2. Technical Data

RF-Section:

Frequency generation		PLL Synthesizer
RF ranges	A	518 ... 550 MHz
	B	630 ... 662 MHz
	C	740 ... 772 MHz
	D	790 ... 822 MHz
	E	838 ... 870 MHz
Switching bandwidth		32 MHz
Operating frequencies		max. 16 out of 1280 (25 kHz steps)
Frequency stability		< ± 15 ppm (-10°C to +55°C)
Antenna		M3 thread
Antenna length, range A:		5 1/8" (130 mm)
	range B:	4 3/8" (110 mm)
	range C and D:	3 1/2" (90 mm)
	range E:	3 1/8" (80 mm)
RF-output power into 50 Ω		typ. 30 mW
	(ERP)	max. 10 mW
Spurious and harmonic radiation		≤ 4 nW (per ETS 300 422)
Modulation		FM
Nom. deviation at 1 kHz		± 24 kHz
Peak deviation		± 48 kHz

AF-Section:

Noise reduction system	proprietary HDX® compressor
AF input	microphone or line level
AF input impedance	> 15 kOhm
AF frequency range	60 Hz ... 18 kHz (- 3 dB)
Signal to noise ratio	> 110 dBA
THD at 1 kHz and nom. deviation	< 0.9%, typ. 0.5 %
recommended microphones:	MKE 2 (miniature omni), ME 3 (miniature super-cardioid) ME 4 (miniature cardioid)

System Control

Microprocessor CPU	8-bit, 4 MHz (M889191A-TX)
Nonvolatile memory	EEPROM
Programming interface / software	3 push buttons / menu driven
Display	multifunction LCD plus bargraphs and LEDs
Indicated parameters	frequency, channel number, lock status, battery status, peak modulation

General

Power supply	9 V alkaline battery (IEC 6LR61)
Power consumption	< 60 mA
Operating time	> 8 hrs
Operating temperature range	-10°C ... +55°C (-14°F ... 131°F)
Dimensions	110 x 65 x 22 mm (4 3/8 × 2 1/2 x 1")
Weight:	approx. 255 g (9 oz)
Recommended receivers:	EM 500 / EM 300 / EM 100 EK 500 / EK 300 / EK 100
In Compliance with:	ETS 300 422, ETS 300 445 (CE) FCC Part 74

3. General Description

The SK 500 / SK 300 and SK 100 are very compact pocket FM transmitters for low power wireless microphone systems. Their primary applications are by stage, film and TV actors, moderators and other presenters. Up to 16 available preprogrammed UHF frequencies (out of a possible 1280) in a 32 MHz range assure optimum and interference-free operation. Their RF characteristics make multi-channel frequency operation easy, and 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. 32 MHz
- HDX® noise reduction system with > 110 dB(A) S/N
- menu driven ergonomic push button operation
- 'LOCK' mode to prevent accidental change of operating parameters
- LCD indicator for operating frequency, channel number, battery condition and lock-out status
- sturdy metal housing
- convenient powering from standard 9 V alkaline or NiCD battery
- suitable for multi-channel operation
- universal microphone input with bias for electret microphones
- line level input for instrument pick-ups
- AF-mute switch

4. Technical Description

4.1 Construction Details

All components, including the operating controls are mounted on three printed circuit boards. The main board contains all control electronics, plus the audio circuits, which consist of an electronic gain controlled preamplifier, dynamic compressor (HDX) stages including an effective modulation limiter, mute control, and peak deviation indicator. Attached to the main board is the RF module, which incorporates the PLL and VCO, together with the RF buffer, driver and output stages, the EEPROM with specific frequency data, and the ON/OFF key. Plugged into a socket at the side of the main board is the display module. The resulting assembly is housed in a sturdy metal housing, providing superb mechanical protection and electronic shielding. Below the printed board assembly is the battery compartment with its contact strip. Attached to the back of the housing is a removable belt clip and the type label, which includes the FCC identifier and other approval and certification markings. A sliding clear plastic cover prevents accidental activation of the operation keys, while permitting to read the LC-display. The recessed mute switch is separately accessible.

4.2 Circuit Description

4.2.1 Main Board with Audio- and Processor-Circuits

Effective low-pass filters at the audio input keep potential RF-interference out of the low noise microphone preamplifier. The AF signal from an electret condenser microphone is input through the tip and sleeve of the 3.5 mm phono jack J101 to the inverting input of IC U101-1. Alternately, a guitar pick-up cable delivers the signal to be transmitted via the ring and sleeve connection of J101 to the high impedance compound emitter follower stage with discrete transistors Q201/Q202 and U101-1. Bias for the preamplifier stages is set by the diode connected transistor strings Q202 to Q207. The gain of the audio amplifier is changed electronically via commands from the control processor by changing the feedback loop around U101-1 through Q109/Q111 and Q110/Q112. The preamplifier is coupled to the HDX® compressor circuit formed by U302-2/U101-2 and its associated components via the R/C link of R302 and C302 for pre-emphasis. The compressor incorporates a limiter for both signal polarities of potentially excessive input signals with Q301 and Q302. The processed signal is output through a buffer amplifier U302-3 and a steep 20 kHz low-pass filter section with U302-4 to the modulation input of the RF-module.

The micro controller U901 controls all transmitter functions. After initializing, the controller recognizes the device's frequency range. The voltage sensitive Schmitt-Trigger IC U904 tests the battery voltage and forces the controller to abort the start-up procedure if its operating voltage falls below its threshold. After successfully booting up. the controller then reads in the data for the last used frequency from the EEPROM and programs the PLL.

In the standard mode of operation, the controller periodically scans the operating keys. Any key activity forces the processor to branch to the corresponding subroutine and send appropriate menu options to the LC-display module, consisting of the LCD U802 and its own controller IC U801. The processor's internal software offers access to commands for scanning and setting the operating frequency, assigning channel designations between 0 and 255, setting the AF-processor gain and locking out any changes to these settings. Frequency and channel data are interpreted in the processor IC and send to the LC-display via its controller. Furthermore, the processor continuously samples the battery status and passes the results to the display. The processor also monitors the PLL IC and any abnormal or 'out-of-lock' condition will force the RF-output to be disabled.

4.2.2 RF-Module

When the transmitter is turned on, the processor module activates all stages with the exception of the RF-output stages. Next it loads via a serial bus the frequency specific data from the EEPROM U3 into the PLL IC U1. This IC sets its internal dividers and compares the 5 kHz reference frequency derived from the 4 MHz crystal Y901 on the main board with the transmission frequency divided in the fast prescaler U2. A phase detector in U1 produces current pulses proportional to the difference in phase. After integration in the loop filters, the resulting signal controls the VCO at D2. Effective RF decoupling is achieved with additional passive components.

The circuit around Q2 and variable capacitance diodes D1 and D2 forms the voltage controlled oscillator with very low current consumption and generating the carrier frequency with very low phase noise at a VCO gain of > 20 MHz/V. The current regulator loop with Q1 further reduces VCO phase noise below 10 MHz by up to 15 dB. The VCO is AF-modulated by D1. Through this arrangement the variation in FM sensitivity is held to +/- 0.5 dB within the tuning range. Trimmcap C6 permits to center the tuning voltage correctly. The VCO output is loosely coupled into a broadband cascade buffer amplifier Q4. To eliminate any possible interference, the entire VCO and buffer section is housed in a tightly shielded compartment.

The subsequent stages with transistors Q5, Q6 and Q9 amplify the transmission signal from -10 dBm via +1 dBm to +17 dBm. Broadband matching between the stages is achieved by the LC high pass filters of L7/C31 and L9/C33. Transistors Q7 and Q8 control and stabilize the RF-output. Under control from the main processor the RF-output stage can be turned off, and it experiences a delayed power-up command to allow the PLL/VCO to achieve reliable lock before emitting a any transmission. A low-pass filter/matching network follows Q9 and eliminates any potential emission of harmonics, while performing the impedance match between the collector impedance of the output stage and the effective antenna impedance.

Also loosely coupled to the VCO output is the prescaler U3. This IC divides the VCO frequency by 64 or 65 respective of the modulus control output of the PLL IC U1.