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User Manual - 600 Watt FM Radio Broadcasting Transmitter

INTENDED USE

i. The equipment in this document is only for use permanently at a pre-defined location with a license or authorisation from the radio spectrum regulator in your country or EU member state.

ii. The installer must have competent RF engineering skills at their disposal, be EMC aware and understand radio frequency systems. The final installation should be in accordance with the EU and the US techincal parameters and the maximum audio deviation level for the full composite MPX signal should be adjusted to b an absoulte maximum for +/-75 KHz.

USA REQUIREMENTS. Section 2.1047 Modulation characteristics and section 2.1049 Occupied bandwidth at:
http://www.gpo.gov/fdsys/granule/CFR-2011-title47-vol1/CFR-2011-title47-vol1-sec2-1047/content-detail.html

EU REQUIREMENTS. Section 8 Audio Processing Limiter at:
https://www.aareff.com/ETR132.pdf

PACKAGE CHECKLIST

Qty	All Versions	Item
1	600 Watt FM Transmitter	
Qty	**90-260V AC Version**	**Item**
1	IEC AC power cord	
Qty	**48V DC Version**	**Item**

1	DC power cord 48 volts	

USA TECHNICAL REQUIREMENTS

Some versions of this transmitter do not include internal audio limiting. To maintain compliance with the FCC rules and technical requirements the audio source / feed should be level controlled to prevent over deviation and excessive use of bandwidth by means of an external audio limiter and/or processing device, MPX stereo generator and/or RDS generator. More information on this is at is in section 2.1047 Modulation characteristics and section 2.1049 Occupied bandwidth at http://www.gpo.gov/fdsys/granule/CFR-2011-title47-vol1/CFR-2011-title47-vol1-sec2-1047/content-detail.html

EU REGULATORY REQUIREMENTS

Some versions of this transmitter do not include internal audio limiting. To maintain compliance with the EU ETSI standard the audio source / feed should be level controlled to prevent over deviation and excessive use of bandwidth by means of an external audio limiter and/or processing device, MPX stereo generator and/or RDS generator. More information on this in section 8 Audio Processing Limiter at https://www.aareff.com/ETR132.pdf

This product complies with EMC directive of the European Union. To meet this directive the user or installer must follow the wiring instructions in the this user manual

This equipment is not intended for installation by an unqualified end user, the installer must have competent RF engineering skills and EMC knowledge at their disposal. The whole transmission system, including the antenna system and external audio limiting, should be installed in the EU in accordance with document ETR132, a copy of this is available at https://www.aareff.com/ETR132.pdf

CONNECT THE ANTENNA TO THE RF OUTPUT

The ANTENNA is very important, check this is installed and ready to use. DO NOT EVER POWER A TRANSMITTER OR RF AMPLIFER WITHOUT AN ANTENNA CONNECTED.

PLUG THE ANTENNA CABLE INTO THE TRANSMITTER. Make sure this tight as poor and loose connections can cause RF burns to personnel, severe noise to the transmission and excessive RF bandwidth. A transmitter should never be operated without an antenna. **DO NOT PLUG IN THE POWER CORD AT THIS STAGE**.

Under NO CIRCUMSTANCES should the antenna be mounted and used at ground level or within a few meters of personnel.

A tuned antenna with the 50 ohm coaxial cable should be used. This should give a return loss ideally of 16dB (SWR 1.4) or better at the operating frequency. The RF plug should be PL259 (UHF) or N type, depending which is fitted to the FM transmitter.

Ensure that all antenna connections are sound, this is important as poor connections and soldered joints can cause RF burns to personnel, severe noise to the transmission and excessive RF bandwidth. Do NOT connect the antenna to the transmitter yet.

Ideally the antenna for this transmitter should be ideally mounted 20 meters high and clear of any surrounding objects to get maximum range and more importantly to reduce risk of radio frequency radiation to personnel. When mounted at 20 meters in height off ground and using 600 watts of transmitter power, power flux density measurements made at ground level directly under the antennas described above show less than 1 W/m2. Several European countries use a value for the power flux density of 10 W/m2 as a basis for considering whether or not an area is safe. The issue of radio frequency radiation limits is a contentious one and work in this field is continuing worldwide.

BOTTOM PANEL CONTROLS

Turn the transmitter upside down to locate the following controls:

If you have the latest model, then you will have the following components:

- **VR2 - RF Power Output Control**
- **Two Small Buttons for Stepping Freq Up and Down.**
- **VR1 - FM Deviation Control**

If you have a pre 2024 model, then you will have this list of swithces, potenciometers and jumpers:

- **VR2 - RF Power Output Control**
- **S2 S1 - 6 Way Dip Switches**
- **VR1 - FM Deviation Control**
- **VC1 - FM Freq Lock. Adj**

BE CAREFUL not to be too heavy handed, these controls are only small pcb mounted pots and switches and can be damaged with excessive force. You will need to use a small electrical screwdriver to adjust these controls.

SET THE RF POWER OUTPUT TO ZERO

Adjust VR2 RF PWR. ADJ fully counter-clockwise. In this counter-clockwise position the transmitter output has no RF output, it is reduced to zero.

SET THE FREQUENCY

LATEST MODEL

Locate the two small frequency up and down buttons. These small buttons are used for stepping up or down in selecting a frequency. As you press the up or down buttons, you'll notice the frequency on the digital display change. It's important to select your frequency correctly, if you don't, it's possible to transmit on an unauthorised frequency.

PRE 2024 MODEL

Locate the two banks of 6 way dip switches S2 and S1. At the very end of this user manual you can locate the section DIL SWITCH (S2 and S1). This table shows all the frequencies from 87.5 to 108 MHz and the corresponding DIP switch settings. Look up your frequency in the table and then set the tiny dip switches to the ON or OFF position as shown in the

table. These switches will determine the start up frequency for the transmitter, so, it's very important they are correct. If they are not correct it's possible to transmit on an unauthorised frequency.

Double check again with the table in the Annex that the dip switches are in the correct positions. Make sure they are pushed fully into the ON position or OFF position, not halfway between.

POWERING THE TRANSMITTER

Double check the power is reduced to zero as described in the section above **SET THE RF POWER OUTPUT TO ZERO** and connect AC or DC power cord as shown below

■ **AC VERSION**
A standard IEC AC power cord is supplied for connection to any AC between 90 and 260 volts.

■ **DC VERSION. Be careful, please read !!!** ⚠

A thick DC power cable is supplied for 48V DC operation. Please **BE CAREFUL** to connect to the 48V battery or supply with the correct polarity. **RED to +** and **BLACK to -**. Make sure the connection is solid, not intermittent or loose. A loose connection causing the unit to stop and start randomly and rapidly can damage the internal regulators. Connection is normally directly to the 48V battery or other high current source.

Once the power cord is connected you should hear the cooling fans start up. Select FWD on the front panel switch. Observe the front panel Power Meter. The Power Meter should show zero. If it is not zero, disconnect the power cord immediately and double check the power is reduced to minimum as described in the section above **SET THE RF POWER OUTPUT TO ZERO**.

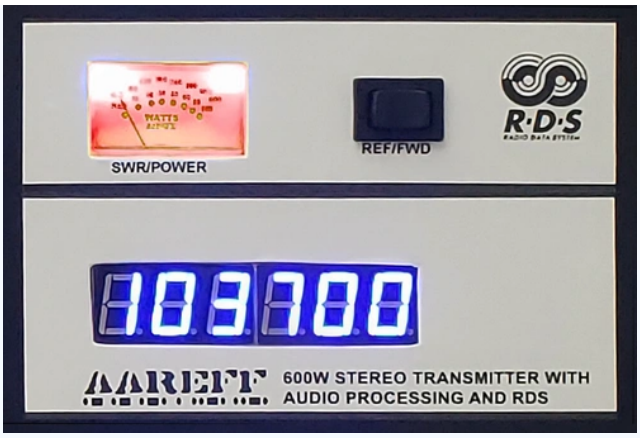
The Power Meter should light up RED, this may change to BLUE after a few seconds, if it does great, if it doesn't, don't worry at this point, this is also normal.

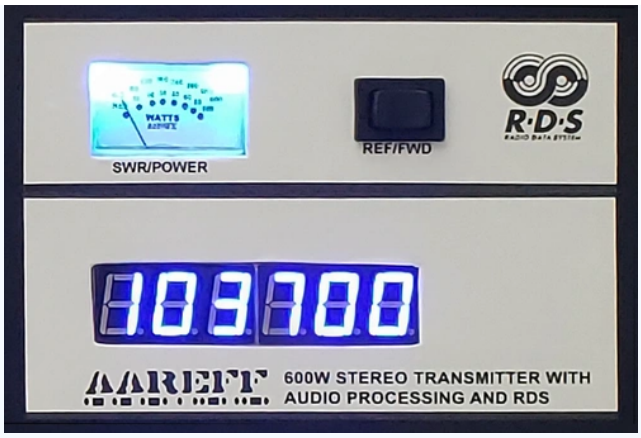
LOCKING THE PLL

This only applies to pre 2024 models

It may be by chance that the PLL is close to lock and the Power Meter has lit up in BLUE. If this is not the case and the Power Meter is lit up in RED, then adjust in any direction VC1 FREQ. ADJ. slowly,

PLEASE be careful, this control is delicate. Be patient and continue to turn slowly until the meter lights up BLUE, then STOP turning. The BLUE light indicates PLL lock. The Power Meter should continue to indicate zero, if the Power Meter is showing anything above ZERO, remove the AC and please follow as described in the section above **SET THE RF POWER OUTPUT TO ZERO**





CONNECTING THE AUDIO BASEBAND

MPX Version. On the MPX version there is just one audio input on the back panel. This is a BNC wide band (30Hz to 76KHz) audio input designed for external processors, stereo and RDS generators

Stereo Version. Stereo versions with and without audio processing have two female XLR transformer balanced inputs.

CHECKING THE AUDIO DEVIATION

During manufacture and test the audio deviation will be set broadcast standard line of +8dBu peak for +/-75KHz peak deviation at 88.0 MHz. There is a high possibility that this will not be the same level as the audio source feed from your studio, external audio limiter and/or processing device, MPX stereo generator and/or RDS generator. You need to check this as excessive deviation can cause adjacent channel interference to other users of the radio spectrum.

WITHOUT TEST EQUIPMENT

Audio deviation is difficult to measure without proper test equipment and the method described here cannot replace proper test equipment, however if your regulator permits this method it is possible to check the deviation very close to correct level by using a relative comparison. Use a radio receiver tuned to a known high quality, high budget and reputed

radio station. For example in the United Kingdom this would be a national BBC station. Feed the audio output of the radio receiver into some VU meter or level indication on a mixer or other audio equipment. Look carefully at the metering level peaks. You will notice the meter peak constantly at a specific level, make a note of this. Place the antenna of radio receiver as close as possible to your transmitter enclosure. Re-tune the radio receiver to your transmitter frequency. Look at the metering again. Adjust VR1 DEV. ADJ. so that your audio constantly peaks at a little lower than the level you noted. When you have achieved this your deviation is a little lower or close to the legal level. The reason for this setting is that it is legal to under deviate, but not-legal to over deviate, with a lack of test equipment

It is better to be under deviating in order to prevent adjacent channel interference until you have proper test equipment available.

WITH TEST EQUIPMENT

Connect the transmitter via a coupler and dummy load to a Spectrum Analyzer, Modulation Analyzer or Deviation Meter. Adjust VR2 RF PWR. ADJ fully ANTI-clockwise. Adjust VR1 DEV. ADJ. for the correct deviation on the test equipment.

SET THE RF POWER OUTPUT LEVEL

Locate the power control VR2 RF PWR. ADJ. If you followed the previous paragraphs, this power control should be in the counter-clockwise. In the fully clockwise position the transmitter output is at maximum RF output. Check the switch on the front panel is set to FWD. Adjust this control to the desired power level. THE TRANSMITTER IS NOW ON AIR!

PROGRAMMING THE RDS

If your version of the transmitter includes RDS and you wish to change the default settings, please go to **RDS Programming and User Manual**

NORMAL OPERATION

On units with fans fitted should hear the cooling fan. The fan draws air into the front and exits the warm air through the rear vents. It is important to keep these vents clear. The front meter should illuminate in BLUE

FWD and REF Switch
The front panel meter should show 600 watts when the switch is selected to FWD. This is power being sent out of the output socket to the antenna. When REF is selected the power reading ideally should be less than 8% of the FWD power, this means that only 8% or less is being reflected back from the antenna, this is an acceptable and a normal amount. If the REF power reading is higher than 8% the antenna may need tuning or there may be a problem with the antenna feeder cable or plugs. If REF reading is higher than 15% then there is a serious problem with the antenna and you should shut down the power amplifier and investigate the antenna cables, connectors and installation for problems.

TECHNICAL DATA

(All stated measurements were made at 220VAC at 26 Degrees Celsius ambient temperature unless stated)

RF and AF Parameters

Power Output Adj.	1-600 Watts into 50 ohms
Freq Range	87.5 to 108 MHz
Spurious Emissions	Less than -75 dB ref to carrier

Harmonic Emissions	Less than -70 dB ref to carrier
Out of Lock RF Muting	Less than -70 dB ref to carrier
Freq Stability	Less than +/- 2 KHz between -20 and +40 C
Freq Fine	Adj +/- 1000 Hz
Freq Adj. Accuracy	+/- 50 Hz
Deviation Sensitivity Stability	+/-2 % max
Residual AM	Less than 0.5 %
Synchronous AM	Less than 0.5 %
RF Output Connector	N-Female
RF Ruggedness	Any VSWR, phase, length of time
MPX Audio Input	Connector Phono/ RCA type unbalanced
Pre-emphasis	(50uS/ 75uS/ None)
MPX Audio Input Sensitivity	Nom. 0.775 V rms for +/- 75 KHz Dev. User adj.
MPX Signal To Noise Ratio	More than 72 dB rel. +/-75KHz dev.
MPX Audio Freq Response	Less than +/-0.5dB between 30 Hz and 76 KHz
MPX Audio Distortion	Less than 0.2 % THD
Operating Temp	-20 to +40 Deg C

AC Mains Parameters

Input Voltage	100-120VAC or 200-240VAC 47-63Hz Check Rear Panel Label
Input Power	900 for 600W RF OUT with RF SWR less than 1.5
Power Factor	PF>0.95/230VAC PF>0.98/115VAC at full power
Working Humidity	20 ~ 90% RH non-condensing
Safety Standards	UL60950-1, TUV EN60950-1 Approved
EMC Conduction & Radiation	Compliance to EN55022 (CISPR22) Class B
EMC Harmonic Current	Compliance to EN61000-3-2,-3
EMC Immunity	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, Light industry level, criteria A

MAINTENANCE

The only maintenance the amplifier needs is some periodic cleaning. Following a number of weeks of continuous 24/7 use (specified below), the amplifier should be shut down and disconnected. A technician or engineer needs to take of the top lid by removing the self tapper screws. Using a soft new and clean paint brush with a vacuum clean hose, the dust should be gently brushed and sucked away from all areas inside. Pay particular attention to the actual fans at the rear and the fan vent at front.

The table below shows the recommended number of weeks cleaning should be done for some typical environmental areas.

WEEKS	SALTY	SANDY	DUSTY	PUBLIC	CLEAN
4	✓				
6		✓	✓		

8				✓	
12					✓

Do not adjust any factory set internal controls.

Under NO CIRCUMSTANCES should any adjustments be made to the internal controls. Such adjustments could damage the unit and invalidate the warranty and also cause serious interference to other users of the electromagnetic spectrum.

LEGAL ADVICE

We sell this equipment to professionals and organizations in good faith it will be used correctly and legally. Nearly every country in the world require licensing for this type of equipment. It is the customer's responsibility to check relevant laws, directives, regulations and licensing requirements before installing or putting this product into service with an antenna system. You, the customer or user agree to defend, indemnify and hold harmless Aareff Systems Limited, it's employees and agents, from and against any claims, actions or demands, including without limitation legal and accounting fees, alleging or resulting from improper or unlawful use of this equipment.

Declaration of Conformity

European Union

We hereby declare that this equipment complies with;
• ETS 300384 European Telecommunications Harmonised Standard when used with an audio compressor limiter supplied and tested by Aareff
• EN 301489-11 V1.3.1 (2006-05) EMC Electromagnetic Compatibility when used with 1 meter AC mains cord supplied. If the installation engineer needs to extend this cord, this and the audio input cable should be no more than 3 meters in length to remain in compliance with EMC directive.
• 2006/95/EC Directive (2006-12) LVD Low Voltage Directive.

Equipment compliance is possible using equipment from and in conjunction from other manufacturers, but since this is beyond the control of Aareff Systems, Aareff Systems cannot or be expected to guarantee compliance in this situation.

United States

The following list are the FCC technical requirements for FM broadcasting. We confirm and verify that this transmitter complies with the technical requirements.

47 CFR Chapter I Federal Communications Commission sections:
• 73.1560, 2.1046 RF Power
• 73.1545, 2.1055 Frequency Stability
• 73.317, 2.1049 (e)(3) Emission Limitation, Emission Mask
• 73.317, 2.1057, 2.1051 Emission Limits, Spurious Emissions at Antenna Terminal
• 73.317, 2.1057, 2.1053 Emission Limits, Field Strength of Spurious Emissions

ROHS

All components used in this apparatus are RoHS compliant and do not contain above the specified limits in any of the following restricted substances:

- Lead
- Hexavalent Chromium

- Mercury
- Cadmium
- Polybrominated Biphenyls (PBB's)
- Polybrominated Diphenylethers (PBDE's)

PRODUCT END OF LIFE

This apparatus must NOT be disposed of with other domestic waste.

We are fully committed to maintaining our responsibilities to the environment. Owners of apparatus that has reached the end of it's useful life can return it to us for recycling, recondition, reuse or proper disposal. You will be required to pay lowest cost postal service available to ship the apparatus to us. Before shipping please contact us for more important information.

PLL 'LOOK UP' (S2 + S1)

MHz	1	2	3	4	5	6		1	2	3	4	5	6
87.5	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	ON	OFF	ON
87.6	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	ON	OFF	OFF
87.7	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	OFF	ON	ON
87.8	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	OFF	ON	OFF
87.9	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	OFF	OFF	ON
88	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	OFF	OFF	OFF
88.1	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	ON	ON	ON
88.2	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	ON	ON	OFF
88.3	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	ON	OFF	ON
88.4	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	ON	OFF	OFF
88.5	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	OFF	ON	ON
88.6	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	OFF	ON	OFF
88.7	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	OFF	OFF	ON
88.8	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	OFF	OFF	OFF
88.9	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	ON	ON	ON
89	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	ON	ON	OFF
89.1	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	ON	OFF	ON
89.2	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	ON	OFF	OFF
89.3	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	OFF	ON	ON
89.4	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	OFF	ON	OFF
89.5	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	OFF	OFF	ON
89.6	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	OFF	OFF	OFF
89.7	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	ON	ON	ON
89.8	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	ON	ON	OFF
89.9	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	ON	OFF	ON

MHz	1	2	3	4	5	6		1	2	3	4	5	6
90	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	ON	OFF	OFF
90.1	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	OFF	ON	ON
90.2	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	OFF	ON	OFF
90.3	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	OFF	OFF	ON
90.4	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	OFF	OFF	OFF
90.5	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	ON	ON	ON
90.6	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	ON	ON	OFF
90.7	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	ON	OFF	ON
90.8	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	ON	OFF	OFF
90.9	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	ON	ON
91	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	ON	OFF
91.1	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	OFF	ON
91.2	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	OFF	OFF
91.3	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	ON	ON	ON
91.4	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	ON	ON	OFF
91.5	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	ON	OFF	ON
91.6	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	ON	OFF	OFF
91.7	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	OFF	ON	ON
91.8	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	OFF	ON	OFF
91.9	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	OFF	OFF	ON
92	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	OFF	OFF	OFF
92.1	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	ON	ON	ON
92.2	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	ON	ON	OFF
92.3	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	ON	OFF	ON
92.4	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	ON	OFF	OFF
92.5	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	OFF	ON	ON
92.6	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	OFF	ON	OFF
92.7	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	OFF	OFF	ON
92.8	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	OFF	OFF	OFF
92.9	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	ON	ON	ON
93	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	ON	ON	OFF
93.1	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	ON	OFF	ON
93.2	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	ON	OFF	OFF
93.3	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	OFF	ON	ON
93.4	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	OFF	ON	OFF
93.5	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	OFF	OFF	ON
93.6	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	OFF	OFF	OFF
93.7	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	ON	ON	ON

MHz	1	2	3	4	5	6		1	2	3	4	5	6
93.8	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	ON	ON	OFF
93.9	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	ON	OFF	ON
94	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	ON	OFF	OFF
94.1	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	OFF	ON	ON
94.2	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	OFF	ON	OFF
94.3	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	OFF	OFF	ON
94.4	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	OFF	OFF	OFF
94.5	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	ON	ON	ON
94.6	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	ON	ON	OFF
94.7	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	ON	OFF	ON
94.8	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	ON	OFF	OFF
94.9	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	OFF	ON	ON
95	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	OFF	ON	OFF
95.1	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	OFF	OFF	ON
95.2	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	OFF	OFF	OFF
95.3	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	ON	ON	ON
95.4	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	ON	ON	OFF
95.5	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	ON	OFF	ON
95.6	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	ON	OFF	OFF
95.7	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	OFF	ON	ON
95.8	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	OFF	ON	OFF
95.9	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	OFF	OFF	ON
96	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	OFF	OFF	OFF
96.1	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	ON	ON	ON
96.2	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	ON	ON	OFF
96.3	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	ON	OFF	ON
96.4	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	ON	OFF	OFF
96.5	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	OFF	ON	ON
96.6	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	OFF	ON	OFF
96.7	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	OFF	OFF	ON
96.8	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	OFF	OFF	OFF
96.9	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	ON	ON	ON
97	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	ON	ON	OFF
97.1	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	ON	OFF	ON
97.2	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	ON	OFF	OFF
97.3	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	ON	ON
97.4	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	ON	OFF
97.5	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	OFF	ON

MHz	1	2	3	4	5	6		1	2	3	4	5	6
97.6	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	OFF	OFF
97.7	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	ON	ON	ON
97.8	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	ON	ON	OFF
97.9	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	ON	OFF	ON
98	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	ON	OFF	OFF
98.1	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	OFF	ON	ON
98.2	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	OFF	ON	OFF
98.3	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	OFF	OFF	ON
98.4	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	OFF	OFF	OFF
98.5	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	ON	ON	ON
98.6	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	ON	ON	OFF
98.7	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	ON	OFF	ON
98.8	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	ON	OFF	OFF
98.9	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	OFF	ON	ON
99	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	OFF	ON	OFF
99.1	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	OFF	OFF	ON
99.2	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	OFF	OFF	OFF
99.3	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	ON	ON	ON
99.4	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	ON	ON	OFF
99.5	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	ON	OFF	ON
99.6	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	ON	OFF	OFF
99.7	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	OFF	ON	ON
99.8	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	OFF	ON	OFF
99.9	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	OFF	OFF	ON
100	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	OFF	OFF	OFF
100.1	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	ON	ON	ON
100.2	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	ON	ON	OFF
100.3	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	ON	OFF	ON
100.4	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	ON	OFF	OFF
100.5	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	OFF	ON	ON
100.6	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	OFF	ON	OFF
100.7	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	OFF	OFF	ON
100.8	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	OFF	OFF	OFF
100.9	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	ON	ON	ON
101	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	ON	ON	OFF
101.1	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	ON	OFF	ON
101.2	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	ON	OFF	OFF
101.3	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	OFF	ON	ON

MHz	1	2	3	4	5	6		1	2	3	4	5	6
101.4	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	OFF	ON	OFF
101.5	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	OFF	OFF	ON
101.6	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	OFF	OFF	OFF
101.7	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	ON	ON	ON
101.8	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	ON	ON	OFF
101.9	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	ON	OFF	ON
102	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	ON	OFF	OFF
102.1	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	ON	ON
102.2	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	ON	OFF
102.3	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	ON
102.4	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF
102.5	ON	OFF	ON	ON	ON	ON		ON	ON	ON	ON	ON	ON
102.6	ON	OFF	ON	ON	ON	ON		ON	ON	ON	ON	ON	OFF
102.7	ON	OFF	ON	ON	ON	ON		ON	ON	ON	ON	OFF	ON
102.8	ON	OFF	ON	ON	ON	ON		ON	ON	ON	ON	OFF	OFF
102.9	ON	OFF	ON	ON	ON	ON		ON	ON	ON	OFF	ON	ON
103	ON	OFF	ON	ON	ON	ON		ON	ON	ON	OFF	ON	OFF
103.1	ON	OFF	ON	ON	ON	ON		ON	ON	ON	OFF	OFF	ON
103.2	ON	OFF	ON	ON	ON	ON		ON	ON	ON	OFF	OFF	OFF
103.3	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	ON	ON	ON
103.4	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	ON	ON	OFF
103.5	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	ON	OFF	ON
103.6	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	ON	OFF	OFF
103.7	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	OFF	ON	ON
103.8	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	OFF	ON	OFF
103.9	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	OFF	OFF	ON
104	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	OFF	OFF	OFF
104.1	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	ON	ON	ON
104.2	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	ON	ON	OFF
104.3	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	ON	OFF	ON
104.4	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	ON	OFF	OFF
104.5	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	OFF	ON	ON
104.6	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	OFF	ON	OFF
104.7	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	OFF	OFF	ON
104.8	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	OFF	OFF	OFF
104.9	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	ON	ON	ON
105	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	ON	ON	OFF
105.1	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	ON	OFF	ON

MHz	1	2	3	4	5	6		1	2	3	4	5	6
105.2	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	ON	OFF	OFF
105.3	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	OFF	ON	ON
105.4	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	OFF	ON	OFF
105.5	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	OFF	OFF	ON
105.6	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	OFF	OFF	OFF
105.7	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	ON	ON	ON
105.8	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	ON	ON	OFF
105.9	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	ON	OFF	ON
106	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	ON	OFF	OFF
106.1	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	OFF	ON	ON
106.2	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	OFF	ON	OFF
106.3	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	OFF	OFF	ON
106.4	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	OFF	OFF	OFF
106.5	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	ON	ON	ON
106.6	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	ON	ON	OFF
106.7	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	ON	OFF	ON
106.8	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	ON	OFF	OFF
106.9	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	OFF	ON	ON
107	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	OFF	ON	OFF
107.1	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	OFF	OFF	ON
107.2	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	OFF	OFF	OFF
107.3	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	ON	ON	ON
107.4	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	ON	ON	OFF
107.5	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	ON	OFF	ON
107.6	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	ON	OFF	OFF
107.7	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	OFF	ON	ON
107.8	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	OFF	ON	OFF
107.9	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	OFF	OFF	ON
108	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	OFF	OFF	OFF

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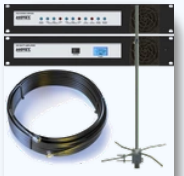

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