2. Technical Data

RF-Section:

Frequency generation	PLL Synthesizer
RF ranges A	425 ... 550 MHz
B	525 ... 650 MHz
C	625 ... 750 MHz
D	725 ... 850 MHz
E	825 ... 960 MHz
Switching bandwidth	24 MHz
Operating frequencies	max. 16 fixed, preprogrammed
Frequency stability	< ± 10 ppm (-10°C to +55°C)
Antenna output	BNC-jack, 50 Ohm
RF-output power (into 50 Ω)	10 to max. 100 mW, adjustable
Spurious and harmonic radiation	≤ 4 nW (per ETS 300 422)
Modulation	FM-stereo, multiplex with pilot tone, wideband (180k0F3E)
Nom. deviation at 1 kHz	± 40 kHz
Peak deviation	± 56 kHz
Pilot signal deviation	± 7.5 kHz

AF-Section:

Noise reduction system	HiDyn*stage*® compander
Input impedance	≥ 15 kΩ
AF input	3-pin XLR jack
AF sensitivity for peak deviation	-10 dBu at 1 kHz, internally adjustable
AF frequency range	40 Hz ... 15 kHz (- 3 dB)
AF-monitor output	1/4" stereo jack, unbalanced
AF-monitor level	0 ... 3 Vrms, adjustable
AF-monitor load impedance	> 16 Ohm
Signal to noise ratio	> 90 dBA (with EK 3052 receiver)
THD at 1 kHz and nom. deviation	< 1%, typ. 0.5 %

System Control

Microprocessor CPU	8-bit, 4 MHz (PIC16C73A)
Nonvolatile memory	512 × 8 Bit EEPROM
Programming interface / software	RS 232C / SePT.EXE V3.0
Display	multifunction LCD plus bargraphs
Indicated parameters	frequency, channel group; rel. RF-level; AF-deviation L & R; mono/stereo; mute

General

Nominal supply voltage	115/230 Vac, +10%, -15%
Operating temperature range	-10°C ... +55°C (-14°F ... 131°F)
Power consumption	max. 13 VA (SR 3054-U) max. 23 VA (SR 3056-U)
Dimensions (without rack mounting hardware)	436 mm × 228 mm × 43 mm (17 3/16" × 9" × 1 3/4")
Weight: SR 3054-U	approx. 3300 g (7 lb. 4 oz)
SR 3056-U	approx. 4000 g (7 lb. 13 oz)
Recommended receiver:	EK 3052-U
In Compliance with:	ETS 300 422
FCC ID:	DMOFT30UMB

3. General Description

The SR 3054-U is a stereo transmitter of a wireless low power auxiliary station for the transmission of audio cue or control command signals with up to 16 preprogrammed UHF frequencies in a 24 MHz range. The SR 3056-U consists of two complete stereo transmitters with up to 16 preprogrammed frequencies each. RF characteristics are the same as for a standard wireless microphone, making multi-channel frequency selection easy. Their high level of operational reliability, ease of use and excellent mechanical stability make these transmitters the ideal choice for use in large live shows.

Features:

- up to 16 switchable operating frequencies per transmitter, PLL controlled
- switching bandwidth max. 24 MHz
- monaural or multiplexed stereo modulation
- HiDyn*stage*® noise reduction system with > 92 dB(A) S/N
- adjustable input sensitivity
- adjustable RF-output power
- LCD indicator for operating frequency, channel group, deviation, relative output power, mute
- space saving 19" 1U housing with internal mains power supply
- suitable for multi-channel operation

4. Technical Description

4.1 Overview

The rack mountable fixed transmitter SR 3054-U and the technically identical dual version SR 3056-U is a component of a professional wireless stereo earmonitor or cue system for broadcast and stage applications. An LC display provides information about the operating frequency, frequency group, individual channel deviation, relative output power and muting status. The RF output power is adjustable in steps between 10 and 100 mW to assure sufficient coverage of a venue without generating excessive RF-energy.

Excellent rejection of noise and interference, result in superior operating range and are achieved by processing the modulation signals through the proprietary Hidyn*stage*® companders and 50 µsec pre-emphasis.

For optimum flexibility, the transmitter employs a PLL-synthesizer for a choice of 16 transmission frequencies. The data required for the 16 FM wideband channels is stored in an EEPROM and processed by a micro controller. A combination of harmonic rejection filter and impedance matching network provides optimized transmission via a suitable external antenna.

A serial interface service port permits interrogation of the system parameters and programming of the operating frequencies range via computer and service software program.

4.2 Construction Details

The entire transmitter is housed in a single height unit (1.75") 19" rack mountable steel case. A transmitter section occupies half of the available width, enabling a version with two transmitters sharing the same housing and power supply.

Each transmitter consists of a main printed circuit boars, which provides interconnections to seven functional modules and contained the power supply components.

A type label with serial number and frequency range information is affixed to the center of the rear apron of the case. Approval and certification marks are shown adjacent to the type label.

At the front panel each transmitter unit features its operating controls and a back lit function display. The controls are a power switch, an audio monitor output with volume control, and three control keys. These control keys are labeled '△' (UP), '▽' (DOWN) and 'SET'. The '△' (UP), '▽' (DOWN) buttons together are also labeled 'M/S' and have the function to toggle between mono to stereo mode.

Transmitter operation is inhibited for the first few moments after it has been turned on or after a frequency change and is indicated with the display showing 'MUTE'. This feature lets the frequency data to be read, to set and lock the PLL and allow operation to stabilize before sending any RF-signal to the transmit antenna.

The liquid crystal display shows the transmit frequency and group. Three bargraph displays indicate the deviation for each audio input and the relative RF-output power. Also indicated is the mode of operation.

At the rear panel are the separate 3-pin XLR input connectors for the left and right stereo audio signals and the BNC-antenna connectors for the modulated RF-output. The mains power connection is via a 2-pin IEC connector with a combination fuse holder/voltage selector. The transmitter uses a double isolated power supply and does not require an AC ground connection. A high density 15-pin sub-D connector next to the AC input provides the programming interface.
This requires a PC with suitable RS232 port, interface cable and appropriate service software.

4.3 Circuit Description

4.3.1 Mother Board with Display Module

The mother board serves as the carrier and interconnecting medium for the function modules, which together comprise the multiplexed stereo transmitter.
A toroidal mains transformer is mounted to the motherboard. The dual transmitter contains a secondary motherboard without the power supply components which interconnects with the primary motherboard via multipin snap-on edge connectors.

An IEC type 2-conductor AC socket assembly at the rear panel is combined with a fuse holder and mains voltage selector. The transformer has a center tapped secondary which is followed by a two Schottky diode full wave rectifiers and several voltage regulator circuits to generate the bipolar supply requirements of the various modules.

Except for the RF-output connectors, all controls and connectors are mounted to the motherboard. The RF-output connectors are the only components discretely wired through coaxial cable with a miniature snap-on connector to the corresponding RF-module.

4.3.2 Audio Input Module

The audio signal is routed to the audio input module through a high-pass filter, which can be internally deactivated, followed by a low-pass filter, a digitally controlled broad band limiter and a limiter interface for the micro controller. All components are doubled to allow stereo operation. The control signals for the two limiters are combined to ensure that both channels are attenuated simultaneously to the same extend.

The high-pass filter is designed with a 3 dB corner frequency of 50 Hz and is active if resistors R24 and R26 have been mounted. With resistors R25 and R27 installed instead, the filter is inactive. Subsequent to the high-pass filter, a low pass filter with a 3 dB cutoff frequency of approximately 30 kHz eliminates high frequencies.

The signals then are amplified in the operational amplifier IC U4 and the feedback gaincell U3. The gaincell is controlled by the DC voltage generated at rectifiers U6 and U7. When the input signal is high enough to exceed the maximum permissible deviation, the control voltage will be higher than the limiter threshold and cause the gaincell to increase the negative feedback, with the result that the audio level is maintained below the threshold level. This level is set by resistors R17, R18 and R19. Excessive input level also sends a triggers the comparator U9 (limiter interface) to send a signal to the microprocessor.

4.3.4 Headphone Module

The headphone module contains a stereo amplifier with a gain of 16 dB. The output stage delivers an audio signal of up to 3 Vrms into a load impedance of 10 Ohm or larger, and therefore can drive directly a pair of headphones to monitor the audio signals to be transmitted. The monitor level can be adjusted with a stereo volume control potentiometer on the mother board. The output signal is connected to a mother board mounted 1/4" stereo phone jack.

4.3.5 HiDyn*stage*® Module

The HiDyn® module consists of a 50μsec pre-emphasis network with peak limiter and a HiDyn® compressor. All circuits are duplicated to allow stereo operation. The control signals for the peak limiters to ensure balanced attenuation in both stereo channels.

The HiDyn® module can be configured either as a HiDyn*plus*® processor with compression prior to the pre-emphasis, or as a HiDyn*stage*® processor with compression subsequent to the pre-emphasis.

The HiDyn® compressor U1 and gaincell U2 compress the dynamics of the audio signals by a factor 2 : 1.

The input signals of the pre-emphasis network/peak limiter are amplified by U3. The gain of U3 increases with higher frequencies, thus providing a 50μsec pre-emphasis. The output level of the HiDyn® module is determined by the control voltage generated by the rectifier formed by U5 and U6. When the output level of the peak limiter gets too high, it will be reduced by the action of the gaincell. Resistors R16, R17 and R18 are used to set the limiter threshold.

4.3.6 MPX Coder Module

The multiplexer module comprises several audio filters and an MPX IC. At the input, all audio signals are filtered by a low-pass filter and a 19 kHz notch filter, formed by U1 and U2, to ensure that high audio frequencies do not interfere with the MPX spectrum.

The filtered audio signals are then processed by the MPX IC U4. When the mono/stereo select at pin 5 is 'low', an MPX signal is produced and the 38 kHz oscillator is operating. A divider in U4 also generates the 19 kHz pilot tone.

At transistor Q1 the MPX signal and the 19 kHz pilot tone are combined to furnish the complete multiplexed stereo signal. Harmonics produced by U4 are eliminated by a low-pass filter around U5.

With pin 5 of U4 set 'high' the 38 kHz oscillator is disabled and the multiplexer module switches to monaural operation. In this mode only the right channel audio signal is used. In the mono mode the gain is increased by 6 dB above the level used for stereo operation, thus ensuring the same modulation level.

4.3.7 RF Module

The RF-module contains a PLL synthesized RF-oscillator with buffer stages, a low power amplifier, a phase lock detector and several RF filters.

The voltage controlled oscillator (VCO) formed by O2 and varactor diodes D200, D201 and D2 is buffered by transistor stages Q3 and Q7. At their outputs two signal are available. The first signal is amplified in the power amplifier U6 and then conditioned by a wide bandpass filter to remove possible harmonics. It is then passed to a rectifier diode and amplifier controller U8 and Q8. This voltage also serves to indicate the power output level, which can be adjusted with R67.

The second signal is the input to the prescaler divider IC U5. The division ratio of U5 is controlled by the PLL processor U2 and the reference oscillator. The VCO control voltage is amplified by the operational amplifier U1. The modulation signal is superimposed on the VCO control voltage. Deviation is adjusted to ± 56 kHz with R1.

The phase lock detector U7 sends its signal to the micro controller, the output power control IC U8 and a diode switch which turns off the output in case the PLL should be out of lock. The 'RF-mute' signal from the micro controller is combined with the phase lock signal and also forces to turn off the RF-output power.

4.3.8 Processor Module

The various functions of the stereo transmitter are controlled by the microprocessor module with a PIC16C73A micro controller U3.

The module consists of a dual layer PCB with components mounted on one side only. It is connected to the motherboard via 45 pins staggered at 0.05" spacing and has the following functions:

Controlling the PLL

a) setting the operation parameters
b) setting the internal dividers according to the selected operating frequency
c) reading in and evaluating the PLL lock detect 'LD' signal

Controlling the LCD module

a) display frequency, group, mode of operation
b) reading and evaluating the '△' (UP), '▽' (DOWN) and 'SET' keys via the LCD module

Measuring of analog system parameters

a) measuring and displaying AF-signal levels of left and right channels
b) measuring and displaying the RF output level

Monitoring the operating voltage

a) initiating a system reset during power-up sequence to ensure a defined module start
b) triggering a system reset in case of abnormal (transient) supply conditions
c) providing a reset possibility via the programming interface

Monitoring and evaluating all system functions

a) turning the Rf-signal off when the operating frequency is changed