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		internal
RF-output power (ERP)		max. 15 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	3-pin XLR, balanced
AF input impedance	> 10 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 %
SKP 500 only	optional 48 V-phantom power

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
Indicated parameters	frequency, channel number, lock status, battery status;

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	105 x 43 x 43 mm (4 1/8 × 1 3/4 x 1 3/4")
Weight:	approx. 195 g (7 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 SKP 500 and SKP 100 are plug-on FM transmitter modules, to be used with any standard microphone for low power wireless microphone systems. Their primary application is by reporters and announcers in video and broadcast applications. 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 live productions.

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 frequency, channel number, battery- and lock-status
- sturdy metal housing
- convenient powering from standard 9 V alkaline or NiCD battery
- suitable for multi-channel operation
- standard 3-pin XLR microphone input connector, locking
- (SKP 500 only): 48V-Phantom power for studio microphone
- AF-mute switch

4. Technical Description

4.1 Construction Details

All components, including the operating controls are mounted on three printed circuit boards. The processor board contains all control electronics, control keys and display. Attached to one side of the processor 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 and mute switch. Mounted perpendicular to the processor board is the audio module with electronic gain controlled microphone preamplifier, dynamic compressor (HDX) stages including modulation limiter and, in the SKP 500, the DC-to-DC converter for 48 V phantom power. The resulting assembly slides into a square metal. Behind the processor and audio modules is the battery compartment. Permanently affixed to the side of the housing opposite the display window is the type label with FCC identifier and other approval and certification markings. The housing of the microphone used with the plug-on transmitter becomes integral part of the transmitter antenna. Microphones with metal housing are preferable over models with plastic housings/handels.

4.2 Circuit Description

4.2.1 Audio Module

Effective low-pass filters at the microphone socket keep potential RF-interference out of the low noise microphone preamplifier, consisting of the combination of discrete transistor Q104 and IC U1-1. In the SKP 500 a regulated 48 V phantom voltage is generated in the DC-to-DC converter section formed by U501 and associated transistors Q501 to Q505. L501 is the inductor for the converter, with D502 rectifying the positive flyback pulses. The output of this converter is effectively stabilized in the feedback path through Zener diode D501 and Q503 and smoothed in the active filter section with Q505 and C515, before being applied via R150 to the matched 6.8 kOhm resistor pair to pins 2 and 3 of the XLR microphone socket.

Bias for the preamplifier stages is set by the diode connected transistor strings Q105 to Q108. Depending on the microphone sensitivity, the incoming signal may be attenuated electronically by U103 and controlled through Q110. The gain of the audio preamplifier is changed electronically via the control processor by changing the feedback loop around U101-1 through Q112/Q102 and Q101/Q109. The audio signal is coupled to the HDX compressor circuit formed by U201-2/U101-2 and its associated components via the R/C link of R201 and C201 for pre-emphasis. The compressor incorporates a limiter with Q201 and Q202 and outputs through the buffer amplifier U201-3. This section is followed by a steep 20 kHz low-pass filter section with U201-4, before the processed audio signal is routed to the modulation input of the RF-module.

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 processor 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, while generating the carrier frequency with very low phase noise and 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.

4.2.3 Processor 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 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.

7. Test Reports (with Photographs)

8. Statement of Attestation for FCC ID: DMOP1EURH

This equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations. To the best of my knowledge, these tests were performed using measurement procedures consistent with industry or Commission standards, and demonstrate that the equipment complies with the appropriate standards.

Each unit manufactured, imported or marketed, as defined in the Commission's regulations, will conform to the samples tested within the variations that can be expected due to quantity production and testing on a statistical basis.

I further testify that the necessary measurements were made by:

CETECOM ICT Services GmbH
Untertürkheimer Straße 6 - 10
D-66117 Saarbrücken
Germany

Signature of authorized signer: 

Printed name of authorized signer: Uwe Sattler

Title of authorized signer: Technical Director

Date: September 27, 1999