERY patent or printed publication, cited in the replacement PTO/SB/08 or its equivalent, in at least one proposed rejection or statement identifying an SNQ and in the corresponding detailed explanation.

Requester is NOT required to, and should not, additionally file a replacement copy of any exhibits, references, etc., or other replacement parts of the request (i.e., replacement documents) if a defect requiring a replacement document is not specifically identified by this notice.

Examples of When a Replacement Statement and Explanation under 37 CFR 1.510(b)(1) and (2) Is Required:

1. The originally-filed request fails to discuss **EVERY** patent or printed publication cited in the originally-filed information disclosure statement in at least one proposed rejection or statement identifying an SNQ and in the corresponding detailed explanation, and the requester does not wish to file a replacement PTO/SB/08 (formerly designated as PTO-1449) or its equivalent listing ONLY those patents and printed publications that are so discussed.

2. The originally-filed request discusses every patent or printed publication cited in the information disclosure statement in at least one proposed rejection or statement identifying an SNQ, but **fails to discuss EVERY patent or printed publication cited in the information disclosure statement in a detailed explanation that corresponds to the proposed rejection or statement identifying an SNQ.**

3. The originally-filed request fails to discuss **EVERY CLAIM** for which reexamination is requested in at least one proposed rejection or statement identifying an SNQ, and in the corresponding detailed explanation.

Examples of Proposed Rejections and Statements Identifying a Substantial New Question of Patentability (SNQ)

Proposed rejections

Claims 1-3 are obvious over reference A in view of reference B.
Claims 4-6 are obvious over reference A in view of references B and C.
Claims 7-10 are obvious over reference Q in view of reference R.

Statements identifying a substantial new question of patentability

A substantial new question of patentability as to claims 1-3 is raised by reference A in view of reference B.
A substantial new question of patentability as to claims 4-6 is raised by reference A in view of references B and C.
A substantial new question of patentability as to claims 7-10 is raised by reference Q in view of reference R.

A proposed rejection or statement identifying an SNQ must be repeated with any *replacement* detailed explanation that corresponds to the proposed rejection or statement identifying an SNQ, in any paper containing a replacement statement and explanation under 37 CFR 1.510(b)(1) and (2).

In addition, the requester should include an explanation of *how the SNQ is raised.*

1. Assume that claim 1 of the patent recites, as one of the limitations, widget W. Requester would state that the XYZ reference, cited in the information disclosure statement, contains a teaching of widget W as recited in claim 1, and that this teaching was not present during the prior examination of the patent under reexamination (i.e., the teaching is "new"). Requester would also state that he believes that a reasonable examiner would consider this teaching important in determining whether or not the claims are patentable. For this reason, requester would state that this teaching by the XYZ reference raises a substantial new question of patentability (SNQ) with respect to at least claim 1 of the patent. Similarly, if dependent claim 6 adds widget H, the requester would state that the ABC reference, cited in the information disclosure statement, contains a teaching of widget H as recited in claim 6, that this teaching was not present during the prior concluded examination of the patent, that a reasonable examiner would consider this teaching important in determining whether or not the claims are patentable, and that this teaching raises an SNQ with respect to dependent claim 6 of the patent.

2. Assume that claim 1 of the patent recites, as one of its limitations, limitation W. Assume either that reference XYZ was applied in a rejection during the prior examination of the patent, or that the teachings of reference XYZ are purely cumulative to a reference cited in a rejection during the prior examination of the patent. Assume further that reference ABC teaches that limitation W would have been either inherent given the teachings of reference XYZ, or would have been obvious in view of the combination of XYZ and ABC. Reference ABC was cited in an information disclosure statement but was never discussed or applied in a rejection ***in combination with the XYZ reference*** during the prior examination of the patent under reexamination. **Requester would state** that reference XYZ was present during the prior examination of the patent under reexamination because it was applied in a rejection during the prosecution of the patent, and that reference ABC was cited in an information disclosure statement but never applied in a rejection (or never discussed), **in combination with the XYZ reference** during the prior examination of the patent under reexamination Requester would then state (1) that the ***combination*** of the XYZ reference and the ABC reference, both of which are cited in the information disclosure statement, contains a teaching of limitation W as recited in claim 1, (2) that this teaching provided by the **combination** of the XYZ and ABC references was not present during the prior examination of the patent under reexamination, (3) that a reasonable examiner would consider this teaching important in determining whether or not the claims are patentable, and (4) that this teaching raises an SNQ with respect to claim 1 of the patent.

Example of a Detailed Explanation

Assume, for example, that a requester believes that the XYZ reference, alone, anticipates claims 1-5. The requester would expressly propose a rejection of claims 1-5 under 35 USC 102(b) as being anticipated by the XYZ reference. In a claim chart, the requester would then show how **each limitation** of claims 1-5 is anticipated by the XYZ reference. If the requester believes that the XYZ reference, in view of the ABC reference, renders obvious claims 6-10, the requester would expressly propose a rejection of claims 6-10 under 35 USC 103 as being obvious over the XYZ reference in view of the ABC reference. In a claim chart, the requester would then show which limitations of claims 6-10 are taught by the XYZ reference, and which limitations of claims 6-10 are taught by the ABC reference. The requester should quote each pertinent teaching in the prior art reference, referencing each quote by page, column and line number, and any relevant figure numbers.

A **patent owner**, when filing a request for reexamination in an *ex parte* reexamination proceeding, may satisfy the requirement under 37 CFR 1.510(b) for supplying a detailed explanation by comparing, limitation-by-limitation, the claim(s) under reexamination with the teachings of each reference cited in the information disclosure statement and in the statement pointing out an SNQ. Each limitation of the claim(s) must be separately discussed. For each claim limitation, the patent owner must do one of the following: (a) show how at least one reference teaches or suggests the limitation, (b) admit that the limitation is "old", or (c) state that the limitation is believed to be missing from the reference. In a claim chart, the patent owner should quote each pertinent teaching in the prior art reference,

referencing each quote by page, column and line number, and any relevant figure numbers. Proposed applications of the cited references and/or proposed combinations of the cited references should separately identified. The patent owner is not required to

expressly propose a rejection of the claim(s) or provide a statement of why the claim(s) under reexamination would have been obvious over a proposed reference combination.

REPLACEMENT DOCUMENTS

If the originally-filed PTO/SB/08 (former PTO-1449) or its equivalent lists patents or printed publications that are NOT discussed in at least one proposed rejection or statement identifying an SNQ AND in the corresponding detailed explanation **in the originally-filed request**, the requester may file a paper containing a **replacement PTO/SB/08 (former PTO-1449) or its equivalent** listing **ONLY** those patents and printed publications that are so discussed. The replacement PTO/SB/08 or its equivalent should include a cover letter expressly withdrawing from the request any formerly cited references that are now being omitted by the replacement PTO/SB/08 or its equivalent. Similarly, if **any patent or printed publication discussed** in at least one proposed rejection or statement identifying an SNQ AND in the corresponding detailed explanation **in the originally-filed request is not listed in the originally-filed PTO/SB/08 (former PTO-1449)** or its equivalent, the requester must file a **replacement PTO/SB/08 (former PTO-1449)** or its equivalent listing all of the patents and printed publications, including the previously omitted reference(s), and provide copies of the missing references if copies were not provided with the originally-filed request

If a copy of a patent, printed publication, or an English-language translation of a patent or printed publication, that is cited in the PTO/SB/08 (former PTO-1449) or its equivalent, is illegible, missing, or incomplete (i.e., it does not contain all of the pages indicated in the PTO/SB/08 (former PTO-1449) or its equivalent), a replacement copy of the patent or printed publication is required.

If a copy of any disclaimer, certificate of correction, or reexamination certificate issued in the patent, or a copy of the entire patent for which reexamination is requested as described in item #6, is missing, or if the copy that was received by the Office was illegible or incomplete, a replacement document (i.e., a replacement copy of the disclaimer, certificate of correction, reexamination certificate, or entire patent under reexamination as described in item #6) is required.

If the requester fails to correctly identify the patent number or the claims for which reexamination is requested on the transmittal form for the request (PTO/SB/57, or an equivalent) as described in item #2, and the patent number and the claims for which reexamination is requested are correctly identified in the originally-filed request, a **replacement transmittal form** is required.

If a certificate of service on the patent owner, as described in item #7, is missing, or if the certificate of service received by the Office is inaccurate or incomplete, a replacement certificate of service is required.

Replacement documents may be facsimile transmitted. A paper containing a replacement statement and explanation may NOT be facsimile transmitted.

ATTACHMENT TO PTOL-2077

The Request for *Ex Parte* Reexamination filed on 12/20/2006 does not comply with the filing requirement of an *ex parte* reexamination proceeding under 37 CFR 1.510(b)(2).

Specifically the request does not include a detailed explanation of how each of the references listed below applies to every claim of U.S. Patent No.7,130,576 for which reexamination was requested (claims 1-23).

United States Patents

4,953,184 (Simone)
6,437,837 (Seo)

Foreign Documents

EP 0912059

Non Patent Literature

A Single Chip Universal Digital Satellite Receiver (Kwentus, et al.)

The Information Disclosure Statement (IDS) accompanying the request for reexamination lists the above references, which are not explained as required by the regulation. However, the other references for example US Patent No. 5,278,837 to Kelley are explained in a manner that complies with 37 CFR 1.510(b)(2). The regulation requires that there be an explanation of the pertinency and manner of applying the cited prior art to every claim for which reexamination is requested. All documents listed on the IDS are cited prior art. Therefore, the IDS co-mingles a document relied upon to establish a substantial new question of patentability with documents that are not relied upon to establish a substantial new question of patentability.

Accordingly, in accordance with 37 CFR 1.510(c), 71 Fed. Reg. 9260, February 23, 2006 (effective March 27, 2006), a filing date for the reexamination request will not be granted **at this time**. Patent owner may either submit an explanation of the pertinency and manner of applying the cited prior art in accordance with 37 CFR 1.510(b)(2), or withdraw the citation of the additionally cited documents and replace the listing of prior art documents with a listing confined to the documents for which the above described discussion required by 37 CFR 1.510(b)(2) has been provided.

Any response to this Notice should be directed to:

By Mail:	Mail Stop "*Ex Parte* Reexam" Attn: Central Reexamination Unit Commissioner for Patents P. O. Box 1450 Alexandria VA 22313-1450
By hand:	Customer Service Window Attn: Central Reexamination Unit Randolph Building, Lobby Level 401 Dulany Street Alexandria, VA 22314

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 3367

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/008,389	02/06/2007 RULE	455	3992	05JM-127751

APPLICANTS

7130576, Residence Not Provided;
Entropic Communications Inc.(OWNER), San Diego, CA;
RF Magic(3RD PTY REQ), San Diego, CA;
Daniel N. Yannuzzi, San Diego, CA

**** CONTINUING DATA ***************************

This application is a REX of 10/289,011 11/06/2002 PAT 7,130,576
which claims benefit of 60/345,965 11/07/2001
and claims benefit of 60/333,722 11/27/2001
and claims benefit of 60/358,817 02/22/2002

**** FOREIGN APPLICATIONS *********************

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☐ no			23	3
35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance				
Verified and Acknowledged Examiner's Signature Initials				

ADDRESS
24244

TITLE

SIGNAL SELECTOR AND COMBINER FOR BROADBAND CONTENT DISTRIBUTION

FILING FEE RECEIVED		
2520	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	90/008,389	7130576	
	Examiner	Art Unit	
		3992	

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
90/008,389	7130576
Examiner	**Art Unit** 3992

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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Claim		Date								
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Issue Classification	Application/Control No. 90/008,389	Applicant(s)/Patent under Reexamination 7130576
	Examiner	Art Unit 3992

ISSUE CLASSIFICATION

ORIGINAL		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
455	003.020	/	/
		/	/
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		/	/
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		/	/
		/	/

CROSS REFERENCES	
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)

(Assistant Examiner) (Date)		Total Claims Allowed:
(Legal Instruments Examiner) (Date)	(Primary Examiner) (Date)	O.G. Print Claim(s) / O.G. Print Fig.

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		31		61		91		121		151		181
	2		32		62		92		122		152		182
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	5		35		65		95		125		155		185
	6		36		66		96		126		156		186
	7		37		67		97		127		157		187
	8		38		68		98		128		158		188
	9		39		69		99		129		159		189
	10		40		70		100		130		160		190
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	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

U.S. Patent and Trademark Office Part of Paper No. 20070210

Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/008,389	7130576
	Certificate Date	Certificate Number

Requester Correspondence Address: ☐ Patent Owner ☒ Third Party
Daniel N. Yannuzzi SHEPPARD, MULLIN, RICHTER & HAMPTON LLP 12275 El Camino Real, Suite 200 San Diego, CA 92130-

LITIGATION REVIEW ☐	(examiner initials)	(date)
Case Name		Director Initials

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER
1.	
2.	
3.	
4.	

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination
	90/008,389	7130576
	Examiner	Art Unit: 3992

SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR

UNITED STATES PATENT AND TRADEMARK OFFICE

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REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/008,389	02/06/2007	7130576

CONFIRMATION NO. 3367

OC000000022455999

Daniel N. Yannuzzi
SHEPPARD, MULLIN, RICHTER & HAMPTON LLP
12275 El Camino Real, Suite 200
San Diego, CA 92130-2006

Date Mailed: 02/12/2007

NOTICE OF REEXAMINATION REQUEST FILING DATE

(Third Party Requester)

Requester is hereby notified that the filing date of the request for reexamination is 02/06/2007, the date the required fee of $2,520 was received.

A decision on the request for reexamination will be mailed within three months from the filing date of the request for reexamination. (See 37 CFR 1.515(a)).

A copy of the Notice is being sent to the person identified by the requester as the patent owner. Further patent owner correspondence will be the latest attorney or agent of record in the patent file. (See 37 CFR 1.33). Any paper filed should include a reference to the present request for reexamination (by Reexamination Control Number).

cc: Patent Owner

24244
MICHAEL W LANDRY
5098 SEACHASE STREET
SAN DIEGO, CA 92130

Jason McDougald
Office of Patent Legal Administration
Central Reexamination Unit 571-272-7705

PART 3 - OFFICE COPY

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/008,389	02/06/2007	7130576

CONFIRMATION NO. 3367

REEXAM ASSIGNMENT NOTICE

OC000000022456000

24244
MICHAEL W LANDRY
5098 SEACHASE STREET
SAN DIEGO, CA 92130

Date Mailed: 02/12/2007

NOTICE OF ASSIGNMENT OF REEXAMINATION REQUEST

The above-identified request for reexamination has been assigned to Art Unit 3992. All future correspondence to the proceeding should be identified by the control number listed above and directed to the assigned Art Unit.

A copy of this Notice is being sent to the latest attorney or agent of record in the patent file or to all owners of record. (See 37 CFR 1.33(c)). If the addressee is not, or does not represent, the current owner, he or she is required to forward all communications regarding this proceeding to the current owner(s). An attorney or agent receiving this communication who does not represent the current owner(s) may wish to seek to withdraw pursuant to 37 CFR 1.36 in order to avoid receiving future communications. If the address of the current owner(s) is unknown, this communication should be returned within the request to withdraw pursuant to Section 1.36.

cc: Third Party Requester(if any)

Daniel N. Yannuzzi
SHEPPARD, MULLIN, RICHTER & HAMPTON LLP
12275 El Camino Real, Suite 200
San Diego, CA 92130-2006

Jason McDonald

Office of Patent Legal Administration
Central Reexamination Unit 571-272-7705

PART 3 - OFFICE COPY

71338
02/06/07

SHEPPARD MULLIN
SHEPPARD MULLIN RICHTER & HAMPTON LLP
ATTORNEYS AT LAW

12275 El Camino Real | Suite 200 | San Diego, CA 92130-2006
858-720-8900 *office* | 858-509-3691 *fax* | *www.sheppardmullin.com*

Writer's Direct Line: 858-720-8924
dyannuzzi@sheppardmullin.com

Our File Number: 05JM-127751

February 6, 2007

Mail Stop: *Ex Parte* Reexamination
Commissioner for Patents
PO Box 1450
Alexandria, VA 222313-1450

Re: Reexamination Control No. 90/008,389
U.S. Patent No. 7,130,576; Issued: October 31, 2006
(*issued from Appl. No. 10/289,011*)
For: **Signal Selector And Combiner For Broadband Content Distribution**
Inventors: Gurantz, et al.
Our Ref: 05JM-127751

Sir:

Transmitted herewith for appropriate action are the following documents:

Cover Letter accompanying Revised Information Disclosure Statement and Clarifying Remarks;

Replacement Statement for the Request for Reexamination of U.S. Patent No. 7,130,576;

Form PTO/SB/08a listing nine cited U.S. references and two cited non-US references;

Form PTO/SB/08b listing five cited non-patent literature documents;

Certificate of Mailing by "Express Mail " (37 CFR 1.10) to the USPTO, Commissioner of Patents;

Certificate of Service by "Express Mail" to Michael Landry; and

One (1) return postcard.

It is respectfully requested that the attached postcard be stamped with the date of filing of these documents, and that it be returned to our us.

The U.S. Patent and Trademark Office is hereby authorized to charge any fee deficiency, or credit any overpayment, to our Deposit Account No. 19-1853.

Respectfully submitted,

Daniel N. Yannuzzi
Attorney for Requester
Registration No. 36,727

for SHEPPARD, MULLIN, RICHTER & HAMPTON LLP

W02-WEST:6DNY1\400187305.1
Enclosures

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s):			Docket No. 05JM-127751	
Application No. 90/008389	Filing Date 12/20/06	Examiner James R. MATTHEWS	Customer No. 30764	Group Art Unit TBD

Invention: **SIGNAL SELECTOR AND COMBINER FOR BROADBAND CONTENT DISTRIBUTION**

I hereby certify that the following correspondence:

Letter Transmittal;Cover Letter accompanying Revised Information Disclosure Statement and Clarifying Remarks; Replacement Statement for the Request for Reexamination of U.S. Patent No. 7,130,576; Form PTO/SB/08a ;Form PTO/SB/08b; Certificate of Service to Michael Landry (1 pg.); Return Receipt Postcard

(Identify type of correspondence)

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

Mail Stop: Ex Parte Rexam

February 6, 2007
(Date)

Lisa E. Jambeau
(Typed or Printed Name of Person Mailing Correspondence)

Lisa E. Jambeau
(Signature of Person Mailing Correspondence)

EV 818035656
("Express Mail" Mailing Label Number)

Note: Each paper must have its own certificate of mailing.

P06A/REV03

71338 U.S. PTO
02/06/07

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of Gurantz, et al.	)	
	)	
In re REQUEST FOR REEXAMINATION	)	
of	)	
U.S. Patent No. 7,130,576	)	
	)	
Patent Date: October 31, 2006	)	Atty. Dkt. No. 05JM-127751
	)	Control No. 90/008,389
For: SIGNAL SELECTOR AND COMBINER FOR BROADBAND CONTENT DISTRIBUTION	)	

Mail Stop: *Ex Parte* Reexamination
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

COVER LETTER ACCOMPANYING REVISED INFORMATION DISCLOSURE STATEMENT AND CLARIFYING REMARKS

This cover letter and these remarks relate to the above-captioned Request for *Ex Parte* Reexamination (the "Original Request"), originally filed on behalf of Requester, R. F. Magic, Inc. On January 10, 2007, the Central Reexamination Unit mailed a Notice Of Failure To Comply With *Ex Parte* Reexamination Request Filing Requirements (the "Notice"). In response to this Notice, Requester, by its undersigned attorney, hereby submits this cover letter with the following remarks, a new Information Disclosure Statement on form PTO/SB/08, and a Replacement Statement for the Original Request, including an updated statement and explanation (the "Replacement Statement").

Requestor hereby expressly withdraws from the request any previously cited references that are being omitted from the replacement PTO/SB/08. Requestor submits that this Cover Letter and Remarks along with the accompanying documents fully address the Notice.

REMARKS

1. References Identified in PTOL-2077

The Attachment to PTOL-2077 accompanying the Notice states that the Original Request does not comply with the requirements set forth in 37 C.F.R. § 1.510(b)(2) because the Original Request does not include a detailed explanation of how each of the references is applied. Particularly, the notice states that a detailed explanation is absent for four of the references listed on the IDS. The references noted are:

United States Patents

4,953,184 (Simone)

6,437,837 (Seo)

Foreign Documents

EP 0912059

Non Patent Literature

A Single Chip Universal Digital Satellite Receiver With 480-Mhz IF Input (Kwentus, *et. al.*)

For the reasons set forth below, and based on the new Information Disclosure Statement submitted herewith, Requester respectfully submits that all noted non-compliance items are hereby cured or sufficiently addressed to render them moot. Requestor addresses each reference individually.

a. References Removed From IDS

United States Patent No. 4,953,184, to Simone, was inadvertently added to the Information Disclosure Statement. The new Information Disclosure Statement accompanying this response on form PTO/SB/08 does not include the '184 Simone patent. Requester hereby expressly withdraws United States Patent No. 4,953,184, to Simone, from the Request. Requester notes that a high-level discussion of the Simone patent remains in the Replacement Statement. This discussion provides background and historical perspective to technologies relating to A/D conversion and digital filtering. A telephone conference with Examiner Patricia Volpe was held on January 31, 2007. Examiner Volpe confirmed that it would be appropriate to leave this discussion of the Simone patent in the document, while removing citation of the Simone patent from the IDS, as the Simone patent is withdrawn from consideration. The undersigned wishes to thank Examiner Volpe for her time.

EP 0912059 was not listed on the original information disclosure statement filed by Requester. It is unclear how this document was raised by the Office as being listed on the original Information Disclosure Statement. Nonetheless, the new Information Disclosure Statement accompanying this response does not include EP 0912059. Although this reference was not believed to be included in the original IDS, out of an abundance of caution, Requester hereby expressly withdraws EP 0912059 from the Request. A telephone conference with Examiner Matthew was held on January 19, 2007 to confirm that this action would be sufficient to address this reference. The undersigned wishes to thank Examiner Matthew for his time.

b. References Properly Addressed in Original Request

As detailed below, the following two references were properly addressed in the Original Request. This was confirmed with Examiner Volpe in the January 31, 2007 telephone conference. The undersigned again wishes to thank Examiner Volpe for her time.

United States Patent No. 6,437,837, to Seo was properly addressed in the Original Request. The Original Request does include a detailed explanation of the pertinency and manner

of applying the Seo '837 patent to claim 10. In particular, a detailed explanation of how the Seo '837 patent is applied to Claim 10 can be found at pages 60 and 94 of the Original Request, and can be found at the same pages in the Replacement Statement.

A Single Chip Universal Digital Satellite Receiver With 480-Mhz IF Input was properly addressed. The Original Request does include a detailed explanation of the pertinency and manner of applying the paper "A Single Chip Universal Digital Satellite Receiver With 480-Mhz IF Input" to the claims. This paper is identified by its full title and then given a shorthand designation as the "Broadcom Paper." This appears in the Table of Exhibits at page 5 and in the list of references at page 9. A detailed explanation of how this reference is applied to Claim 3 can be found at pages 55 and 89 of the Original Request. A detailed explanation of how this reference is applied to Claim 15 can be found at page 95 of the Original Request. These explanations can also be found at the same pages in the Replacement Statement.

2. The Replacement Statement

Although a Replacement Statement is not required to correct the deficiencies noted in the PTOL-2077, an updated Replacement Statement is submitted herewith to correct typographical errors. Particularly, in the discussion of Claim 15 at page 95, the Original Request inadvertently referenced Claim 10 instead of Claim 15 in two instances. These are replaced with proper reference to Claim 15 in the Replacement Statement. Also, at page 55 the Original Request inadvertently reference the "Broadcom Paper" as the "Broadcom Satellite Receiver Reference." This too is corrected in the Replacement Statement. Finally, the Control Number was added to the cover page in the Replacement Statement. The correction of these two typographical errors and the addition of the Control Number are the only changes made by the Replacement Statement.

It was confirmed with Examiner Volpe that copies of the attachments and exhibits do not need to be resubmitted with the Replacement Statement. As such, these are not being refiled herewith.

CONCLUSION

Requester has addressed each of the items raised by the Attachment to PTOL-2077. Specifically, a new IDS on form PTO/SB/08 is submitted without U.S. 4,953,184 or EP 0912059, and a statement made that these are expressly withdrawn. The other two references, U.S. 6,437,837, and the paper "A Single Chip Universal Digital Satellite Receiver With 480-Mhz IF Input" were properly addressed in the Original Request and remain in the Replacement Statement. Requester has pointed the Office to locations in the Original Request and Replacement Statement where these references are addressed. Requestor submits that it has fully complied with all filing requirements for an *ex parte* reexamination proceeding under 37 C.F.R. § 1.510(a) and (b) and respectfully requests that its request for *ex parte* reexamination be accepted as complete and given a filing date.

Respectfully Submitted,

DATED: February 6, 2007

SHEPPARD MULLIN RICHTER & HAMPTON LLP

By _____

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PTO/SB/08a (09-06)
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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	90/08,389
Filing Date	12/20/06
First Named Inventor	Itzhak GURANTZ
Art Unit	TBD
Examiner Name	James R. MATTHEWS
Attorney Docket Number	05JM-127751

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 5,278,837		Kelley	
		US- 5,285,284		Takashima et al.	
		US- 5,654,774		Pugel et al.	
		US- 5,703,390		Green et al	
		US- 6,005,861		Humpleman	
		US- 6,353,463		Seo	
		US- 6,437,837		Seo	
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		US-			
		US-			
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] "Number[4] "Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
		EP 1009113				
		EP 0757489				

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3]Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6]Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	90/008,389
Filing Date	12/20/06
First Named Inventor	Itzhak GURANTZ
Art Unit	TBD
Examiner Name	James R. MATTHEWS
Attorney Docket Number	05JM-127751

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Eutelstat, "Information for Installers of Hot Bird tm DVB-S Systems, Version 1.0" http://www.eutelstat.com/docs/tech, June 7, 1999	
		Eutelstat, Digital Satellite Equipment Control (DiSEqC TM) "Update and Recommendation for Implementation, Version 2.0" http://www.eutelstat.org/press/tv_recept1/html#DiSEqC, April 18, 1997	
		Philips Semiconductors-Integrated Circuits "Data Sheet for UAA3203M Frequency Shift Keying Receiver" Preliminary specification, 1997 Aug 12, www.datasheetcatalog.com	
		A.Y. Kwentus, et al. "A Single Chip Universal Digital Satellite Receiver with 480-Mhz IF Input" IEEE Journal of Solid-State Circuits, Vol. 34, No. 11, November 1999, pp. 1634-1646	
		Thomson Consumer Electronics "RCA DirectTV Receiver with UltimateTV Service Setup Guide" WebTV Networks, Inc. 2000	

Examiner Signature		Date Considered	

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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71338 U.S. PTO
02/06/07

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of Gurantz, et al.	)	
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REQUEST FOR REEXAMINATION	)	
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U.S. Patent No. 7,130,576	)	
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Patent Date: October 31, 2006	)	Atty. Dkt. No. 05JM-127751
	)	Control No. 90/008,389
For: SIGNAL SELECTOR AND COMBINER FOR BROADBAND CONTENT DISTRIBUTION	)	

Mail Stop: *Ex Parte* Reexamination
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

REPLACEMENT STATEMENT FOR THE

REQUEST FOR REEXAMINATION OF U.S. PATENT NO. 7,130,576

Sir:

Reexamination under 35 U.S.C. §§ 302-307 and 37 C.F.R. § 1.510 is requested of United States Patent No. 7,130,576 (hereinafter "the '576 patent") which was applied for on November 6, 2002 by Gurantz, et al. (but for which some of the subject matter might have an effective filing date of perhaps as early as November 7, 2001). The '576 Patent has not previously been subject to reexamination. This Request is brought on behalf of RF Magic, Inc.

Pursuant to 37 C.F.R. § 1.510, a full copy of the '576 patent is attached as **Exhibit A**.

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F. A Single Chip Universal Digital Satellite Receiver with 480-MHz IF Input (the Broadcom Paper) 14

G. Philips Data Sheet for UAA3202M Frequency Shift Keying Receiver (Philips Data Sheet) 14

H. United States Patent No. 5,654,774 to Pugel *et al.* 14

I. United States Patent No. 4,953,184 to Simone 14

J. European Patent No. 1009113 14

K. European Patent No. 0757489 15

L. United States Patent No. 5,285,284 to Takashima et al. 15

The Takashima patent reference (Exhibit M) was filed on November 9, 1992 and issued February 8, 1994, over 7 years before the earliest possible priority date of the '576 patent and thus is prior art under 35 U.S.C. §102(b). 15

M. United States Patent No. 6,353,463 to Seo 15

The Seo '463 patent reference (Exhibit N) was filed on August 24, 1998 more than 3 years before the earliest possible priority date of the '576 patent and issued March 5, 2002. It is thus prior art under 35 U.S.C. §102(e). 15

N. RCA DIRECTV Receiver with UltimateTV Service Setup Guide (The RCA Setup Guide) 15

The RCA Setup Guide (Exhibit O) has a copyright date of 2000. This is before the earliest possible priority data of the '576 patent and thus it is prior art under 35 U.S.C. §102(a). 15

O. United States Patent No. 5,278,837 to Kelley 15

The Kelly patent reference (Exhibit P) was filed on June 29, 1992 and issued January 11, 1994, over 7 years before the earliest possible priority date of the '576 patent and thus is prior art under 35 U.S.C. §102(b). 15

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A. Claims 1, 2, 6, 8, 9, 11-14, 16, 18, 19, 21 and 22 of the '576 Patent are unpatentable under 35 U.S.C. §102(b) as being anticipated by the Eutelsat Installer's Guide as discussed below: 30

B. Claims 2 – 5, 7, 10, 15-17, and 20-23 of the '576 Patent are unpatentable under 35 U.S.C. §103 as being rendered obvious by the Eutelsat Installers Guide in combination with various secondary references as discussed below: 53

C. Claims 1, 2, 6, 8, 9, 11-14, 16, 18, 19, 21 and 22 of the '576 Patent are unpatentable under 35 U.S.C. §102(b) as being anticipated by the Eutelsat DiSEqC Specification as discussed below 65

D. Claims 2 – 5, 7, 10, 15-17, and 20-23 of the '576 Patent are unpatentable under 35 U.S.C. §103 as being rendered obvious by the Eutelsat DiSEqC Specification as discussed below: 87

IX. ACTION REQUESTED 99

TABLE OF EXHIBITS

A. United States Patent No. 7,130,576, to Gurantz *et al.*;

B. "INFORMATION FOR INSTALLERS OF HOT BIRD™ DVB-S SYSTEMS, VERSION 1.0" (hereinafter "Eutelsat Installers Guide"), EUTELSAT, dated June 7, 1999;

C. "DIGITAL SATELLITE EQUIPMENT CONTROL (DiSEqC TM) UPDATE AND RECOMMENDATIONS FOR IMPLEMENTATION, VERSION 2.0" (hereinafter "Eutelsat DiSEqC Specification"), EUTELSAT, dated April 18, 1997;

D. United States Patent No. 6,437,837 to Seo (hereinafter "Seo");

E. United States Patent No. 5,073,390 to Green *et al.* (hereinafter "Green");

F. United States Patent No. 6,005,861 to Humplemann (hereinafter "Humplemann");

G. "A SINGLE CHIP UNIVERSAL DIGITAL SATELLITE RECEIVER WITH 480-Mhz IF INPUT" (hereinafter the "Broadcom Paper");

H. "PHILLIPS DATA SHEET FOR UAA3202M FREQUENCY SHIFT KEYING RECEIVER", (hereinafter the "Phillips Data Sheet");

I. United States Patent No. 5,654,774 to Pugel *et al.* (hereinafter "Pugel");

J. United States Patent No. 4,953184 to Simone (hereinafter "Simone");

K. European Patent No. 1009113 (hereinafter "EPO '113 Patent");

L. European Patent No. 0757489 (hereinafter "EPO '489 Patent");

M. United States Patent No. 5,285,284 to Takashima *et al.* (hereinafter "Takashima");

N. United States Patent No. 6,353,463 to Seo (hereinafter "Seo")

O. "RCA DIRECTTV RECEIVER WITH ULTIMATETV SERVICE SETUP GUIDE (hereinafter the "RCA Setup Guide"); and

P. United States Patent No. 5,278,837 to Kelley (hereinafter "Kelley").