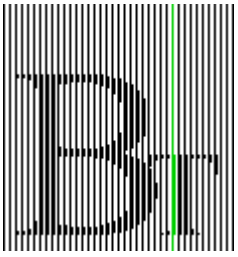
TECHNICAL MANUAL
and
USER'S HANDBOOK
for
SHOWMAN UT5100 SERIES
RECEIVER/DEMODULATOR



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REVISION HISTORY

Document Number: UT5100-7000
File Name: UT5100.DOC
Latest Revision: A9

Issue:	A6
Date:	05/03/97
Author:	M.K.Goddard
Description:	Update
Issue:	A7
Date:	03/04/98
CR:	475
Author:	A. Rutherford
Description:	Additions to Warnings in text regarding replacement of fuses (for CAN/CSA 950 approval).
Issue:	A8
Date:	03/02/99
CR:	583
Author:	P. Brown
Description:	Channel Frequency Tables incorporated.
Issue:	A9
Date:	09/07/99
CR:	642
Author:	P Brown
Description:	Manual updated - Circuits/Schematics and Parts List removed.
Issue:	
Date:	
CR:	
Author:	
Description:	
Issue:	
Date:	
CR:	
Author:	
Description:	

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ELECTROMAGNETIC COMPATIBILITY (EMC)

This equipment has been type-tested and conforms to current European EMC regulations.

When tested, the equipment was operated with all cables attached. Mating connectors were of the fully screened variety and, where practical, the cables were double screened, with the screens bonded to connector bodies at each end of their respective cables.

When this equipment is installed as part of a larger system, it is the responsibility of the system provider to ensure that EMC regulations continue to be met.

Suggested cable types:

75 ohm video (BNC connectors):	Equivalent to BBC No.PSF1/3M BICC TM3304 BRAND REX GT851
Twisted Pair Audio/Digital:	Canford Audio FST Belden 8451 Alpha 2461
Data Cables:	Belden 9829 (2 pair) BICC H9589 (4 pair) Brand Rex BE57901

GENERAL SAFETY SUMMARY

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

If this equipment is used in any manner not specified, including failure to follow any rating or direction for use, the protection provided by the equipment may be impaired.

In case of difficulty or doubt about a matter of safety, please refer to the manufacturer.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Avoid Exposed Circuitry. Do not touch exposed connectors and components when power is present.

Do Not Operate in Wet/Damp Conditions. Do not operate this product in wet or damp conditions. The unit is for indoor use, at altitudes up to 2 Km, in temperatures from 0 °C to 40 °C and humidity up to 80 %.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Product Damage Precautions

Use Proper Power Source. Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation. To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

Terms in This Manual. These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. These symbols may appear on the product:

DANGER
High Voltage

Protective Ground
(Earth) Terminal

ATTENTION
Refer to Manual

Double
Insulated

INSTALLATION

On receipt of the equipment, open the box and verify that the unit and all accessory items are included.

Save the shipping carton and packing materials in case it becomes necessary to ship the unit to the manufacturer for service or repair.

WARNING. *Before proceeding, read the Safety Summary at the front of this manual.*

Electrical Installation

The equipment is designed to operate from a single-phase power source having one of its current-carrying conductors at or near earth ground potential (the neutral conductor). Only the line conductor is fused for over-current protection.

Systems that have both current-carrying conductors live with respect to ground (such as phase-to-phase on multiphase systems) are not recommended as power sources. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

The mains outlet, intended to supply the equipment unit, should either be close to the unit and easily accessible to the user or the equipment mains inlet should be easily accessible in the final installation.

WARNING. *Correct mains polarity must always be observed, do not use reversible plugs with this equipment. Ensure all live mains connections are connected correctly.*

Fuse Rating

CAUTION: *For continued protection against risk of fire, replace only with the same type and rating of fuse.*

ATTENTION: *Pour ne pas compemettre la protection contre les risques d'incendie, remplacer par un fusible de même type et de mêmes caractéristiques nominales.*

Installation Within the UK

The power lead for this unit is fitted with moulded connectors. The mains plug may not suit the local mains outlet. In this case the fuse should first be removed from the plug, which should then be cut off and destroyed, in order to minimise any risk of shock from the exposed leads in the event that the plug be inserted into a live socket.

The wires of the power lead are colour coded as follows:

BROWN	LIVE
BLUE	NEUTRAL
GREEN/YELLOW	EARTH

A suitable plug should be wired to the power lead as follows:

Connect the BROWN wire to the terminal marked "L" or coloured brown or red.
Connect the BLUE wire to the terminal marked "N" or coloured blue or black.
Connect the GREEN/YELLOW wire to the terminal marked "E" or "⏚"or coloured green and yellow or green.

The plug fitted should contain a 3 amp fuse protecting the BROWN wire. Alternatively the distribution circuit supplying the plug must be protected by a 5 amp fuse or circuit breaker.

Ensure that the cord grip tightly clamps the power lead outer sheath.

WARNING: *This unit must be earthed.*

Installation Outside the UK

If the power lead supplied has a UK style moulded on mains plug (identified by the marking BS1363) the colour code of the wires within the lead is as follows:

BROWN	LIVE
BLUE	NEUTRAL
GREEN/YELLOW	EARTH

Ensure the relevant country wiring regulations are observed.

WARNING: *This unit must be earthed.*

Mechanical Installation

The equipment requires no assembly. Always allow approximately 100mm of rear panel clearance for cable and power cord connections. Ensure that ventilation slots on the sides on the product are not obstructed and provide a free air-flow path.

Changing the Mains Voltage

The unit is designed to operate over the specified range without need for adjustment.

Power On Procedure

To power the equipment, connect it to the AC power source. There is no power switch. The power on sequence is complete in approximately 5 seconds.

FRONT PANEL CONTROLS AND DISPLAYS

PROGRAM SELECT

These ten push-buttons can each be programmed to select one of the factory programmed channels within Showman (see STORE below).

A green LED illuminates within the selected button.

CHANNEL

This display indicates the Showman channel number the unit is tuned to, within the maximum range **01** to **99** plus **01.** to **99.** (decimal point indicates second set) - a maximum total of 198 possible channels. The actual number provided depends upon the channel/frequency allocation plan, which is factory programmed to system and/or customer requirements - see separate sheet(s).

TUNING

A momentary press and release of the TUNING ∧ or ∨ push-buttons causes the CHANNEL display to step to the next or previous factory stored channel respectively. A press and hold of the TUNING ∧ or ∨ button will result in continual cycling through the available channels in the selected direction until the button is released.

AFC (Automatic Frequency Control)

Showman features precise synthesised frequency tuning and as such does not normally require the selection of AFC when tuned to a standard broadcast or cable channel. However, if a non-standard frequency is tuned to, such as the RF output from a video recorder or satellite receiver, then selecting AFC "ON" will enable Showman to tune "off channel" by up to ±4MHz to attempt to capture this signal. AFC "ON" is indicated by a red led lit within the AFC button.

STORE

When pressed, this push-button stores, at the chosen PROGRAM SELECT push-button location, the displayed CHANNEL number along with the status of the AFC, AUDIO OUTPUT SELECT, and PHONES MONITOR.

An "AUTO-STORE" mode is also available which allows Showman to search through all available channels looking for a RF carrier levels and storing the first ten found under the PROGRAM SELECT push-button locations. This is operated by holding in the TUNING ∧ push-button and pressing the STORE push-button.

RF LEVEL

The ten segment green led RF LEVEL bar display indicates approximate RF carrier signal strength of between 100µV (+40dBµV) and 1mV (+60dBµV) when between 2 and 9 segments are lit respectively.

AUDIO INPUT STATUS

Eight led's that show which of the following audio standards and operational modes is available at the input:

STANDARD:	MODE:
FM	MONO, DUAL OR STEREO
NICAM	MONO, DUAL OR STEREO
NICAM	NICAM = FM
NICAM	NICAM DATA PRESENT

AUDIO OUTPUT SELECT

When the incoming audio signal is in the DUAL mode (e.g. when two languages are broadcast simultaneously) the MONO 1 and MONO 2 push-buttons can be used to select the wanted output. If both outputs are required then pressing the STEREO push-button will select MONO 1 and MONO 2. The push-buttons LED's indicate the output selection. When a stereo signal is broadcast, the STEREO push-button led will be lit and the MONO push-buttons will have no function. When a mono only signal is broadcast, the MONO 1 push-button led will be lit and the STEREO and MONO 2 push-buttons will have no function.

PHONES MONITOR

The PHONES output provides a headphone monitoring point of all the available audio signals without altering any of the output selections. Pressing the SELECT push-button cycles the monitoring through as follows:

FM1 > FM2 > NICAM > FM1+FM2 > FM1

The LEVEL control adjusts the sound volume to the headphones.

NICAM ERROR RATE OPTION

This "second function" option allows NICAM error rates to be displayed on the CHANNEL indicator. It is enabled by a second press of the current PROGRAM SELECT push-button. When selected the PROGRAMME SELECT push-button led flashes along with the STEREO AUDIO OUTPUT SELECT push-button led. The CHANNEL display indicates PEAK error rate. Pressing the MONO 1 push-button selects PEAK HOLD error rate mode. The MONO 2 push-button selects AVERAGE error rate mode. The error rate shown is errors per 10,000 NICAM words (64,000 words per second). Error rates above 99 are indicated by "UU" on the display.

REAR PANEL CONNECTORS

⏚:	Earth terminal post for bonding Showman to equipment ground.
POWER INPUT:	IEC mains power input connector, fused T1A. Mains input may be within the range 85 ~ 260VAC, 50 ~ 60Hz.
SERIAL:	Serial Remote Control input (see below).
PARALLEL:	Parallel Remote Control (see below).
DAUD:	IEC/EBU 958 Digital Audio output. (1 volt p-p > 75Ω).
NCLK:	Nicam Clock output (5 volts p-p > 75Ω).
NDAT:	Nicam Data output (5 volts p-p > 75Ω).
SIN/COS:	Sine and Cosine quadrature demodulated digital output waveforms for "eyeheight" measurement (can be 75Ω terminated).
QPSK:	Modulated NICAM intercarrier output. (Differential Quadrature Phase Shift Keying modulation).
AUDIO 1 (L):	NICAM Audio Output - Left Hand Channel (or Language 1 in Dual Mode). Normally defaults to FM audio (alternatively to mute) when NICAM is not transmitted or if the NICAM error rates exceed a pre-determined level. (For default options and error rate mute level selection, see Table 3: Internal Status Switch - Bit Functions). The output signal is low impedance, balanced about ground.
AUDIO 1 (R):	NICAM Audio Output - Right Hand Channel (or Language 2). Defaults and output as for Audio 1 (L).
AUDIO 2 (L):	FM Mono Audio Output or Left Hand Channel (Language 1) in two carrier analog FM Stereo/Dual Mono (Zweiton/IRT) mode.
AUDIO 2 (R):	FM Mono Audio Output or Right Hand Channel (Language 2) - as for Audio 2(L).
IF OUT:	A buffered (75Ω) 38.9MHz (vision carrier) output of the full video vestigial sideband plus all sound carriers - available for re-modulation or monitoring (75Ω terminated).
⏄:	Aerial/Antenna input (-20 to +30dBmV). Nominal 75Ω impedance.
VID 1 TO 4:	Four 75Ω outputs of standard 1 volt video.

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OPERATING INSTRUCTIONS

WARNING: THIS UNIT MUST BE EARTHED

At the rear of the unit connect:

- A 75Ω aerial/antenna feed into the F-type connector marked "⏚".
- Mains, within the range 85 to 260VAC, into the POWER INPUT. Check that, when power is first connected to the unit, all the front panel led's either flash on and off four times or remain lit for a few seconds.
- A video monitor, terminated in 75Ω, to one of the four VIDEO OUTPUT BNC's.
- Stereo audio monitors to the XLR audio output connectors - AUDIO 1 is normally set to output NICAM derived sound, AUDIO 2 is normally set to output FM derived sound. Note: the XLR audio outputs (pins 2 and 3) are electronically balanced about ground (pin 1) and are designed to push-pull drive into a 600Ω or high impedance load. For single ended drive, the signal must be taken from pin 2 with pin 3 grounded to pin 1.

At the front of the unit:

- Set the MONITOR LEVEL control fully anti-clockwise.
- Connect a set of high impedance stereo headphones into the PHONES connector.
- Press PROGRAM SELECT push-button 1.
- Check that the AFC led indicator is off; if "on", press the AFC push-button once.
- Press the TUNING ∧ or ∨ push-buttons until the required channel number is displayed in the CHANNEL window. Note that holding down the TUNING ∧ or ∨ push-button results in auto-repeat of that function.
- Press the STORE push-button.
- Repeat the above for PROGRAM SELECT push-button 2 and so on .
- Alternatively, an auto-search and store function is activated by pressing and holding in the TUNING ∧ push-button and then pressing the STORE push-button. Showman will then scan all available channels, searching for RF carriers. The first ten carriers found, above a certain level, will be stored at locations available under PROGRAM SELECT push-buttons 1 to 10.
- Repeat press the SELECT push-button to cycle the PHONES MONITOR led's through the sequence FM1 > FM2 > NICAM > FM1 + FM2 > FM1 until the audio output to be monitored on the headphones is selected. FM1 + FM2 must be selected for monitoring FM stereo sound. The selected monitoring option may be stored for individual PROGRAM SELECT locations by again pressing the STORE push-button.
- Adjust the headphone volume to a suitable level by means of the MONITOR LEVEL control.

NOTES:

Program RF signal strength is approximately indicated by the number of segments lit on the SIGNAL LEVEL bar display. All segments lit indicates a signal strength >1mV, no segments lit, a signal strength <100µV.

If the program selected is known to be on a standard channel, no further fine tuning is required (or possible) as the synthesised tuning method employed by the SHOWMAN receiver is accurate to within ± 62.5kHz. However if the program is derived from a non-standard source, e.g. from the RF output of a video recorder or satellite receiver, then automatic frequency control (AFC) should be selected by pressing the AFC push-button (red led on). In this mode the SHOWMAN will attempt to search for a program that is up to ±4MHz (±½ a system I channel) "off" nominal channel centre frequency, however this range may be restricted if the search locates the sound carrier first. For normal "on channel" operation, AFC should be set to off (AFC led off).

SERIAL REMOTE CONTROL

Introduction

The following pages detail the command protocol used to control the Showman system via the serial control port.

A choice of electrical interfaces allows either a single system to be connected to a single host (RS422) or up to 8 systems to be connected to a single host (RS485). To enable the host to identify which of the 8 systems it is talking to on the RS485 bus, each Showman can be set to one of 8 individual addresses.

The serial control port allows access to the Showman front panel controls, so that unmanned sites can have remote control over the Showman system via a simple serial link. The serial control port is also capable of providing status information on current program selection, which allows the remote site to monitor such items as signal strength, audio input status, etc..

The command and reporting protocol consist of delimited data strings with error checking to detect and reject invalid or corrupted information.

Electrical Standards

EIA/TIA-422-A Electrical Specifications Standard

The RS422 electrical standard is based on EIA/TIA-422-A specifying a unidirectional single driver multiple receivers, terminated, balanced interface.

The electrical characteristics in brief are as below:

Parameter	Limit & Units
Driver Open Circuit Voltage	≤ |6.0V|
Driver Loaded Output Voltage	≥ |2.0V|
Balance of Loaded Output Voltage	≤ 400 mV
Driver Output Offset Voltage	≤ 3.0V
Balance of Offset Voltage	≤ 400 mV
Driver Short Circuit Current	≤ |150 mA|
Driver Leakage Current	≤ |100 μA|
Driver Output Impedance	≤ Ω
Receiver Input Resistance	≥ 4 kΩ
Receiver Thresholds	± 200 mV
Receiver Internal Bias	≤ 3.0V
Maximum Receiver Input Current	3.25 mA
Receiver Common Mode Range	± 7V (± 10V)
Receiver Operating Differential Range	± 200 mV to ± 6V
Maximum Differential Input Voltage	± 12V

EIA/TIA-485 Electrical Specifications Standard

The RS485 electrical standard is based on EIA/TIA-485 specifying a bi-directional (half duplex), multipoint, balanced interface.

The electrical characteristics in brief are as below:

Parameter	Limit & Units
Driver Open Circuit Voltage	≤|6.0V|
Driver Loaded Output Voltage	≥|1.5V|
Balance of Driver Loaded Output Voltage	≤|200 mV|
Maximum Driver Offset Voltage	3.0V
Balance of Driver Offset Voltage	≤|200 mV|
Driver Transition Time	≤ 30% Tui
Driver Short Circuit Current (-7V to +12V)	≤|250 mA|
Receiver Thresholds	± 200 mV
Maximum Bus Input Current (+12V/-7V)	≤ 1.0 mA / ≤ 0.8 mA

Electrical Connection

The Showman serial control port is a 9 way D-type socket located on the rear panel of the unit. The connections for this port are described in table 1.

PIN	IDENT	Description
1	GND	Signal Ground
2	TX-	Transmit data -
3	RX+	Receive data +
4	GND	Signal Ground
5	N.C.	No connection
6	GND	Signal Ground
7	TX+	Transmit data +
8	RX-	Receive data -
9	GND	Signal Ground

Communications Data format

Asynchronous, bit serial, word serial.

Baud rate 9600

The communications format consists of ten bits as detailed below.

<Start><Data><Stop>

Element	**No. bits**
<Start>	1
<Data>	8
<Stop>	1

Response time of target system to any single command: 50ms[1]
Maximum time between successive command bytes: 10ms

[1] Some commands may have a longer response time depending on its function. Refer to the individual command for specific details.

Command & Response Protocol

The command and response strings consist of the following elements. All elements must be transmitted in the order shown.

Command string format

<Cstart><Address><Cmd><Par><ChkDig><Cstop>

Response string format

<Rstart><Address><ACK/NAK><ChkDig><Rstop>

Control Function Commands

Control Function	Command[1] (Cmd)	Parameter[1] (Par)	Description
Program Selection	80h	31h	Select Program 1
	80h	32h	Select Program 2
	80h	33h	Select Program 3
	80h	34h	Select Program 4
	80h	35h	Select Program 5
	80h	36h	Select Program 6
	80h	37h	Select Program 7
	80h	38h	Select Program 8
	80h	39h	Select Program 9
	80h	3Ah	Select Program 10
AFC Control	81h	30h	Turn AFC off
	81h	31h	Turn AFC on
Audio Output Selection Control	82h	3Bh	Select MONO1
	82h	3Ch	Select MONO2
	82h	3Dh	Select STEREO
Save Settings	83h	3Eh	Save current program selection settings
Channel Selection	84h	<31h - F7h>	Select channel 1 - 199
Frequency Table Selection	85h	<31h - 49h>	Select frequency table 1 - 18
Reset System[2]	FFh	30h	Resets system

[1] All commands and parameter values shown are in hexadecimal
[2] No acknowledge is sent upon receiving a valid reset command

Description of Control Commands

On receipt of a complete command string the system responds with either an acknowledge response, to indicate that the command and parameter bytes have been validated and the command successfully implemented, or with a NAK response, indicating that an error has occurred with an element of the command string.

Specific details for each of the commands are given below giving descriptions of the actions taken by the commands and the programming considerations necessary when issuing the command.

Program Selection	Selects one of the 10 pre-set programs from the non-volatile memory. The saved settings include channel number, frequency and front panel selections. An acknowledge response is sent on receipt of a valid program selection command.
AFC control	Turns on/off program AFC control. AFC status is saved as part of an individual program's set-up. An acknowledge response is sent on receipt of a valid AFC control command.
Audio Output Selection Control	Selects audio output preference depending on available audio input status i.e. if FM stereo required but only FM mono is available then MONO 1 will be selected automatically. An acknowledge response is sent on receipt of a valid command.
Save Settings	Changes made to the channel number, audio output selection or AFC status of an individual program are only temporary i.e. if power is lost then the program set-up will be lost. To make any changes permanent to an individual program then the 'Save Settings' command should be used. An acknowledge response is sent on receipt of a valid command but as this command writes to the system non-volatile memory, the system may take up to 5s to respond.
Channel Selection	Selects channel from internal frequency table. If a channel number is given which is not supported in the current frequency table then the system sends a NAK response otherwise and acknowledge response is returned.
Frequency Table Selection	Selects one of the 18 internal frequency tables currently supported by the Showman. Once the table selection has been validated the selection is stored immediately in the system's non-volatile memory. An acknowledge response is sent on receipt of a valid command.
System Reset	Performs a full system reset, clearing all registers and returns the system to a power-on state. No acknowledge is sent on receipt of this command. Allow 5-10s for the system reset to complete before issuing any further serial commands.

Status Reporting Function Commands

Report Function	Command (Cmd)	Parameter (Par)	Description
System status 1	40h	30h	Request system status 1
System status 2	41h	30h	Request system status 2

Report string format

<Rstart><Address><Dat1><Dat2><Dat3><Dat4><Dat5><Dat6><ChkDig><Rstop>

Command Responses

System Status 1 Report

Response Byte	Data	Description
Dat1	<31h - 3Ah>	Program Number
Dat2	<31h - F7h>	Channel Number
Dat3	<00h - FFh>	Status byte 1
	bit 0	AFC status (0=off, 1=on)
	bit 1	Stereo output selected (0=not selected, 1=selected)
	bit 3	Mono1 output selected (0=not selected, 1=selected)
	bit 4	Mono2 output selected (0=not selected, 1=selected)
	bit 5	Reserved
	bit 6	Reserved
	bit 7	Reserved
Dat4	<00h - FFh>	Status byte 2
	bit 0	NICAM=FM mode (0=not active, 1 = active)
	bit 1	NICAM Mono mode (0=not active, 1 = active)
	bit 2	NICAM Dual mode (0=not active, 1 = active)
	bit 3	NICAM Stereo mode (0=not active, 1 = active)
	bit 4	NICAM Data mode (0=not active, 1 = active)
	bit 5	FM Mono mode (0=not active, 1 = active)
	bit 6	FM Dual mode (0=not active, 1 = active)
	bit 7	FM Stereo mode (0=not active, 1 = active)
Dat5	<00h - FFh>	Signal strength (00h = no signal, FFh = Strongest signal)
Dat6	<00h - FFh>	AFC level (6Fh - 8Fh AFC OK)

System Status 2 Report

Response Byte	Data	Description
Dat1	<31h - 49h>	Frequency table selection
Dat2	<00h - FFh>	Nicam errors
Dat3	<00h - FFh>	Status switch setting
	bit 0	Switch 1 - Error rate selection 1
	bit 1	Switch 2 - Error rate selection 2
	bit 2	Switch 3 - FM mono routing (0=AB AB, 1=BB AA)
	bit 3	Switch 4 - Control priority (0=FM, 1=NICAM)
	bit 4	Switch 5 - NICAM default (0=Silence, 1=FM)
	bit 5	Switch 6 - NICAM XLR1/2 (0=FM, 1=NICAM)
	bit 6	Switch 7 - FM/NICAM XLR 3/4 (0=NICAM, 1=FM)
	bit 7	Switch 8 - FM System (0=FM2, 1=FM1)
Dat4	<00h - FFh>	Remote port status (Parallel port)
	bit 0	Remote port bit 0
	bit 1	Remote port bit 1
	bit 2	Remote port bit 2
	bit 3	Remote port bit 3
	bit 4	Reserved
	bit 5	Reserved
	bit 6	Reserved
	bit 7	Reserved
Dat5	<00h - FFh>	Tuner frequency MSB[1]
Dat6	<00h - FFh>	Tuner frequency LSB[1]

[1] To convert tuner frequency to actual frequency apply the following formula:
((TUNER LSB + (TUNER MSB * 256))/16) - 38.9

Description of Protocol Elements

Element	Value	Description
Cstart	02h	Signals the start of a command string transmission from the host controller to the target system
Cstop	03h	Signals the end of a command string transmission
Rstart	04h	Signals the start of a command response transmission from the target system to the host controller
Rstop	05h	Signals the end of a command response transmission
Address	01h	Address of target system 1
	02h	Address of target system 2
	04h	Address of target system 3
	08h	Address of target system 4
	10h	Address of target system 5
	20h	Address of target system 6
	40h	Address of target system 7
	80h	Address of target system 8
ChkDig	<00h-FFh>	Check digit (See below)
ACK	06h	Command acknowledge
NAK	0Fh	Command rejected

Check Digit Calculation

This is a one byte unsigned binary number, the two's complement of the lsb of the numeric sum of the transmitted characters up to the check digit.

Example 1. Select program 9 on target system 4.

Cstart	02	
Address	08	
Cmd	80	
Par	09	

	93	→ 10010011 (SUM lsb)
		→ 01101100 (Complement)
Check Digit		→ 01101101 (+1 = 2's complement)

Therefore the full command including checksum is:

Cstart	02
Address	08
Cmd	80
Par	09
ChkDig	6D
Cstop	03

Example 2. Target system 8 acknowledge response

Rstart	04	
Address	80	
Ack	06	

	8A	→ 10001010 (SUM lsb)
		→ 01110101 (Complement)
Check Digit		→ 01110110 (+1 = 2's complement)

Therefore the full acknowledge response including checksum is:

Rstart	04
Address	80
Ack	06
ChkDig	76
Rstop	05

Setting Device Address (Only available locally)

If multiple target systems are to be connected to a single host controller, using the RS485 option, each target system will need to be set to a unique address in order to avoid bus contention. Up to 8 target systems can be connected onto a single bus.

To set a system's device address, the unit should be switched on whilst holding down the AFC button on the front panel. The device address will then appear in the channel display and can be altered by using the up/down arrow buttons. When the appropriate address has been selected, pressing the store button saves the address in the systems non-volatile memory. Pressing the AFC button terminates the set device address mode. Any changes to the device address will be lost if the set device address mode is terminated before pressing the store button.

Once set the address will be fixed for that system and can only be altered by repeating the above process.

Valid device address: 01h
02h
04h
08h
10h
20h
40h
80h

RS422/RS485 Termination

It is recommended that a terminating resistor (approx. 100Ω) should be fitted on the receive lines on both the first and last units in the system. Usually the first unit in the system would be the host PC, please refer to the PC manual for setting the termination at this end. The Showman unit is fitted with an optional termination resistor, PCB reference LK2, and is selected by setting the link in the TERM position. The default position of LK2 is in the OPEN position.

Selecting Channel Frequency Table Locally

Selection of channel frequency table would normally be achieved using the serial port but for those sites that do not have access to a PC the frequency table can be selected locally using the front panel.

To select a new table or to view the current selection, switch the unit on whilst holding down the SELECT button on the front panel. The current frequency table selection will then appear in the channel display and can be altered by using the up/down arrow buttons. When the required table has been selected, press the STORE button to save the table selection in the systems non-volatile memory. Press the SELECT button to terminate the select table mode, then press the up, or down arrow key to enable the selected frequency table. Any changes to the table selection will be lost if the above key press routine is not followed correctly.

PARALLEL REMOTE CONTROL

GENERAL

PARALLEL remote control operates at 5V positive logic levels. The inputs (A0 to A3 plus LOAD) all have internal 4.7KΩ pull up resistors to +5 volts.

WARNING: A +12 volt output (protected by an internal 0.5A thermal fuse - R195), is available on PARALLEL "D" connector, pin 9, for powering active remote control panels, but this must be externally regulated to +5 volts before use.

OPERATION

1) Set up the remote command required (from TABLE 2) on PARALLEL remote control connector lines A0 to A3 (see TABLE 1 for pin functions).

2) The command will be actioned on the rising edge of the LOAD input.

Note: the LOAD input should be set low at all other times when remote control is attached.

TABLE 1: PARALLEL REMOTE CONTROL: 9 WAY "D" CONNECTOR PIN FUNCTIONS

PIN	FUNCTION
1	A3
2	A2
3	A1
4	A0
5	RESERVED
6	0 VOLTS
7	RESERVED
8	LOAD
9	+12 VOLTS*

* MUST BE REGULATED TO +5V BEFORE USE - SEE ABOVE

TABLE 2: REMOTE CONTROL - TRUTH TABLE

A3	A2	A1	A0	FUNCTION
0	0	0	0	PROGRAM 1
0	0	0	1	PROGRAM 2
0	0	1	0	PROGRAM 3
0	0	1	1	PROGRAM 4
0	1	0	0	PROGRAM 5
0	1	0	1	PROGRAM 6
0	1	1	0	PROGRAM 7
0	1	1	1	PROGRAM 8
1	0	0	0	PROGRAM 9
1	0	0	1	PROGRAM 10
1	0	1	0	TUNING ∧
1	0	1	1	TUNING ∨
1	1	0	0	STORE
1	1	0	1	AFC ON
1	1	1	0	AFC OFF
1	1	1	1	NO CHANGE

TABLE 3: INTERNAL STATUS SWITCH S1 - BIT FUNCTIONS

BIT	FUNCTION	UP (ON)	DOWN (OFF)
1	ERROR RATE 1	SEE TABLE 4	SEE TABLE 4
2	ERROR RATE 2	SEE TABLE 4	SEE TABLE 4
3	DUAL MONO ROUTING*	LANGUAGE * 2 2 1 1	LANGUAGE * 1 2 1 2
4	CONTROL PRIORITY	NICAM	FM
5	NICAM DEFAULT	FM	SILENCE
6	AUDIO 1 OUTPUT	NICAM	FM
7	AUDIO 2 OUTPUT	FM	NICAM
8	MONO FM SYSTEM	FM1	FM2

*ROUTING OF THE DUAL LANGUAGE (NICAM OR FM) AUDIO TO THE AUDIO XLR CONNECTORS. TABLE SHOWS THE LANGUAGE 1 OR 2 OUTPUTS AS VIEWED FROM THE REAR OF THE UNIT.

TABLE 4: SWITCH S1 - BIT 1 AND 2 FUNCTIONS

S1 BIT 1	S1 BIT 2	NICAM MUTE*	NICAM UNMUTE*
UP	UP	>240 (F0)	<60 (3C)
UP	DOWN	>160 (A0)	<40 (28)
DOWN	UP	>80 (50)	<20 (14)
DOWN	DOWN	>40 (28)	<10 (0A)

*DEC (HEX) ERRORS PER 128mS

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NICAM ERROR RATE DISPLAY OPTION

- To enter the NICAM ERROR DISPLAY MODE press the active PROGRAM SELECT push-button.
- If this option is available, the PROGRAM SELECT push-button led will flash along with the STEREO AUDIO OUTPUT SELECT push-button led.
- There are three NICAM ERROR RATE display modes, which are selected by pressing the STEREO, MONO 1 or MONO 2 AUDIO OUTPUT SELECT push-buttons as follows:

  STEREO selects PEAK error rate mode

  MONO1 selects PEAK HOLD error rate mode.

  MONO 2 selects AVERAGE error rate mode.

NOTES

- The average rate is taken over 8 samples (approx. 1 second).
- The default display is the peak error display.
- The error rate displayed is errors per 10,000 NICAM words. The NICAM system operates at 64,000 NICAM words per second.
- If the measured error rate exceeds 99 errors per 10,000 words, then the display will show 'UU'.
- The Peak mode responds instantly to errors (peak) received, and decays slowly from that figure (operation similar to an audio PPM).
- Peak Hold does not decay and therefore maintains an indication of the peak errors detected since this mode was selected.
- The Peak and Peak Hold modes can be zeroed by re-pressing the appropriate button.

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CIRCUIT DESCRIPTION

UT5100-3002 MAIN CIRCUIT BOARD

GENERAL

This circuit diagram is split into six sheets. Sheet 1 is an overall block diagram showing the relationship between Sheets 2 to 6.

SHEET 2.

Microcontroller and Memory

U3 is an 8-bit microcontroller featuring the Philips patented I^2C bus peripheral control system. The chip, run at 11MHz from crystal Y1, has various interrupt facilities along with analog to digital input capability. Analog input AFC VOLTS (U3 pin 1) enables the tuner (via the SCL and SDA lines of the I^2C BUS) to capture a received channel that is slightly "off" frequency or whose frequency drifts. Analog input SIGLEV (U3 pin 68) is a voltage, proportional to the RF aerial signal strength, that controls the level at which FM audio muting occurs. C3 provides power on reset. An on chip watchdog timer checks for program malfunction and produces a system reset if necessary. (For testing/fault finding, the watchdog timer may be disabled by linking JP1) U3 contains 256 x 8 on chip RAM. Program memory is stored in U5 whose low order address is latched, from the combined address/data lines DAT0 to DAT7, into U4 on a low ALE command (from U3 pin 48). High order addressing for U5 is supplied directly by ADH0 to ADH6. U6, a PAL device, decodes chip selection lines F0 to F7.

Remote Control

Remote control commands enter the board via connector J14. Inputs are pulled high by RP1. Control is activated by grounding the relevant pin. These inputs are monitored by U1, which sends the remote control status to the microcontroller, U3 over the I^2C bus.

WARNING: A +12 volt output is available on J14 pin 9, via R195, for powering active remote control panels. This output must be externally regulated to +5 volts before use. Note R195 is a 0.5A thermal fuse (10Ω resistor on early units).

EEPROM

U7, which communicates with the microcontroller via the I^2C BUS, stores the status of the front panel controls during "power down" and restores the settings after switch on.

Push-button Encoder

U11 is the keyboard encoder IC. Logic level scanning signals are sent from the X0 to X2 outputs of U11, via J15 and J16, to the front panel push-button matrix (see Front Panel circuit diagram UT5100-3010). Pressing one of the buttons results in a scanning signal being returned, again via J15 and J16, to the Y0 to Y5 inputs of U11. From this data, U11 decodes which button has been pressed.. Contact bounce elimination time is set by C10. A high "data ready" signal

from U11 pin 16 latches the 8 bit parallel encoded push-button data (D0 to D7) into U13. The "data ready" signal also sets U12A pin 6 low in order to interrupt U3 via pin 26. Data from U13 is passed to the data bus DAT0 to DAT7 on low command F7 from U6. F7 also clears U12A pin 6 high.

Status Bits Control

The settings of the internal 8 bit DIL Status switch are passed to the data bus DAT0 to DAT7 on a low command F6 from U6.

Channel Number Display Latch

U8 latches channel number display data (DAT0 to DAT7) on a low command F0 from U6. The latched data is decoded by U9 and U10 for control of the "10's" and "100's" seven segment front panel display device respectively. The outputs of U9 and U10 are current fed, via series resistor packs RP2 to RP5, off the board to the front panel through J15 and J16.

Control Latches

U14, U15, U16 and U19 latch data (DAT0 to DAT7) on high commands F1, F2, F3 and F4, respectively, from U6. The latched data controls the front panel status led's which are current fed, via series resistor packs RP6 to RP11, off the board through J15 and J16, also the routing of the headphone signals (PHON0 to PHON4).

SHEET 3

Tuner

U20 is a frequency synthesised, I^2C BUS controlled, all band VHF/UHF tuner, capable of receiving (to an accuracy of ±62.5kHz) any channel within the frequency range 45.25MHz to 860.25MHz. Specific channel access is customer/system defined, this data being factory programmed into memory (U5 sheet 2). With synthesised tuning, it is not normally necessary to have conventional automatic frequency control (AFC) on the tuner. However AFC is provided for use in the event of wanting to receive a non-standard channel - such as the output from a VCR. Automatic gain control voltage for the tuner is supplied from the Vision IF stage through R9 and onto U20 pin 5. For minimum to maximum tuner gain, the dc voltage on pin 5 is approximately from +1 volt to +10 volts respectively.

IF Bandpass Filter

FL11 is a surface acoustic wave (SAW) bandpass filter that allows full transmission of the video vestigial sideband and sound carrier intermediate frequencies (IF). U63 buffers the filter output and restores signal level after filter loss.

IF Output Amplifier

U64 amplifies the IF signal to provide a rear panel IF OUTPUT on BNC connector J12. The output level is adjustable by way of VR21.

Bandpass Filters

FL1 and FL3 are the vision and sound IF bandpass SAW filters.

Video IF

U22 is a combined video IF amplifier/demodulator IC. Tuned network L3/C25 is centred on $2f_{pc}$ (77.8MHz). VR1 sets the AGC crossover point between Tuner and IF gain control. VR2 is set for minimum differential phase distortion. U23 provides local +5V supply to the stage. FL2 is a sound trap filter used on some standards.

Signal Level Bar Driver

U25A level shifts and amplifies the voltage from AGC capacitor C22. U26 converts the analog voltage on U25A pin 1 into a series of digital current drives to the front panel led bar graph RF CARRIER display.

Sound I.F.

U24 is a combined sound IF amplifier/dual FM demodulator. The sound IF signal from FL3 (Bandpass Filters) defines the sound passband and also passes the vision carrier centre frequency, f_{pc} (38.9MHz). L6/C33 and varicap diodes D1/D2 form the frequency defining components of a voltage controlled oscillator that is phase locked within U24 to the incoming f_{pc}. This regenerated "clean" carrier is used to de-modulate the sound intercarrier frequencies. Networks FL4/FL9 and FL5/FL10 define the FM1 and FM2 sound intercarrier passbands respectively. L5/C28/C261 and L4/C27/C260 form tuned reference circuits for the FM1 and FM2 audio de-modulation stages, respectively. The intercarrier signal on U24 pin 15 is passed also to the NICAM decoder stage (sheet 5).

+33 Volt Generator

U62/Q5/L10 etc. form a switch-mode power supply that generates +33 volts (set by VR20) required by the tuner.

SHEET 4

Video Compensation

VR5, VR6 (where fitted) and VC2 are adjusted to compensate for any frequency response errors introduced by the video processing stages. U30 is a buffer/low impedance driver amplifier for the following stage.

Delay Equalisation

FL6, when fitted, provides group-delay correction, as required by certain TV system specifications. LK6 is linked if FL6 is not fitted.

Video Output Amplifier

U31, Q1, Q2 and Q3 are the active components of the video output amplifier, which drives the four video output BNC connectors - J8 to J11. The output video amplitude is set by VR7. VR8, where fitted, sets the nominal video output dc voltage.

Power Input and Decoupling

DC power enters the board at J18. Decoupling capacitors, not shown elsewhere on the circuit diagrams, are indicated here along with "U" number references, where applicable.

SHEET 5

NICAM IF Filter

The NICAM IF signal from the Sound IF stage (U24 sheet 3) also contains the FM intercarrier signals and therefore has to be bandpass filtered, either by FL7 (6.552MHz) or FL8 (5.85MHz), dependent on system standard. FL7 is a single section frequency response defining network. FL8 is a double section filter, the first section defining the frequency response, the second section being a group-delay equaliser. When FL8 is fitted, U32 forms a buffer between the two filter sections and U33 is the output amplifier. When FL7 is fitted, LK7 is linked, and U32 forms the output amplifier. (U33 is not fitted). The QPSK output signal from this stage is 75Ω fed to the rear panel BNC connector J6.

QPSK Demodulator

U35 is a dedicated QPSK (Quadrature Phase Shift Keying) demodulator for the NICAM 728 system. It produces serial data that is synchronised to a 728kHz NICAM clock, generated in conjunction with U38 - the NICAM decoder stage (see below). A carrier phase recovery circuit within U35, along with the circuitry around crystal Y2 and varicap diode D19 form a voltage controlled oscillator (VCO) locked to twice the NICAM carrier frequency (11.7MHz for system B/G or 13.104MHz for system I). The VCO control voltage can be monitored on TP10. The VCO signal is used in a costas loop quadrature demodulator, the two outputs of which are filtered by R73, C91, L8 and C90 (0°, cosine signal) and R74, C93, L9 and C92 (90°, sine signal). The sine and cosine signals are buffered, by U36 and U38 respectively, and 75Ω driven to rear panel BNC's J4 and J5. The cosine or sine waveform, in conjunction with NICAM clock back panel output (BNC J2), can be used to measure the "eye-height" of the recovered data. Within U35 the cosine and sine signals are processed in a bit-rate clock recovery circuit where

the clock rate of the incoming data is compared with the clock rate from U38 pin 1 and an error voltage generated (on U35 pin 1) which is sent to control the NICAM Decoder VCO. U34 provides the local +5 volt supply for the stage.

NICAM Decoder

U38 performs the digital decoding functions for the NICAM 728 digital stereo sound system. Its operating mode is set up over the I^2C bus from the Microcontroller (U3). On TP11 is the error voltage from the QPSK Demodulator stage (see above). This voltage, via Q4, controls the bias across varicap diode D20 that, in turn, controls the frequency of oscillation of crystal Y3 (8.192MHz) from which the NICAM clock is derived (U38 pin 1). U39A buffers and inverts the NICAM clock and data for routing to the BNC output stages. The digital audio interface output (from U38 pin 28) is also buffered and inverted by U39A. NICAM audio outputs may be monitored on TP12 (right channel) and TP13 (left channel). Default FM signals can be selected within U38 (by the I^2C bus) and are level set by VR9 (right) and VR10 (left). R95, D21 and C126 are power on reset components. U37 provides the local +5 volt supply for the stage.

Audio Invert (R) and (L)

U61A and B, respectively, invert the FMR and FML default signals connected to the external input of the NICAM Decoder, in which they are re-inverted.

NICAM Clock PLL

U60 is a PLL flywheel circuit that controls the frequency/phase of an "on chip" oscillator in order to "lock" it to the average PCLK signal from U38 pin 1.

NICAM Data Output

U44 is an inverting NICAM Data (NDAT) 75Ω output driver stage. R124/125/126 scale the NICAM Data output to ±2.5 volts into 75Ω about ground (0 volts).

NICAM Clock Output

U43 is an inverting NICAM Clock (NCLK) 75Ω output driver stage. R119/120/121 scale the NICAM Clock output to ±2.5 volts into 75Ω about ground (0 volts).

Digital Audio Output

U41 is an inverting Digital Audio (DAUD) 75Ω output driver stage. R109/110/111 scale the Digital Audio output to ±0.5 volts into 75Ω about ground (0 volts).

SHEET 6

NICAM Gain (Right) and (Left)

NICAM audio "out of band" frequencies are attenuated by R96/C128 (right channel) and R101/C133 (left channel). U40A and U40B provide high impedance buffering and gain adjustment (VR11 and VR12) for the right and left channels, respectively.

FM Stereo Decoder

U56 is an I^2C bus controlled two-carrier FM stereo/dual mono decoder (Zweiton/IRT system). The decoder operates at a clock frequency of 10MHz, regulated by crystal Y4. In the stereo mode, multiplexed 2 x (RIGHT) and (LEFT + RIGHT)/2 are received, from the Sound IF stage, on AF1 and AF2 respectively. A high frequency identification tone is modulated on top of the AF2 signal when stereo or dual mono is being received. U56 decodes these signals and relays data about the incoming signal status over the I^2C bus to the micro-controller (U3, sheet 2), where the information is used to control the front panel AUDIO INPUT STATUS led's and the AUDIO OUTPUT SELECT functions. VR17 is set for minimum crosstalk between the left and right output signals in the stereo mode (not operable in dual mode). VR18 and VR19 set the level of external NICAM signals that can be routed through to the outputs of U56 if required (S1 settings, sheet 2). Outputs FML and FMR from U56 pins 14 and 13, respectively, are the source of the NICAM Decoder (sheet 5) default FM signals. The main FM audio outputs are from U56 pins 11 and 12. FM audio 50µS de-emphasis is integrated into U56.

FM1 Gain (Right) and (Left)

U29A and B are buffer amplifiers to match the FM Stereo Decoder outputs to the audio output stages.

Phones Select

U53 to U55 are dual analog audio switches. Each is operated by a logic level signal on its control "C" input; low (0V) for off, high (+5V) for on. Phones control lines PHON0 to PHON4 are micro-controlled via the Control Latches (Sheet 2).

Audio 1 (Left) and (Right), Audio 2 (Left) and (Right)

These four output amplifiers are electrically identical, balanced, audio line output stages. Each amplifier is configured such that if one side of the output balanced pair is connected to ground, the other output signal increases to double amplitude. Potentiometers VR13 to 16 set individual output signal balance.

UT5100-3010 FRONT PANEL BOARD

GENERAL

Signals and power enter the board via JP1 and JP2. D1 is the RF LEVEL 10 segment led display. LED1 is the dual, seven segment CHANNEL led display.

Phones Amplifier

Headphone audio enters the board on JP2 pins 47 and 49. Double ganged potentiometer VR1A and B is the front panel PHONES LEVEL control. U1A and B amplifies and 270Ω drives the front panel PHONES output jack socket.

POWER SUPPLY

THIS IS A SAFETY ITEM AND, AS SUCH, ANY FAULTS THAT DEVELOP SHOULD ONLY BE CORRECTED BY RETURNING THE UNIT TO THE MANUFACTURER.

ADJUSTMENTS

WARNING: The following is a summary of the factory set links and adjustments.
Any alterations should only be attempted by qualified personnel with appropriate test equipment.

Refer to Circuit Diagram UT5100-3002

Sheet 1

LK1	Link to disable watchdog timer. Normally open.

Sheet 3

VR1	Tuner/IF AGC takeover point. Set, with an aerial/antenna RF video input of 10mV (rms), for 600mV p-p IF sync tip level between U20 pin 16 and 0 volts.
VR2	Video differential phase. Set for minimum error.
VR20	Set +33 volts supply.
VR21	IF output level.
L3	Video IF PLL centre adjust. Set for +2.5 volts dc on TP1
L4	FM2 demodulator centre frequency. Set for maximum audio on U24 pin 6.
L5	FM1 demodulator centre frequency. Set for maximum audio on U24 pin 7.
L6	Sound IF PLL centre adjust. Set for maximum intercarrier level with minimum video sync pulse amplitude modulation content.
L11	Not fitted.
LK3	Not fitted
LK4	Fit for single IF SAW filter.
LK5	Fit for dual IF SAW filter.

Sheet 4

VR5/6 (where fitted) & VC2.	Set for optimum video frequency response flatness.
VR7	Video output amplitude. Set for 1 volt p-p into 75Ω.
VR8 (where fitted)	Video output dc average level. Set for 0 volts.
LK6	Linked when FL6 not fitted.

Sheet 5

VC1	QPSK PLL centre adjust. Set for 2.5 volts dc on TP10.
VR9	Default FM (right) audio for NICAM decoder..
VR10	Default FM (left) audio for NICAM decoder.
LK7	Not fitted when U33 and FL8 fitted.

Sheet 6

VR3	FM1 (left) audio amplitude.
VR4	FM2 (right) audio amplitude.
VR11	NICAM (right) audio amplitude.
VR12	NICAM (left) audio amplitude.
VR13	AUDIO 2 (right) output balance.
VR14	AUDIO 1 (right) output balance.
VR15	AUDIO 1 (left) output balance.
VR16	AUDIO 2 (left) output balance.
VR17	FM stereo decoder matrix balance.
VR18	NICAM (left) audio level to external input of FM stereo decoder.
VR19	NICAM (right) audio level to external input of FM stereo decoder.

AUDIO OUTPUT LEVELS (NICAM with DUAL STEREO FM)

To set the audio output levels:

1. Set the internal status switch, S1, as follows: UUDU DUUU.
   (U=UP, D=DOWN, reading S1 bit 1 to bit 8).
2. Adjust VR11 to set the NICAM audio right level from AUDIO 1 (R).
3. Adjust VR12 to set the NICAM audio left level from AUDIO 1 (L).
4. Adjust VR3 to set the FM1 (left) audio level from AUDIO 2 (L)
5. Adjust VR4 to set the FM2 (right) audio level from AUDIO 2 (R)
6. Set S1: UUDU UUDU.
7. Adjust VR19 to set the NICAM audio right level from AUDIO 2 (R).
8. Adjust VR18 to set the NICAM audio left level from AUDIO 2 (L).
9. Set S1: UUDU UDUU.
10. Adjust VR9 to set the FM2 (right) audio level from AUDIO 1 (R)
11. Adjust VR10 to set the FM1 (left) audio level from AUDIO 2 (L)

Set S1: UUDU UUUU or as required - see previous Tables 3 and 4.

APPENDIX A: ELECTRICAL SPECIFICATION

Power Requirements

CATEGORY	DESCRIPTION
Line Voltage Ranges	95 to 240 V AC ± 10%
Power Consumption	0.5 A Max.
Line Frequency	50 / 60Hz
Fuse	1 AT 250V (20mm)

Environmental Characteristics

CATEGORY	DESCRIPTION
Operating Temperature	+5°C to +35°C
Storage Temperature	-20°C to +70°C
Operating Altitude	2000 metres
Non-operating Altitude	15,000 metres
Relative Humidity (maximum operating)	80% for temperatures up to 31°C, decreasing linearly to 50% at 40°C.

Physical Characteristics

CATEGORY	DESCRIPTION
Dimensions (1RU)	Height: 44mm Width: 482mm Depth: 375mm (from front panel - excluding handles)
Weight	Net Weight: 3.5kg

Certifications and Compliances

Category	Description
EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN50081-1 Emissions:[1] EN 55013 Sound and Television Broadcast Receivers and Associated Equipment EN 55022 Class B Radiated and Conducted Emissions EN50082-2 Immunity:[1] EN61000-4-2 Electrostatic Discharge Immunity IEC 801-3 RF Radiated Field Immunity EN61000-4-4 Electrical Fast Transient/Burst Immunity [1] High-quality shielded cables must be used to ensure compliance.

APPENDIX B: POWER CORD SPECIFICATIONS

Standard US

Description

Three 18 AWG, stranded, insulated wires twisted together and jacketed (type SVT), 98.000 inches in overall length. Insulated wires are IEC colour coded: one blue (neutral), one brown (active), one green and yellow stripe (earth ground).

Maximum Current and Maximum Voltage Rating (At 60°C).

10 Amps DC or RMS., at 250V for both plug and cable.

Operating Temperature Range

-20 to +60°C.

Flexible Cord

Unless otherwise specified, flexible cord (ZJCZ), shall meet requirements for type SVT cable (class 43 insulation) as specified in Underwriters' Laboratories, Inc., Standard UL 62.

Certification By Canadian Standards Association

The cable assembly shall be a CSA certified cord set.

European

Description

This specification establishes the requirements for a 10 amp, 2.5 metre, AC detachable power supply cord or line cord to be used in European countries.

Cord and/or Line Cord

Publication 7 of the International Commission on Rules for the Approval of Electrical Equipment (CEE).

CENELEC HD 21.1 S2 (General Requirements)
CENELEC HD 21.2 S2 (Test Procedure)
CENELEC HD 21.5 S2 (Flexible Cables)
IEC Publication 3200 European Norm EN 60320, For Power Connectors

Ratings of Components

	Voltage	Current
Cordage	300/500 V	10 A
Plug	250 V	16 A
Connector	250 V	10 A

Straight Appliance Receptacle

Grounding contact, per IEC Standard 320 and European Norm EN 60320.

Cordage

Polyvinyl chloride sheathed flexible cord per British Standard Institution Standard BS 6500 and HD 21.1 S2, HD 21.2 S2 and HD 21.5 S2.

Type: 1.00mm HO5W-F

Flexible Cord

Unless otherwise specified, flexible cord (ZJCZ) shall meet requirements for type SJT cable (class 43 insulation) as specified in Underwriters Laboratories, Inc., Standard UI 62.

UK

Description

This specification establishes the requirements for a 10 amp (straight) 2.5 metre AC detachable power supply cord or line cord to be used in the United Kingdom.

Ratings of Components

	Voltage	Current
Cordage:	300/500 V	10 A
Plug:	250 V	13 A
Connector:	250 V	10 A
Fuse:	250 V	13 A

Straight Appliance Receptacle

Moulded polyvinyl chloride straight connector with grounding contact, per British Standard Institution, Standards BS 4491 per IEC 320, European NORM FN 60320.

Cordage

Polyvinyl chloride sheathed flexible cord per British Standard Institution Standard BS 6500 and HD 21.2 S2, HD 21.2 S2 and HD 21.5 S2

Type: 1.0mm^2 H05W-F.

Code Designation

British Statutory Instruments No. 310-1969 and 931-1977.
CENELEC Standard HD 308.

Colour

Neutral	Line	Ground Conductor	Cordage
Blue	Brown	Green/Yellow	Grey or Black

Australian

Description

Cable assembly, Power: Three, 1.00mm square, 250 V, 10 amp, 2.5 metres long.

Cord

Telecom Australia Specification: 1239 for ground pin contact.

Component Ratings

AS 3191 for cable:	250/6600 V, 10 A (10 A for 1.00mm^2).
AS 3221 for plugs:	250 V, 10 Amp.
AS 3109, 1 for power connector:	250 V, 10 Amp.

Ground Circuit Resistance

Plug contact to receptacle contacts 0.100Ω maximum.

Two Pole Plug

As 3112 - 1990, male, two pole with ground contact.
Straight connector AS 3109.1 -1987, style two pole with ground contact, female -IEC Standard 320 and EN60320.

Cord

Type: CDB03PI P, 3 PVC ordinary duty cord.

Conductors

Three conductors of 32 strands or 0.2mm untinned copper wire (1.0 sq. mm).

Colour

Neutral	Line	Ground Conductor	Cordage
Blue	Brown	Green/Yellow	Grey or Black

Operating Temperature

-10 to 65°C.

APPENDIX C: SERVICE

WARNING. *Be sure that the power is not supplied to the unit while performing any procedures in this section.*

This section contains instructions for user and preventative maintenance.

Packaging for Shipment

If it becomes necessary to return the system to the manufacturer, follow these instructions:

Write the following on a tag attached to the product: the product owner, complete address and phone number of someone at your firm who can be contacted, the product serial number and a description of the required service.

Repackage the product in the original packaging materials. If they are not available, follow these directions:

Obtain a carton of corrugated cardboard having inside dimensions 150mm or greater than the dimensions of the instrument.

Surround the product with a protective bag (anti-static preferred).

Pack dunnage or urethane foam between the product and the carton. If you use Styrofoam kernels, overfill the box and compress by closing the lid. There should be 75mm of tightly packed cushioning on all sides of the instrument.

Seal the carton with shipping tape, industrial stapler, or both.

Fuse Replacement

1. Disconnect both the power cables from the rear panel.

2. Remove the fuse holder by inserting a suitable instrument either side of the holder and pulling straight out.

3. Remove the old fuse and replace it with a new fuse of the same type. Use only 250 V, 1 A time delayed fuses (20mm).

4. Replace the fuse holder ensuring that the holder clicks back into its socket.

Cleaning

The instrument should be cleaned often enough to prevent dust and dirt from accumulating. Dirt acts as a thermal insulator, preventing effective heat dissipation and can also provide high-resistance electrical leakage paths between conductors or components in a humid environment.

CAUTION. *Do not allow water to get inside any enclosed assembly or component. Do not clean any plastic materials with benzene, toluene, xylene, acetone, or similar compounds, because they may damage the plastic.*

Exterior Cleaning

Clean the dust from the outside of the instrument with a soft, clean cloth or small brush. A brush is especially useful for removing dust from around the buttons and connectors. Hardened dirt can be removed using a soft cloth dampened with a mild detergent and water solution. Abrasive cleaners should not be used.

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APPENDIX E: Channel Frequency Tables

Table Number	Standard	Region	Description
1	I	UK	Standard channels
2	I	UK	Standard channels + United Artists cable channels
3	I	UK	Standard channels + Belfast cable channels
4	I	UK	Standard channels + cable channels
5	BG	Europe	Standard channels
6	BG	Europe	Standard channels + cable channels S1-S10 (7MHz) S11-S20 (7MHz) S21-S41 (8MHz)
7	BG	Belgium	RTBF (off air + cable)
8	BG	Sweden	Standard channels + cable channels S1-S10 (7MHz) S11-S20 (7MHz) S21-S41 (7MHz)
9	BG/DK	Europe, East & West	Standard channels + cable channels (S1-S41) O.I.R.T channels R1-R12, C.C.I.R channels 1-E12
10	BG	Italy	Includes cable S1-S20 (7MHz) & non-standard CH 75-79 + S21-S41 (8MHz)
11	L	France	Standard channels + cable channels
12	I	Ireland	Standard channels + cable channels
13	I	Ireland	Standard channels + RTE cable channels
14	BG	New Zealand	General bands 1/3/4/5
15	I	South Africa	Standard channels + channels S14-S35 & channel 13 (247.43MHz)
16	DK	China	Standard channels + “DS” off-air channels + “DZ” cable channels
17	BG	Italy	Standard channels + “DS” off air channels + “DZ” cable channels. S1-S10 (7MHz) S11- S20 (7MHz) S21-S41 (8MHz)
18	B	Australia	General bands 1/2/3/4/5 (7MHz)
19	BG	Belgium	RTBF (off air + cable)
20	BG	Europe + Portugal	Standard + cable channels + special channels S1-S10 (7MHz) S11- S20 (7MHz) S21-S41 (8MHz)
21	BG	Europe	Standard + cable channels with off-set S1-S10 (7MHz) S11- S20 (7MHz) S21-S41 (8MHz) (use AFC for bold channels)

TABLE 1			TABLE 2			TABLE 2		TABLE 3		
CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO	CH	FREQ.	CH	FREQ.	NAME/NO
01			01			01.	719.25	01		
02			02			02.	56	02		
03			03			03.	64	03		
04			04			04.	72	04		
05			05			05.	80	05		
06			06			06.	88	06		
07			07			07.	96	07		
08			08			08.	104	08		
09			09			09.	112	09		
10			10			10.	120	10		
11			11			11.	128	11		
12			12			12.	136	12		
13			13			13.	144	13		
14			14			14.		14		
15			15			16.	168	15		
16			16			17.	176	16		
17			17			18.	184	17		
18			18			19.	192	18		
19			19			20.	200	19		
20			20			21.	208	20		
21	471.25	21	21	471.25	21	22.	216	21	471.25	21
22	479.25	22	22	479.25	22	23.	224	22	479.25	22
23	487.25	23	23	487.25	23	24.	232	23	487.25	23
24	495.25	24	24	495.25	24	25.	240	24	495.25	24
25	503.25	25	25	503.25	25	26.	248	25	503.25	25
26	511.25	26	26	511.25	26	27.	256	26	511.25	26
27	519.25	27	27	519.25	27	28.	264	27	519.25	27
28	527.25	28	28	527.25	28	29.	272	28	527.25	28
29	535.25	29	29	535.25	29	30.	280	29	535.25	29
30	543.25	30	30	543.25	30	31.	288	30	543.25	30
31	551.25	31	31	551.25	31	32.	296	31	551.25	31
32	559.25	32	32	559.25	32	33.	304	32	559.25	32
33	567.25	33	33	567.25	33	34.	312	33	567.25	33
34	575.25	34	34	575.25	34	35.	320	34	575.25	34
35	583.25	35	35	583.25	35	36.	328	35	583.25	35
36	591.25	36	36	591.25	36	37.	336	36	591.25	36
37	599.25	37	37	599.25	37	38.	344	37	599.25	37
38	607.25	38	38	607.25	38	39.	352	38	607.25	38
39	615.25	39	39	615.25	39	40.	360	39	615.25	39
40	623.25	40	40	623.25	40	41.	368	40	623.25	40
41	631.25	41	41	631.25	41	42.	376	41	631.25	41
42	639.25	42	42	639.25	42	43.	384	42	639.25	42
43	647.25	43	43	647.25	43	44.	392	43	647.25	43
44	655.25	44	44	655.25	44	45.	400	44	655.25	44
45	663.25	45	45	663.25	45	46.	408	45	663.25	45
46	671.25	46	46	671.25	46	47.	416	46	671.25	46
47	679.25	47	47	679.25	47	48.	424	47	679.25	47
48	687.25	48	48	687.25	48	49.	432	48	687.25	48
49	695.25	49	49	695.25	49	50.	440	49	695.25	49
50	703.25	50	50	703.25	50	51.	448	50	703.25	50
51	711.25	51	51	711.25	51	52.	456	51	711.25	51
52	719.25	52	52	719.25	52	53.	464	52	719.25	52
53	727.25	53	53	727.25	53	54.	472	53	727.25	53
54	735.25	54	54	735.25	54	55.	480	54	735.25	54
55	743.25	55	55	743.25	55	56.	488	55	743.25	55
56	751.25	56	56	751.25	56	57.	496	56	751.25	56
57	759.25	57	57	759.25	57	58.	504	57	759.25	57
58	767.25	58	58	767.25	58	59.	512	58	767.25	58
59	775.25	59	59	775.25	59	60.	520	59	775.25	59
60	783.25	60	60	783.25	60	61.	528	60	783.25	60
61	791.25	61	61	791.25	61	62.	536	61	91.25	61
62	799.25	62	62	799.25	62	63.	544	62	799.25	62
63	807.25	63	63	807.25	63	65.	560	63	807.25	63
64	815.25	64	64	815.25	64	66.	568	64	815.25	64
65	823.25	65	65	823.25	65	67.	576	65	823.25	65
66	831.25	66	66	831.25	66	68.	584	66	831.25	66
67	839.25	67	67	839.25	67	69.	592	67	839.25	67
68	847.25	68	68	847.25	68	70.	600	68	847.25	68
69	855.25	69	69	855.25	69	71.	608	69	855.25	69
70			70			72.	616	70		
71			71			73.	624	71		
72			72			74.	632	72		
73			73			75.	640	73		
74			74			76.	647.25	74		
75			75			77.		75		
76			76			78.		76		
77			77			79.		77		
78			78			80.		78		
79			79			81.		79		
80			80			82.		80		
81			81			83.		81		
82			82			84.		82		
83			83			85.		83		
84			84			86.		84		
85			85			87.		85		
86			86			88.		86		
87			87			89.		87		
88			88			90.		88		
89			89			91.		89		
90			90			92.		90		
91			91			93.		91		
92			92			94.		92		
93			93			95.		93		
94			94			96.		94		
95			95			97.		95		
96			96			98.		96		
97			97			99.		97		
98			98					98		
99			99					99		

TABLE 3 (cont'd)

CH	FREQ.	NAME/NO
01.	RESERVED	
02.	432	Channel Guide
03.	248	Parliament Guide
04.	256	Live TV
05.	192	Performance Channel
06.	216	NBC Super Channel
07.	336	Travel Channel
08.	RESERVED	
09.	440	RTE1
10.	448	RTE2
11.	480	BBC1
12.	504	BBC2
13.	528	Ulster
14.	560	CH4
15.	RESERVED	
16.	312	Eurosport
17.	368	CNN International
18.	384	Sky Movies
19.	304	Euronews
20.	160	Sky One
21.	288	Bravo
22.	272	UK Gold
23.	240	UK Living
24.	200	Cartoon/TNT
25.	264	TCC/Family
26.	224	Nick/Sky Sports Gold
27.	280	Discovery/TLC
28.	416	QVC
29.	344	Sci-fi Channel
30.	184	CMT Europe
31.	176	MTV
32.	424	VH-1
33.	RESERVED	
34.	RESERVED	
35.	RESERVED	
36.	RESERVED	
37.	RESERVED	
38.	RESERVED	
39.	RESERVED	
40.	128	Sky Movies
41.	136	Movie Channel
42.	152	Sky Movies Gold/Sky Soap
43.	208	Disney Channel
44.	RESERVED	
45.	168	Sky Sports
46.	408	Sky Sports 2
47.	376	HVC
48.	296	Adult Channel
49.	RESERVED	
50.	RESERVED	
51.	232	TVEInt.
52.	360	RaiUno
53.	RESERVED	
54.	352	SatOne
55.	320	TV5
56.	RESERVED	
57.	RESERVED	
58.	RESERVED	
59.	RESERVED	
60.	RESERVED	
61.	56	
62.	64	
63.	72	
64.	80	
65.	88	
66.	96	
67.	104	
68.	112	
69.	120	
70.	144	
71.	328	
72.	392	
73.	400	
74.	456	
75.	464	
76.	472	
77.	488	
78.	496	
79.	512	
80.	520	
81.	536	
82.	544	
83.	552	
84.	568	
85.	576	
86.	584	
87.	592	
88.	600	
89.	608	
90.	616	
91.	624	
92.	632	
93.	640	
94.		
95.		
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99.		

TABLE 4

CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO
01	48		00.	840	
02	56		01.	848	
03	64		02.	856	
04	72		03.	864	
05	80		04.	471.25	
06	88		05.	479.25	
07	96		06.	487.25	
08	104		07.	495.25	
09	112		08.	503.25	
10	120		09.	511.25	
11	128		10.	519.25	
12	136		11.	527.25	
13	144		12.	535.25	
14	152		13.	543.25	
15	160		14.	551.25	
16	168		15.	559.25	
17	176		16.	567.25	
18	184		17.	575.25	
19	192		18.	583.25	
20	200		19.	591.25	
21	208		20.	599.25	
22	216		21.	607.25	
23	224		22.	615.25	
24	232		23.	623.25	
25	240		24.	631.25	
26	248		25.	639.25	
27	256		26.	647.25	
28	264		27.	655.25	
29	272		28.	663.25	
30	280		29.	671.25	
31	288		30.	679.25	
32	296		31.	687.25	
33	304		32.	695.25	
34	312		33.	703.25	
35	320		34.	711.25	
36	328		35.	719.25	
37	336		36.	727.25	
38	344		37.	735.25	
39	352		38.	743.25	
40	360		39.	751.25	
41	368		40.	759.25	
42	376		41.	767.25	
43	384		42.	775.25	
44	392		43.	783.25	
45	400		44.	791.25	
46	408		45.	799.25	
47	416		46.	807.25	
48	424		47.	815.25	
49	432		48.	823.25	
50	440		49.	831.25	
51	448		50.	839.25	
52	456		51.	847.25	
53	464				
54	472				
55	480				
56	488				
57	496				
58	504				
59	512				
60	520				
61	528				
62	536				
63	544				
64	552				
65	560				
66	568				
67	576				
68	584				
69	592				
70	600				
71	608				
72	616				
73	624				
74	632				
75	640				
76	648				
77	656				
78	664				
79	672				
80	680				
81	688				
82	696				
83	704				
84	712				
85	720				
86	728				
87	736				
88	744				
89	752				
90	760				
91	768				
92	776				
93	784				
94	792				
95	800				
96	808				
97	816				
98	824				
99	832				

TABLE 5

CH	FREQ.	NAME/NO
01		
02	48.25	E2
03	55.25	E3
04	62.25	E4
05	175.25	E5
06	182.25	E6
07	189.25	E7
08	196.25	E8
09	203.25	E9
10	210.25	E10
11	217.25	E11
12	224.25	E12
13		
14		
15		
16		
17		
18		
19		
20		
21	471.25	21
22	479.25	22
23	487.25	23
24	495.25	24
25	503.25	25
26	511.25	26
27	519.25	27
28	527.25	28
29	535.25	29
30	543.25	30
31	551.25	31
32	559.25	32
33	567.25	33
34	575.25	34
35	583.25	35
36	591.25	36
37	599.25	37
38	607.25	38
39	615.25	39
40	623.25	40
41	631.25	41
42	639.25	42
43	647.25	43
44	655.25	44
45	663.25	45
46	671.25	46
47	679.25	47
48	687.25	48
49	695.25	49
50	703.25	50
51	711.25	51
52	719.25	52
53	727.25	53
54	735.25	54
55	743.25	55
56	751.25	56
57	759.25	57
58	767.25	58
59	775.25	59
60	783.25	60
61	791.25	61
62	799.25	62
63	807.25	63
64	815.25	64
65	823.25	65
66	831.25	66
67	839.25	67
68	847.25	68
69	855.25	69
70		
71		
72		
73		
74		
75		
76		
77		
78		
79		
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81		
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96		
97		
98		
99		

TABLE 6

CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO
01			01.	105.25	S1
02	48.25	E2	02.	112.25	S2
03	55.25	E3	03.	119.25	S3
04	62.25	E4	04.	126.25	S4
05	175.25	E5	05.	133.25	S5
06	182.25	E6	06.	140.25	S6
07	189.25	E7	07.	147.25	S7
08	196.25	E8	08.	154.25	S8
09	203.25	E9	09.	161.25	S9
10	210.25	E10	10.	168.25	S10
11	217.25	E11	11.	231.25	S11
12	224.25	E12	12.	238.25	S12
13			13.	245.25	S13
14			14.	252.25	S14
15			15.	259.25	S15
16			16.	266.25	S16
17			17.	273.25	S17
18			18.	280.25	S18
19			19.	287.25	S19
20			20.	294.25	S20
21	471.25	21	21.	303.25	S21
22	479.25	22	22.	311.25	S22
23	487.25	23	23.	319.25	S23
24	495.25	24	24.	327.25	S24
25	503.25	25	25.	335.25	S25
26	511.25	26	26.	343.25	S26
27	519.25	27	27.	351.25	S27
28	527.25	28	28.	359.25	S28
29	535.25	29	29.	367.25	S29
30	543.25	30	30.	375.25	S30
31	551.25	31	31.	383.25	S31
32	559.25	32	32.	391.25	S32
33	567.25	33	33.	399.25	S33
34	575.25	34	34.	407.25	S34
35	583.25	35	35.	415.25	S35
36	591.25	36	36.	423.25	S36
37	599.25	37	37.	431.25	S37
38	607.25	38	38.	439.25	S38
39	615.25	39	39.	447.25	S39
40	623.25	40	40.	455.25	S40
41	631.25	41	41.	463.25	S41
42	639.25	42	42.		
43	647.25	43	43.		
44	655.25	44	44.		
45	663.25	45	45.		
46	671.25	46	46.		
47	679.25	47	47.		
48	687.25	48	48.		
49	695.25	49	49.		
50	703.25	50	50.		
51	711.25	51	51.		
52	719.25	52	52.		
53	727.25	53	53.		
54	735.25	54	54.		
55	743.25	55	55.		
56	751.25	56	56.		
57	759.25	57	57.		
58	767.25	58	58.		
59	775.25	59	59.		
60	783.25	60	60.		
61	791.25	61	61.		
62	799.25	62	62.		
63	807.25	63	63.		
64	815.25	64	64.		
65	823.25	65	65.		
66	831.25	66	66.		
67	839.25	67	67.		
68	847.25	68	68.		
69	855.25	69	69.		
70			70.		
71			71.		
72			72.		
73			73.		
74			74.		
75			75.		
76			76.		
77			77.		
78			78.		
79			79.		
80			80.		
81			81.		
82			82.		
83			83.		
84			84.		
85			85.		
86			86.		
87			87.		
88			88.		
89			89.		
90			90.		
91			91.		
92			92.		
93			93.		
94			94.		
95			95.		
96			96.		
97			97.		
98			98.		
99			99.		

TABLE 7

CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO
01	69.25	S1	01.	70.25	S1+1MHz
02	48.25	E2	02.	48.25	E2
03	55.25	E3	03.	55.25	E3
04	62.25	E4	04.	62.25	E4
05	175.25	E5	05.	175.25	E5
06	182.25	E6	06.	182.25	E65
07	189.25	E7	07.	189.25	E7
08	196.25	E8	08.	196.25	E8
09	203.25	E9	09.	203.25	E9
10	210.25	E10	10.	210.25	E10
11	217.25	E11	11.	217.25	E11
12	224.25	E12	12.	224.25	E12
13	119.25	M3(S3)	13.	119.25	M3(S3)
14	126.25	M4(S4)	14.	126.25	M4(S4)
15	133.25	M5(S5)	15.	133.25	M5(S5)
16	140.25	M6(S6)	16.	140.25	M6(S6)
17	147.25	M7(S7)	17.	147.25	M7(S7)
18	154.25	M8(S8)	18.	154.25	M8(S8)
19	161.25	M9(S9)	19.	161.25	M9(S9)
20	168.25	M10(S10)	20.	168.25	M10(S10)
21	471.25	21	21.	471.25	21
22	479.25	22	22.	479.25	22
23	487.25	23	23.	487.25	23
24	495.25	24	24.	495.25	24
25	503.25	25	25.	503.25	25
26	511.25	26	26.	511.25	26
27	519.25	27	27.	519.25	27
28	527.25	28	28.	527.25	28
29	535.25	29	29.	535.25	29
30	543.25	30	30.	543.25	30
31	551.25	31	31.	551.25	31
32	559.25	32	32.	559.25	32
33	567.25	33	33.	567.25	33
34	575.25	34	34.	575.25	34
35	583.25	35	35.	583.25	35
36	591.25	36	36.	591.25	36
37	599.25	37	37.	599.25	37
38	607.25	38	38.	607.25	38
39	615.25	39	39.	615.25	39
40	623.25	40	40.	623.25	40
41	631.25	41	41.	631.25	41
42	639.25	42	42.	639.25	42
43	647.25	43	43.	647.25	43
44	655.25	44	44.	655.25	44
45	663.25	45	45.	663.25	45
46	671.25	46	46.	671.25	46
47	679.25	47	47.	679.25	47
48	687.25	48	48.	687.25	48
49	695.25	49	49.	695.25	49
50	703.25	50	50.		
51	711.25	51	51.	711.25	51
52	719.25	52	52.	719.25	52
53	727.25	53	53.	727.25	53
54	735.25	54	54.	735.25	54
55	743.25	55	55.	743.25	55
56	751.25	56	56.	751.25	56
57	759.25	57	57.	759.25	57
58	767.25	58	58.	767.25	58
59	775.25	59	59.	775.25	59
60	783.25	60	60.	783.25	60
61	791.25	61	61.	791.25	61
62	799.25	62	62.	799.25	62
63	807.25	63	63.	807.25	63
64	815.25	64	64.	815.25	64
65	823.25	65	65.	823.25	65
66	831.25	66	66.	831.25	66
67	839.25	67	67.	839.25	67
68	847.25	68	68.	847.25	68
69	855.25	69	69.	855.25	69
70	76.25	S2	70.	77.25	S2+1MHz
71	231.25	U1(S11)	71.	231.25	U1(S11)
72	238.25	U2(S12)	72.	238.25	U2(S12)
73	245.25	U3(S13)	73.	245.25	U3(S13)
74	252.25	U4(S14)	74.	252.25	U4(S14)
75	259.25	U5(S15)	75.	259.25	U5(S15)
76	266.25	U6(S16)	76.	266.25	U6(S16)
77	273.25	U7(S17)	77.	273.25	U7(S17)
78	280.25	U8(S18)	78.	280.25	U8(S18)
79	287.25	U9(S19)	79.	287.25	U9(S19)
80	294.25	U10(S20)	80.	294.25	U10(S20)
81	303.25	S21	81.	301.25	U11
82	311.25	S22	82.	308.25	U12
83	319.25	S23	83.	315.25	U13
84	327.25	S24	84.	322.25	U14
85	335.25	S25	85.	329.25	U15
86	343.25	S26	86.	336.25	U16
87	351.25	S27	87.	343.25	U17
88	359.25	S28	88.	350.25	U18
89	367.25	S29	89.	357.25	U19
90	375.25	S30	90.	364.25	U20
91	383.25	S31	91.	371.25	U21
92	391.25	S32	92.	378.25	U22
93	399.25	S33	93.	385.25	U23
94	407.25	S34	94.	392.25	U24
95	415.25	S35	95.	399.25	U25
96	423.25	S36	96.	406.25	U26
97	431.25	S37	97.	413.25	U27
98	439.25	S38	98.	420.25	U28
99	447.25	S39	99.	427.25	U29

TABLE 8

CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO
01			01.	105.25	S1
02	48.25	E2	02.	112.25	S2
03	55.25	E3	03.	119.25	S3
04	62.25	E4	04.	126.25	S4
05	175.25	E5	05.	133.25	S5
06	182.25	E6	06.	140.25	S6
07	189.25	E7	07.	147.25	S7
08	196.25	E8	08.	154.25	S8
09	203.25	E9	09.	161.25	S9
10	210.25	E10	10.	168.25	S10
11	217.25	E11	11.	231.25	S11
12	224.25	E12	12.	238.25	S12
13			13.	245.25	S13
14			14.	252.25	S14
15			15.	259.25	S15
16			16.	266.25	S16
17			17.	273.25	S17
18			18.	280.25	S18
19			19.	287.25	S19
20			20.	294.25	S20
21	471.25	21	21.	301.25	S21
22	479.25	22	22.	308.25	S22
23	487.25	23	23.	315.25	S23
24	495.25	24	24.	322.25	S24
25	503.25	25	25.	329.25	S25
26	511.25	26	26.	336.25	S26
27	519.25	27	27.	343.25	S27
28	527.25	28	28.	350.25	S28
29	535.25	29	29.	357.25	S29
30	543.25	30	30.	364.25	S30
31	551.25	31	31.	371.25	S31
32	559.25	32	32.	378.25	S32
33	567.25	33	33.	385.25	S33
34	575.25	34	34.	392.25	S34
35	583.25	35	35.	399.25	S35
36	591.25	36	36.	406.25	S36
37	599.25	37	37.	413.25	S37
38	607.25	38	38.	420.25	S38
39	615.25	39	39.	427.25	S39
40	623.25	40	40.	434.25	S40
41	631.25	41	41.	441.25	S41
42	639.25	42	42.		
43	647.25	43	43.		
44	655.25	44	44.		
45	663.25	45	45.		
46	671.25	46	46.		
47	679.25	47	47.		
48	687.25	48	48.		
49	695.25	49	49.		
50	703.25	50	50.		
51	711.25	51	51.		
52	719.25	52	52.		
53	727.25	53	53.		
54	735.25	54	54.		
55	743.25	55	55.		
56	751.25	56	56.		
57	759.25	57	57.		
58	767.25	58	58.		
59	775.25	59	59.		
60	783.25	60	60.		
61	791.25	61	61.		
62	799.25	62	62.		
63	807.25	63	63.		
64	815.25	64	64.		
65	823.25	65	65.		
66	831.25	66	66.		
67	89.25	67	67.		
68	847.25	68	68.		
69	855.25	69	69.		
70			70.		
71			71.		
72			72.		
73			73.		
74			74.		
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98			98.		
99			99.		

TABLE 9

CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO	CH	FREQ. NAME/NO
01			01.	105.25	S1	5.1	
02	48.25	E2	02.	112.25	S2	5.2	
03	55.25	E3	03.	119.25	S3	5.3	
04	62.25	E4	04.	126.25	S4	5.4	
05	175.25	E5	05.	133.25	S5	5.5	
06	182.25	E6	06.	140.25	S6	5.6	
07	189.25	E7	07.	147.25	S7	5.7	
08	196.25	E8	08.	154.25	S8	5.8	
09	203.25	E9	09.	161.25	S9	5.9	
10	210.25	E10	10.	168.25	S10	6.0	
11	217.25	E11	11.	231.25	S11	6.1	
12	224.25	E12	12.	238.25	S12	6.2	
13			13.	245.25	S13	6.3	
14			14.	252.25	S14	6.4	
15			15.	259.25	S15	6.5	
16			16.	266.25	S16	6.6	
17			17.	273.25	S17	6.7	
18			18.	280.25	S18	6.8	
19			19.	287.25	S19	6.9	
20			20.	294.25	S20	7.0	
21	471.25	21	21.	303.25	S21	7.1	
22	479.25	22	22.	311.25	S22	7.2	
23	487.25	23	23.	319.25	S23	7.3	
24	495.25	24	24.	327.25	S24	7.4	
25	503.25	25	25.	335.25	S25	7.5	
26	511.25	26	26.	343.25	S26	7.6	
27	519.25	27	27.	351.25	S27	7.7	
28	527.25	28	28.	359.25	S28	7.8	
29	535.25	29	29.	367.25	S29	7.9	
30	543.25	30	30.	375.25	S30	8.0	
31	551.25	31	31.	383.25	S31	8.1	
32	559.25	32	32.	391.25	S32	8.2	
33	567.25	33	33.	399.25	S33	8.3	
34	575.25	34	34.	407.25	S34	8.4	
35	583.25	35	35.	415.25	S35	8.5	
36	591.25	36	36.	423.25	S36	8.6	
37	599.25	37	37.	431.25	S37	8.7	
38	607.25	38	38.	439.25	S38	8.8	
39	615.25	39	39.	447.25	S39	8.9	
40	623.25	40	40.	455.25	S40	9.0	
41	631.25	41	41.	463.25	S41	9.1	
42	639.25	42	42.			9.2	
43	647.25	43	43.			9.3	
44	655.25	44	44.			9.4	
45	663.25	45	45.			9.5	
46	671.25	46	46.			9.6	
47	679.25	47	47.			9.7	
48	687.25	48	48.			9.8	
49	695.25	49	49.			9.9	
50	703.25	50	50.				
51	711.25	51	51.				
52	719.25	52	52.				
53	727.25	53	53.				
54	735.25	54	54.				
55	743.25	55	55.				
56	751.25	56	56.				
57	759.25	57	57.				
58	767.25	58	58.				
59	775.25	59	59.				
60	783.25	60	60.				
61	791.25	61	61.				
62	799.25	62	62.				
63	807.25	63	63.				
64	815.25	64	64.				
65	823.25	65	65.				
66	831.25	66	66.				
67	839.25	67	67.				
68	847.25	68	68.				
69	855.25	69	69.				
70			70.				
71	49.75	R1	71.				
72	59.25	R2	72.				
73	77.25	R3	73.				
74	85.25	R4	74.				
75	93.25	R5	75.				
76	175.25	R6	76.				
77	183.25	R7	77.				
78	191.25	R8	78.				
79	199.25	R9	79.				
80	207.25	R10	80.				
81	215.25	R11	81.				
82	223.25	R12	82.				
83			83.				
84			84.				
85			85.				
86			86.				
87			87.				
88			88.				
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91			91.				
92			92.				
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95			95.				
96			96.				
97			97.				
98			98.				
99			99.				

TABLE 10			TABLE 11			TABLE 12			TABLE 13		
CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO
01			01.	105.25	S1	1	176		01	45.75	IA	01	45.75	IA
02	48.25	E2	02.	112.25	S2	2	184		02	53.75	IB	02	53.75	IB
03	55.25	E3	03.	119.25	S3	3	192		03	61.75	IC	03	61.75	IC
04	62.25	E4	04.	126.25	S4	4	200		04	175.25	ID	04	175.25	ID
05	175.25	E5	05.	133.25	S5	5	208		05	183.25	IE	05	183.25	IE
06	182.25	E6	06.	140.25	S6	6	216		06	191.25	IF	06	191.25	IF
07	189.25	E7	07.	147.25	S7	21	471.25		07	199.25	IG	07	199.25	IG
08	196.25	E8	08.	154.25	S8	22	479.25		08	207.25	IH	08	207.25	IH
09	203.25	E9	09.	161.25	S9	23	487.25		09	215.25	IJ	09	215.25	IJ
10	210.25	E10	10.	168.25	S10	24	495.25		10	223.25	IK	10	223.25	IK
11	217.25	E11	11.	231.25	S11	25	503.25		11			11		
12	224.25	E12	12.	238.25	S12	26	511.25		12			12		
13	53.75	A	13.	245.25	S13	27	519.25		13			13		
14	62.25	B	14.	252.25	S14	28	527.25		14			14		
15	82.25	C	15.	259.25	S15	29	535.25		15			15		
16	175.25	D	16.	266.25	S16	30	543.25		16			16		
17	183.75	E	17.	273.25	S17	31	551.25		17			17		
18	192.25	F	18.	280.25	S18	32	559.25		18			18		
19	201.25	G	19.	287.25	S19	33	567.25		19			19		
20	210.25	H	20.	294.25	S20	34	575.25		20			20		
21	471.25	21	21.	303.25	S21	35	583.25		21	471.25	21	21	471.25	21
22	479.25	22	22.	311.25	S22	36	591.25		22	479.25	22	22	479.25	22
23	487.25	23	23.	319.25	S23	37	599.25		23	487.25	23	23	487.25	23
24	495.25	24	24.	327.25	S24	38	607.25		24	495.25	24	24	495.25	24
25	503.25	25	25.	335.25	S25	39	615.25		25	503.25	25	25	503.25	25
26	511.25	26	26.	343.25	S26	40	623.25		26	511.25	26	26	511.25	26
27	519.25	27	27.	351.25	S27	41	631.25		27	519.25	27	27	519.25	27
28	527.25	28	28.	359.25	S28	42	639.25		28	527.25	28	28	527.25	28
29	535.25	29	29.	367.25	S29	43	647.25		29	535.25	29	29	535.25	29
30	543.25	30	30.	375.25	S30	44	655.25		30	543.25	30	30	543.25	30
31	551.25	31	31.	383.25	S31	45	663.25		31	551.25	31	31	551.25	31
32	559.25	32	32.	391.25	S32	46	671.25		32	559.25	32	32	559.25	32
33	567.25	33	33.	399.25	S33	47	679.25		33	567.25	33	33	567.25	33
34	575.25	34	34.	407.25	S34	48	687.25		34	575.25	34	34	575.25	34
35	583.25	35	35.	415.25	S35	49	695.25		35	583.25	35	35	583.25	35
36	591.25	36	36.	423.25	S36	50	703.25		36	591.25	36	36	591.25	36
37	599.25	37	37.	431.25	S37	51	711.25		37	599.25	37	37	599.25	37
38	607.25	38	38.	439.25	S38	52	719.25		38	607.25	38	38	607.25	38
39	615.25	39	39.	447.25	S39	53	727.25		39	615.25	39	39	615.25	39
40	623.25	40	40.	455.25	S40	54	735.25		40	623.25	40	40	623.25	40
41	631.25	41	41.	463.25	S41	55	743.25		41	631.25	41	41	631.25	41
42	639.25	42	42.			56	751.25		42	639.25	42	42	639.25	42
43	647.25	43	43.			57	759.25		43	647.25	43	43	647.25	43
44	655.25	44	44.			58	767.25		44	655.25	44	44	655.25	44
45	663.25	45	45.			59	775.25		45	663.25	45	45	663.25	45
46	671.25	46	46.			60	783.25		46	671.25	46	46	671.25	46
47	679.25	47	47.			61	791.25		47	679.25	47	47	679.25	47
48	687.25	48	48.			62	799.25		48	687.25	48	48	687.25	48
49	695.25	49	49.			63	807.25		49	695.25	49	49	695.25	49
50	703.25	50	50.			64	815.25		50	703.25	50	50	703.25	50
51	711.25	51	51.			65	823.25		51	711.25	51	51	711.25	51
52	719.25	52	52.			66	831.25		52	719.25	52	52	719.25	52
53	727.25	53	53.			67	839.25		53	727.25	53	53	727.25	53
54	735.25	54	54.			68	847.25		54	735.25	54	54	735.25	54
55	743.25	55	55.			69	855.25		55	743.25	55	55	743.25	55
56	751.25	56	56.						56	751.25	56	56	751.25	56
57	759.25	57	57.						57	759.25	57	57	759.25	57
58	767.25	58	58.						58	767.25	58	58	767.25	58
59	775.25	59	59.						59	775.25	59	59	775.25	59
60	783.25	60	60.						60	783.25	60	60	783.25	60
61	791.25	61	61.						61	791.25	61	61	791.25	61
62	799.25	62	62.						62	799.25	62	62	799.25	62
63	807.25	63	63.						63	807.25	63	63	807.25	63
64	815.25	64	64.						64	815.25	64	64	815.25	64
65	823.25	65	65.						65	823.25	65	65	823.25	65
66	831.25	66	66.						66	831.25	66	66	831.25	66
67	839.25	67	67.						67	839.25	67	67	839.25	67
68	847.25	68	68.						68	847.25	68	68	847.25	68
69	855.25	69	69.						69	855.25	69	69	855.25	69
70			70.						70			70		
71			71.						71			71		
72			72.						72			72		
73			73.						73			73		
74			74.						74			74		
75	69.25	75	75.						75			75		
76	76.25	76	76.						76			76		
77	83.25	77	77.						77			77		
78	90.25	78	78.						78			78		
79	97.25	79	79.						79			79		
80	105.25	S1	80.						80			80		
81	112.25	S2	81.						81			81	200	RTE1
82	119.25	S3	82.						82			82	175	RTE2
83	126.25	S4	83.						83			83	216	BBC1
84	133.25	S5	84.						84			84	208	BBC2
85	140.25	S6	85.						85			85	184	UTV
86	147.25	S7	86.						86			86	64	CH4
87	154.25	S8	87.						87			87	248	PLUG-UP1
88	161.25	S9	88.						88			88	264	PLUG-UP2
89	168.25	S10	89.						89			89	256	DAIL
90	231.25	S11	90.						90			90	272	SEANAD
91	238.25	S12	91.						91			91	240	CNN
92	245.25	S13	92.						92			92	282	SKY NEWS
93	252.25	S14	93.						93			93	230	EURO-SPORT
94	259.25	S15	94.						94			94	192	EURO-NEWS
95	266.25	S16	95.						95			95	56	MTV
96	273.25	S17	96.						96			96		
97	280.25	S18	97.						97			97		
98	287.25	S19	98.						98			98		
99	294.25	S20	99.						99			99		

TABLE 14

CH	FREQ.	NAME/NO
01	45.25	01
02	55.25	02
03	62.25	03
04	175.25	04
05	182.25	05
06	189.25	06
07	196.25	07
08	203.25	08
09	210.25	09
10	217.25	10
11	224.25	11
12		
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17		
18		
19		
20		
21	471.25	21
22	479.25	22
23	487.25	23
24	495.25	24
25	503.25	25
26	511.25	26
27	519.25	27
28	527.25	28
29	535.25	29
30	543.25	30
31	551.25	31
32	559.25	32
33	567.25	33
34	575.25	34
35	583.25	35
36	591.25	36
37	599.25	37
38	607.25	38
39	615.25	39
40	623.25	40
41	631.25	41
42	639.25	42
43	647.25	43
44	655.25	44
45	663.25	45
46	671.25	46
47	679.25	47
48	687.25	48
49	695.25	49
50	703.25	50
51	711.25	51
52	719.25	52
53	727.25	53
54	735.25	54
55	743.25	55
56	751.25	56
57	759.25	57
58	767.25	58
59	775.25	59
60	783.25	60
61	791.25	61
62	799.25	62
63	807.25	63
64	815.25	64
65	823.25	65
66	831.25	66
67	839.25	67
68	847.25	68
69	855.25	69
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TABLE 15

CH	FREQ.	NAME/NO
01		
02		
03		
04	175.25	4
05	183.25	5
06	191.25	6
07	199.25	7
08	207.25	8
09	215.25	9
10	223.25	10
11	231.25	11
12	239.25	12
13	247.43	13
14		
15		
16		
17		
18		
19		
20		
21	471.25	21
22	479.25	22
23	487.25	23
24	495.25	24
25	503.25	25
26	511.25	26
27	519.25	27
28	527.25	28
29	535.25	29
30	543.25	30
31	551.25	31
32	559.25	32
33	567.25	33
34	575.25	34
35	583.25	35
36	591.25	36
37	599.25	37
38	607.25	38
39	615.25	39
40	623.25	40
41	631.25	41
42	639.25	42
43	647.25	43
44	655.25	44
45	663.25	45
46	671.25	46
47	679.25	47
48	687.25	48
49	695.25	49
50	703.25	50
51	711.25	51
52	719.25	52
53	727.25	53
54	735.25	54
55	743.25	55
56	751.25	56
57	759.25	57
58	767.25	58
59	775.25	59
60	783.25	60
61	791.25	61
62	799.25	62
63	807.25	63
64	815.25	64
65	823.25	65
66	831.25	66
67	839.25	67
68	847.25	68
69	855.25*	69
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CH	FREQ.	NAME/NO
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14.	247.25	S14
15.	255.25	S15
16.	263.25	S16
17.	271.25	S17
18.	279.25	S18
19.	287.25	S19
20.	295.25	S20
21.	303.25	S21
22.	311.25	S22
23.	319.25	S23
24.	327.25	S24
25.	335.25	S25
26.	343.25	S26
27.	351.25	S27
28.	359.25	S28
29.	367.25	S29
30.	375.25	S30
31.	383.25	S31
32.	391.25	S32
33.	399.25	S33
34.	407.25	S34
35.	415.25	S35
36.	423.25	S36*
37.	431.25	S37*
38.	439.25	S38*
39.	447.25	S39*
40.	455.25	S40*
41.	463.25	S41*
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TABLE 16

CH	FREQ.	NAME/NO
01	49.75	DS-01
02	57.75	DS-02
03	65.75	DS-03
04	77.25	DS-04
05	85.25	DS-05
06	168.25	DS-06
07	176.25	DS-07
08	184.25	DS-08
09	192.25	DS-09
10	200.25	DS-10
11	208.25	DS-11
12	216.25	DS-12
13	471.25	DS-13
14	479.25	DS-14
15	487.25	DS-15
16	495.25	DS-16
17	503.25	DS-17
18	511.25	DS-18
19	519.25	DS-19
20	527.25	DS-20
21	535.25	DS-21
22	543.25	DS-22
23	551.25	DS-23
24	559.25	DS-24
25	607.25	DS-25
26	615.25	DS-26
27	623.25	DS-27
28	631.25	DS-28
29	639.25	DS-29
30	647.25	DS-30
31	655.25	DS-31
32	663.25	DS-32
33	671.25	DS-33
34	679.25	DS-34
35	687.25	DS-35
36	695.25	DS-36
37	703.25	DS-37
38	711.25	DS-38
39	719.25	DS-39
40	727.25	DS-40
41	735.25	DS-41
42	743.25	DS-42
43	751.25	DS-43
44	759.25	DS-44
45	767.25	DS-45
46	775.25	DS-46
47	783.25	DS-47
48	791.25	DS-48
49	799.25	DS-49
50	807.25	DS-50
51	815.25	DS-51
52	823.25	DS-52
53	831.25	DS-53
54	839.25	DS-54
55	847.25	DS-55
56	855.25	DS-56
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CH	FREQ.	NAME/NO
01.	112.25	DZ-01
02.	120.25	DZ-02
03.	128.25	DZ-03
04.	136.25	DZ-04
05.	144.25	DZ-05
06.	152.25	DZ-06
07.	160.25	DZ-07
08.	224.25	DZ-08
09.	232.25	DZ-09
10.	240.25	DZ-10
11.	248.25	DZ-11
12.	256.25	DZ-12
13.	264.25	DZ-13
14.	272.25	DZ-14
15.	280.25	DZ-15
16.	288.25	DZ-16
17.	296.25	DZ-17
18.	304.25	DZ-18
19.	312.25	DZ-19
20.	320.25	DZ-20
21.	328.25	DZ-21
22.	336.25	DZ-22
23.	344.25	DZ-23
24.	352.25	DZ-24
25.	360.25	DZ-25
26.	368.25	DZ-26
27.	376.25	DZ-27
28.	384.25	DZ-28
29.	392.25	DZ-29
30.	400.25	DZ-30
31.	408.25	DZ-31
32.	416.25	DZ-32
33.	424.25	DZ-33
34.	432.25	DZ-34
35.	440.25	DZ-35
36.	448.25	DZ-36
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TABLE 17

CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO
01	53.75	A	01.	105.25	S1
02	62.25	B	02.	112.25	S2
03	82.25	C	03.	119.25	S3
04	175.25	D	04.	126.25	S4
05	183.75	E	05.	133.25	S5
06	192.25	F	06.	140.25	S6
07	201.25	G	07.	147.25	S7
08	210.25	H	08.	154.25	S8
09	217.25	H1	09.	161.25	S9
10	224.25	H2	10.	168.25	S10
11			11.	231.25	S11
12			12.	238.25	S12
13			13.	245.25	S13
14			14.	252.25	S14
15			15.	259.25	S15
16			16.	266.25	S16
17			17.	273.25	S17
18			18.	280.25	S18
19			19.	287.25	S19
20			20.	294.25	S20
21	471.25	21	21.	303.25	S21
22	479.25	22	22.	311.25	S22
23	487.25	23	23.	319.25	S23
24	495.25	24	24.	327.25	S24
25	503.25	25	25.	335.25	S25
26	511.25	26	26.	343.25	S26
27	519.25	27	27.	351.25	S27
28	527.25	28	28.	359.25	S28
29	535.25	29	29.	367.25	S29
30	543.25	30	30.	375.25	S30
31	551.25	31	31.	383.25	S31
32	559.25	32	32.	391.25	S32
33	567.25	33	33.	399.25	S33
34	575.25	34	34.	407.25	S34
35	583.25	35	35.	415.25	S35
36	591.25	36	36.	423.25	S36
37	599.25	37	37.	431.25	S37
38	607.25	38	38.	439.25	S38
39	615.25	39	39.	447.25	S39
40	623.25	40	40.	455.25	S40
41	631.25	41	41.	463.25	S41
42	639.25	42	42.		
43	647.25	43	43.		
44	655.25	44	44.		
45	663.25	45	45.		
46	671.25	46	46.		
47	679.25	47	47.		
48	687.25	48	48.		
49	695.25	49	49.		
50	703.25	50	50.		
51	711.25	51	51.		
52	719.25	52	52.		
53	727.25	53	53.		
54	735.25	54	54.		
55	743.25	55	55.		
56	751.25	56	56.		
57	759.25	57	57.		
58	767.25	58	58.		
59	775.25	59	59.		
60	783.25	60	60.		
61	791.25	61	61.		
62	799.25	62	62.		
63	807.25	63	63.		
64	815.25	64	64.		
65	823.25	65	65.		
66	831.25	66	66.		
67	839.25	67	67.		
68	847.25	68	68.		
69	855.25	69	69.		
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TABLE 18

CH	FREQ.	NAME/NO
01	57.25	1
02	64.25	2
03	86.25	3
04	95.25	4
05	102.25	5
06	175.25	6
07	182.25	7
08	189.25	8
09	196.25	9
10	209.25	10
11	216.25	11
12		
13		
14		
15	138.25	5A
16		
17		
18		
19		
20	46.25	0
21		
22		
23		
24		
25		
26		
27		
28	527.25	28
29	534.25	29
30	541.25	30
31	548.25	31
32	555.25	32
33	562.25	33
34	569.25	34
35	576.25	35
36	583.25	36
37	590.25	37
38	597.25	38
39	604.25	39
40	611.25	40
41	618.25	41
42	625.25	42
43	632.25	43
44	639.25	44
45	646.25	45
46	653.25	46
47	660.25	47
48	667.25	48
49	674.25	49
50	681.25	50
51	688.25	51
52	695.25	52
53	702.25	53
54	709.25	54
55	716.25	55
56	723.25	56
57	730.25	57
58	737.25	58
59	744.25	59
60	751.25	60
61	758.25	61
62	765.25	62
63	772.25	63
64	779.25	64
65	786.25	65
66	793.25	66
67	800.25	67
68	807.25	68
69	814.25	69
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TABLE 19

CH	FREQ.	NAME/NO
01	48.25	
02	55.25	
03	62.25	
04	119.25	
05	126.25	
06	133.25	
07	140.25	
08	147.25	
09	154.25	
10	161.25	
11	168.25	
12	175.25	
13	182.25	
14	189.25	
15	196.25	
16	203.25	
17	210.25	
18	217.25	
19	224.25	
20	231.25	
21	238.25	
22	245.25	
23	252.25	
24	259.25	
25	266.25	
26	273.25	
27	280.25	
28	287.25	
29	294.25	
30	303.25	
31	311.25	
32	319.25	
33	327.25	
34	335.25	
35	343.25	
36	351.25	
37	359.25	
38	367.25	
39	375.25	
40	383.25	
41	391.25	
42	399.25	
43	407.25	
44	415.25	
45	423.25	
46	431.25	
47	439.25	
48	447.25	
49	455.25	
50	463.25	
51	471.25	
52	479.25	
53	487.25	
54	495.25	
55	503.25	
56	511.25	
57	519.25	
58	527.25	
59	535.25	
60	543.25	
61	551.25	
62	559.25	
63	567.25	
64	575.25	
65	583.25	
66	591.25	
67	599.25	
68	607.25	
69	615.25	
70	623.25	
71	631.25	
72	639.25	
73	647.25	
74	655.25	
75	663.25	
76	671.25	
77	679.25	
78	687.25	
79	695.25	
80	703.25	
81	711.25	
82	719.25	
83	727.25	
84	735.25	
85	743.25	
86	751.25	
87	759.25	
88	767.25	
89	775.25	
90	783.25	
91	791.25	
92	799.25	
93	807.25	
94	815.25	
95	823.25	
96	831.25	
97	839.25	
98	847.25	
99.	855.25	

TABLE 20

CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO
01			01.	105.25	S1
02	48.25	E2	02.	112.25	S2
03	55.25	E3	03.	119.25	S3
04	62.25	E4	04.	126.25	S4
05	175.25	E5	05.	133.25	S5
06	182.25	E6	06.	140.25	S6
07	189.25	E7	07.	147.25	S7
08	196.25	E8	08.	154.25	S8
09	203.25	E9	09.	161.25	S9
10	210.25	E10	10.	168.25	S10
11	217.25	E11	11.	231.25	S11
12	224.25	E12	12.	238.25	S12
13			13.	245.25	S13
14			14.	252.25	S14
15			15.	259.25	S15
16			16.	266.25	S16
17			17.	273.25	S17
18			18.	280.25	S18
19			19.	287.25	S19
20			20.	294.25	S20
21	471.25	21	21.	303.25	S21
22	479.25	22	22.	311.25	S22
23	487.25	23	23.	319.25	S23
24	495.25	24	24.	327.25	S24
25	503.25	25	25.	335.25	S25
26	511.25	26	26.	343.25	S26
27	519.25	27	27.	351.25	S27
28	527.25	28	28.	359.25	S28
29	535.25	29	29.	367.25	S29
30	543.25	30	30.	375.25	S30
31	551.25	31	31.	383.25	S31
32	559.25	32	32.	391.25	S32
33	567.25	33	33.	399.25	S33
34	575.25	34	34.	407.25	S34
35	583.25	35	35.	415.25	S35
36	591.25	36	36.	423.25	S36
37	599.25	37	37.	431.25	S37
38	607.25	38	38.	439.25	S38
39	615.25	39	39.	447.25	S39
40	623.25	40	40.	455.25	S40
41	631.25	41	41.	463.25	S41
42	639.25	42	42.		
43	647.25	43	43.		
44	655.25	44	44.		
45	663.25	45	45.		
46	671.25	46	46.		
47	679.25	47	47.		
48	687.25	48	48.		
49	695.25	49	49.		
50	703.25	50	50.		
51	711.25	51	51.	127.25	
52	719.25	52	52.	135.25	
53	727.25	53	53.	143.25	
54	735.25	54	54.	151.25	
55	743.25	55	55.	159.25	
56	751.25	56	56.	167.25	
57	759.25	57	57.	175.25	
58	767.25	58	58.	183.25	
59	775.25	59	59.	191.25	
60	783.25	60	60.	199.25	
61	791.25	61	61.		
62	799.25	62	62.		
63	807.25	63	63.		
64	815.25	64	64.		
65	823.25	65	65.		
66	831.25	66	66.		
67	839.25	67	67.		
68	847.25	68	68.		
69	855.25	69	69.		
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TABLE 21

CH	FREQ.	NAME/NO	CH	FREQ.	NAME/NO
01			01.	105.25	S1
02	**48.50**	**E2**	02.	112.25	S2
03	**55.50**	**E3**	03.	119.25	S3
04	**62.50**	**E4**	04.	126.25	S4
05	**175.75**	**E5**	05.	133.25	S5
06	**182.75**	**E6**	06.	140.25	S6
07	**189.75**	**E7**	07.	147.25	S7
08	**197.00**	**E8**	08.	154.25	S8
09	**204.00**	**E9**	09.	161.25	S9
10	**211.00**	**E10**	10.	168.25	S10
11	**218.00**	**E11**	11.	232.25	S11
12	**225.00**	**E12**	12.	239.25	S12
13			13.	246.25	S13
14			14.	253.25	S14
15			15.	260.25	S15
16			16.	267.25	S16
17			17.	274.25	S17
18			18.	281.25	S18
19			19.	288.25	S19
20			20.	295.25	S20
21	471.25	21	21.	303.25	S21
22	479.25	22	22.	311.25	S22
23	487.25	23	23.	319.25	S23
24	495.25	24	24.	327.25	S24
25	503.25	25	25.	335.25	S25
26	511.25	26	26.	343.25	S26
27	519.25	27	27.	351.25	S27
28	527.25	28	28.	359.25	S28
29	535.25	29	29.	367.25	S29
30	543.25	30	30.	375.25	S30
31	551.25	31	31.	383.25	S31
32	559.25	32	32.	391.25	S32
33	567.25	33	33.	399.25	S33
34	575.25	34	34.	407.25	S34
35	583.25	35	35.	415.25	S35
36	591.25	36	36.	423.25	S36
37	599.25	37	37.	431.25	S37
38	607.25	38	38.	439.25	S38
39	615.25	39	39.	447.25	S39
40	623.25	40	40.	455.25	S40
41	631.25	41	41.	463.25	S41
42	639.25	42	42.		
43	647.25	43	43.		
44	655.25	44	44.		
45	663.25	45	45.		
46	671.25	46	46.		
47	679.25	47	47.		
48	687.25	48	48.		
49	695.25	49	49.		
50	703.25	50	50.		
51	711.25	51	51.		
52	**719.25**	**52**	52.		
53	**727.25**	**53**	53.		
54	**735.25**	**54**	54.		
55	**743.25**	**55**	55.		
56	**751.25**	**56**	56.		
57	**759.25**	**57**	57.		
58	**767.25**	**58**	58.		
59	**775.25**	**59**	59.		
60	**783.25**	**60**	60.		
61	**791.25**	**61**	61.		
62	**799.25**	**62**	62.		
63	807.25	63	63.		
64	815.25	64	64.		
65	823.25	65	65.		
66	831.25	66	66.		
67	839.25	67	67.		
68	847.25	68	68.		
69	855.25	69	69.		
70			70.		
71			71.		
72			72.		
73			73.		
74			74.		
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83			83.		
84			84.		
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89			89.		
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91			91.		
92			92.		
93			93.		
94			94.		
95			95.		
96			96.		
97			97.		
98			98.		
99			99.		

BROADCAST TECHNOLOGY LIMITED
Sopwith Park, West Portway Industrial Estate
Andover, Hampshire SP10 3TS
☎ :+44 (0)1264 332633 :+44(0)1264 334509
E-Mail : support@btl.uk.com V.A.T. No. GB/474 44 36 32

CUSTOMER REPORT

Company: _____

Address: _____

_____

_____

Contact name (person(s) responsible): _____

Customer Reference: _____

Telephone No: _____ Date: _____

Fax: _____ E-Mail: _____

Delivery address upon <u>despatch</u> of good(s), to be completed if different from above;
**** Note** - upon returning goods packaging must be suitable for professional electronic equipment. Where possible please ship via "Emery Worldwide" our import-clearing agent.*

Contact name: _____

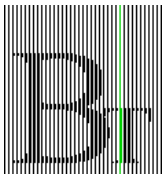
Address: _____

_____

In the event of any fault occurring please copy, complete and return Customer and Fault Reports to Broadcast Technology Ltd at the above address.

***For internal use only**;-*
RN no:
Date received:
Checked for rework by:
Remedial action taken:
Approx. cost of repair:
Approx. time taken:
Date returned:

Please see reverse



FAULT REPORT FORM

Broadcast Technology Ltd Returns Number: ☐

Type: ☐	Serial No: ☐	Del Date: ☐

Please tick appropriate box(s)

Nature of Fault: Software ☐ Hardware ☐

Software used (if known): _____

Configuration: _____

Appearance of Failure:

Systematic ☐ When Hot ☐ When Cold ☐ Intermittent ☐

Description of fault: _____

_____

_____

What do you think is the cause of the fault?: _____

_____

_____

Comments: _____

_____

Customer's signature: *Date:*
(Engineer reporting fault)

DETAILED COMMENTS: (*If necessary, please add more details on a separate sheet).*

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