1 Characteristics

1.1 Uses

The 1-kW TV Transmitter NT 315 is used for the emission of colour TV broadcasts in band IV/V in accordance with the NTSC, PAL or SECAM system and operates on the principle of combined vision and sound amplification. It is suitable for dual sound.

By combining two single transmitters via a central control unit, a system with passive standby can be configured. If the primary transmitter fails, the central control unit connects the standby transmitter to the antenna and the faulty transmitter to the dummy antenna (dummy load). The faulty transmitter can thus be checked without interrupting transmission.

The transmitter can be switched on and off and the operating status monitored by a remote control unit.

For protection of the personnel and the system, the system can be immediately disconnected from the AC supply by means of emergency OFF buttons.

1.2 Description

See block diagram, Fig. 1-1

The 1-kW TV transmitter is made up of the exciter, the transistor driver stage with its own power supply unit, the 1-kW power amplifier and the transmitter control unit and accommodated in a cabinet rack. In the case of dual transmitters, the function is integrated into the transmitter control units of the two single transmitters.

The signals are modulated at the standard IFs of 38.9 MHz (vision) and the 33.4 MHz (sound 1) as well as 33.15 MHz (sound 2) for standard G. The VF signal is applied to the VF amplifier which is provided with two inputs for a nominal input voltage of 1 V (0.77 V_{pp}) and a level control for correcting the input signal by ± 3 dB.

The VF amplifier consists of a white-level limiter, a circuit for clamped DC restoration and a frequency-response equalizer. The receiver precorrector is connected between the VF amplifier and the vision modulator. By changing the cable connections on the front panel of the exciter stage, the receiver precorrector can be bypassed and replaced by an attenuator for level adjustment. The output signal of the VF amplifier can be monitored via a test output which is brought out on the front panel of the transmitter or on a connection board on the top of the rack.

The processed VF signal is applied to the vision modulator where it amplitude-modulates the IF. The modulated IF signal is routed through the vestigial sideband filter and the delay equalizer for compensating the group delay variations caused by the steep edges of the vestigial sideband filter. Another delay equalizer corrects the group delay variations of the transmitter as a whole.

The IF oscillator (in the vision modulator) supplies the intermediate frequency for the modulator and consists of a circuit for level control at the IF which maintains the level preceding the IF precorrector constant ensuring a stabilized precorrection of the transmitter.

The free-running oscillator in the sound modulator is locked to the vision IF (38.9 MHz). However, the sound modulator can also be locked to the line frequency. For this, a coding connector in the sound modulator must be rewired accordingly. When operating with a precision offset unit, the sound modulator (free-running oscillator) is locked to the vision IF. The accuracy of the vision IF corresponds to that of the reference frequency.

The modulated vision IF and the modulated sound IF are then taken to the IF precorrector. In dual-sound operation, the outputs of both sound modulators are combined via a diplexer and are then routed to the IF precorrector. This compensates for non-linearities (slope and phase) of the transmitter, in particular of the power stages. A test point at the input of the IF precorrector for the modulated vision IF is routed to the front panel or to the top of the transmitter rack.

The frequency converter mixes the modulated and precorrected IF signal with the oscillator frequency $f = f_{vision} + 38.9$ MHz to produce the required vision frequency. A level control in the frequency converter equalizes gain fluctuations of the subsequent stages. A switch on the front panel can be used to switch the level control between manual and automatic mode. The frequency $f_v + 38.9$ MHz is derived from a crystal oscillator whose frequency-determining components are accommodated in an oven. The UHF oscillator contains a free-running oscillator controlled by variable capacitance diodes locked to ten times the frequency of the crystal oscillator by means of a phase link. An external signal can be applied with $f = (f_{vision} + IF)/10$ to act as an external drive. The oscillator circuit is designed for operation in conjunction with a precision offset unit, so that the frequency accuracy is identical to that of the externally applied reference frequency (1 or 5 MHz). If the reference frequency fails, the precision offset unit disconnects the control line from the crystal oscillator.

The modulated RF signal is routed to the output amplifier of the exciter stage, which drives the subsequent solid-state driver amplifier. Its operating voltage supplies a separate power supply unit which also carries out monitoring tasks. The output stage of the driver amplifier comprises 8 parallel-connected RF transistors. It supplies the control power for the valve output stage. The two-section, bandpass-filter-coupled valve stage is fitted with a coaxial tetrode in grounded-grid configuration.

The valve in the cavity resonator is a highly linear coaxial power tetrode with thoriated tungsten filament. The high-voltage AC supply unit is equipped with a fast-acting thyristor cut-off to protect the power tetrode from flashovers between anode and other electrodes.

A required sequence for the switch-on of the transmitter is performed by the transmitter control unit which also evaluates the status of the individual transmitter.

At the outputs of all power stages, there are directional couplers provided with measuring systems for checking the RF level as well as the quality data without interrupting the operation.

By combining two single transmitters via a coaxial RF switch, a dual transmitter in passive standby configuration is obtained. Integrated into the transmitter control units of the two single transmitters, the central control unit permits local or remote control of the system. If the primary transmitter fails, the central control unit switches the standby transmitter to the antenna.

1.3 Specifications

Frequency range	470 to 860 MHz (band IV/V)
Channels	21 to 68
TV standard (normal model)	G (in line with CCIR)
Other standards available on request	D K H I M N
with video modulation bandwidth (MHz)	5 6 5 5.5 4.2 4.2
Class of emission	vision: A5C (negative) sound: F3
Frequency deviation in each sound channel	≤ 50 kHz
Colour systems	PAL, NTSC, SECAM
Amplification of vision and sound signal	combined

Transmitter output

Vision/sound power ratio	100:5:1 for dual-sound operation 20:1 or 10:1 for single-sound operation
Nominal vision output (peak sync level)	1 kW
Nominal sound output	50 W/10 W for dual-sound operation 50 W or 100 W for single-sound operation
Change in peak sync level caused by black-to-white transition and vice versa	≤ 0.5 dB
Indication of output power	peak-voltage meter
Output connector	13/30 (coaxial) 50 Ω, IEC 169-5
Return loss	≥ 34 dB
Permissible VSWR	≤ 1.3
Strongest harmonic emission	≤ 10 mW
Strongest emission of unwanted mixture products	≤ 1 µW
Intermodulation products with respect to sync peak	≥ 62 dB

TV Transmitter, 1 kW, Band IV/V, NT 315

Video input

Number of inputs	2
Input voltage (C)CVS	1 V_{pp} (0.7 V_{pp}) (variations of ± 3 dB can be compensated for)
Input connector	BNC female, 75 Ω
Return loss	≥ 34 dB (up to 6 MHz)
Crosstalk between the inputs	≥ 56 dB down (up to 6 MHz)

Sound input

Number of inputs	2 (1 for single-sound operation)
AF bandwidth	30 Hz to 15 kHz (optional 30 Hz to 100 kHz)
Input level range for 50 kHz deviation	-4 to + 8 dBm
Input impedance between 40 Hz and 15 kHz	600 Ω or > 2000 Ω (balanced)
Connector	3-contact female, similar to DIN 41524, lockable

Measurement points

Directional coupler (channel frequency)	transmitter output
Connector	N female, 50 Ω
IF	input of IF precorrector
Connector	BNC female, 50 Ω
Video	VF amplifier
Connector	BNC female, 75 Ω

Frequency

Setting error	vision transmitter : < ± 50 Hz sound transmitter : < ± 50 Hz
Frequency drift (with internal control)	
of vision transmitter within 12 weeks and after uninterrupted run-in period of 10 days	≤ ± 150 Hz
of sound transmitter within 12 weeks	≤ ± 350 Hz (= locked to line frequency)

Intermediate frequency (standard G)	vision: 38.9 MHz sound: 33.4 MHz (sound 1) 33.1578125 MHz (sound 2 for dual sound)
Input for external drive	BNC female, 50 Ω
External drive frequence	$f_0 = \frac{f_{vision} + IF}{10}$
Input voltage	0.7 to 1 V_{rms}

Power supply

AC supply voltage	3 x 380 V, + 5/-10%
AC supply frequency	50 Hz ± 2%
Average power consumption (including built-in AC voltage stabilizer and ventilating system)	
of single transmitter	approx. 5.5 kVA for black level
of double transmitter	approx. 11 kVA
Power factor (cosφ)	≥ 0.9

Cooling

Coolant	air	
Permissible temperature ranges	**Rated**	**Operating**
Operating room	+ 5 to + 45 °C	-10 to + 45 °C
Cooling air at inlet to transmitter	+ 10 to + 45 °C	-20 to + 45 °C
Permissible air humidity	75%	90% (at t_{amb} ≤ 26 °C)
Permissible air pressure	690 to 1060 mbar (max. installation height approx. 3000 m above sea level)	
Valves	1-kW output stage: TH 347, manufacturer: Thomson CSF	

Transmission characteristics of vision transmitter

DC restoration	clamped to blanking level (without affecting the burst)
Modulation failure	permissible for any duration (normal operation is automatically resumed when modulation signal returns)
White-level limiter	disconnectible
Non-linearity distortion (10% superimposition)	
with optimum correction from 0 to 4.5 MHz	≥0.9 (with 10 to 75% modulation)
at 4.43 MHz	≥0.9 (with 10 to 86.5% modulation)
Differential phase, referred to 4.43 MHz, with 10 to 86.5% modulation	≤ ± 3° (with equalization)
Group-delay variations (without receiver precorrection and without sound trap in TV demodulator)	≤ ± 35 ns
Delay difference between luminance (referred and chrominance signals to amplitude of 20T pulse), with receiver precorrection and sound trap	<4% (3% with precorrection and sound trap)
AM S/N ratio, referred to 10 to 75% modulation	
Noise (weighted for 10 kHz to 5 MHz, rms value)	≥60 dB down (not including demodulator)
Ripple (peak value for 1 kHz)	≥46 dB down (not including demodulator)
Intercarrier interference ratio (with sinewave modulation up to 100 kHz and unmodulated sound transmitter)	≥44 dB (referred to 30 kHz frequency deviation of sound transmitter)

Transmission characteristics of sound transmitter

(applicable to both sound carriers)

AF response between 30 Hz and 15 kHz (referred to 500 Hz) with pre- and de-emphasis	≤ ± 0.5 dB
without pre- and de-emphasis	
up to 43 kHz	≤ ± 0.1 dB
up to 53 kHz	≤ ± 0.3 dB
up to 75 kHz	≤ ± 1 dB
up to 100 kHz	≤ ± 2 dB
Distortion between 40 Hz and 15 kHz up to ± 50 kHz frequency deviation	≤ 0.4% (without pre- and de-emphasis)
Unweighted FM S/N ratio between 40 Hz and 15 kHz (referred to 30 kHz deviation with f_{mod} = 500 Hz)	≥ 50 dB
Weighted FM S/N ratio (referred to 30 kHz deviation with f_{mod} = 500 Hz)	≥ 60 dB
Residual AM S/N ratio, unweighted (referred to 100% AM)	≥ 46 dB
Stereo crosstalk (dual-sound)	> 32 dB
Channel crosstalk (dual-sound)	> 70 dB

Weights

Single transmitter	380 kg
Dual transmitter	570 kg