

CTCSS TONE PROTECTION

Radio System Interference

Interference to CAL FIRE Local Net communications has become increasingly common, as a result of planned re-use of CAL FIRE assigned radio frequencies, FCC authorized frequency assignment, and as a result of antenna improvements made at various CAL FIRE remote radio sites:

- Local Net radio frequencies have been re-utilized to create additional Command Nets. This was accomplished to increase radio system efficiency and relieve Command Net congestion. Re-use of radio frequencies, however can cause interference to existing Local Net assignments.
- CAL FIRE radio frequencies are not assigned exclusively to our Department. Federal Communications Commission (FCC) rules also authorize use of these radio channels to other local government "forestry-conservation" agencies. These users can also create interference to CAL FIRE radio nets.
- Improved antenna towers and associated radio and antenna systems at CAL FIRE remote radio sites have improved local area radio coverage. However, coverage may be extended unintentionally to other co-channel Units with resultant interference.

Continuous Tone Coded Squelch System (CTCSS)

An accepted, standard method for elimination of co-channel, public safety radio system interference is the activation of Continuous Tone Coded Squelch System (CTCSS) protection. CTCSS protection is built into modern radio equipment. Several years ago CAL FIRE converted the mountain top mobile relay selection from "burst-tone" to CTCSS.

Note: References are occasionally made to "PL" as a tone protection system. "PL" refers to "Private Line", which is the trade name reference to the CTCSS feature provided in radio equipment manufactured by Motorola Corporation.

Recent purchases of CAL FIRE replacement radio equipment have provided the opportunity to enable CTCSS protection throughout our radio system. Basic elements of CTCSS implementation will include protection of all radio equipment:

- Each Local Net has been assigned a discrete CTCSS "tone". Mobile relays within the Local Net continuously transmit the specified CTCSS tone.
- Radio receivers within each Local Net are CTCSS "protected" so that the receiver will not "open" unless it detects the assigned CTCSS tone. All receivers are protected; ECC control stations, FFS, AAB, and Conservation Camp base stations, all mobile radios, all HTs and all aircraft and helicopter radios.
- An example of CTCSS protection is illustrated by examination of the BTU Local Net and the co-channel (151.400/159.375 MHz) CAL FIRE Command-4 Net, which is operating in central California;

- 1) BTU ECC radio receivers will be protected by CTCSS "Tone-1".
- 2) BTU mobile relays will always transmit CTCSS "Tone-1".
- 3) BTU ECC Local Net will only hear radio traffic from their mobile relays. (See also CTCSS Limitations)
- 4) BTU ECC Local Net will not hear the interfering radio traffic from Command-4, because that radio system transmits CTCSS "Tone-8"

Similar CTCSS tone assignments are planned and activated to eliminate other CAL FIRE co-channel interference situations. System planning and engineering will be completed to ensure that existing and future co-channel radio systems are assigned different CTCSS tones.

CTCSS protection is commonly used, worldwide, for control/protection of commercial and public safety radio systems.

CTCSS Tone Plans

CAL FIRE CTCSS tone protection plans will be published in the CAL FIRE Radio Call Plan, as issued to all CAL FIRE radio users. CAL FIRE Telecommunications staff also provides a radio channel summary to the Aviation Management Unit, North/South Operations Command Centers, and Unit Emergency Command Centers for distribution to agency, cooperator, and vendor aircraft operators.

With the exception of HUU and AEU, the assigned CTCSS tone is the same number as the second digit of the Unit designator.

Example:

- TGU unit designation is "2500", which equates to CTCSS "Tone-5" (146.2Hz)
- CZU unit designation is "1700", which equates to CTCSS "Tone-7" (167.9Hz)

Exception to standard CTCSS assignments:

- HUU unit designation is "1200" assigned CTCSS is "Tone-1" (110.9Hz)
- AEU unit designation is "2700", assigned CTCSS is "Tone-5" (146.2Hz)

CDF Command Nets 3 through 10 have been assigned "Tone-8" (103.5Hz) statewide. This assignment will provide protection from co-channel CAL FIRE Local Nets.

CDF Command Nets 1 and 2 will not be CTCSS protected. They are frequencies that are assigned exclusively statewide to CAL FIRE. Out-of-state radio interference may, in the future, require CTCSS protection for these nets.

CDF Tactical Channels are CTCSS protected with tone 16 (192.8) on transmit and receive.

CTCSS Limitations – Car-to-Car (direct) Communications-

CTCSS protection for a specific Local Net includes activation of CTCSS tone decoding for all mobile radios. Car-to-Car (direct) communications requires that the assigned Unit CTCSS tone be transmitted to "open" the mobile receiver. The Kenwood mobile radio is programmed to automatically select the proper CTCSS tone in the "TA" (talk around) transmit mode.

Out-of-unit mobile radios and cooperators should use the mobile relay system within each Unit, (if their radios are not programmed with the receive tone) as per the published Radio Call Plan, or the Group 3 Channel Assignment Plan.

CDF COMMAND NETS

CMD-1 and CMD-2 Command Net repeater locations statewide are shown on the map on pages 74-75. They are used as command frequencies for communications between ECC's, Incident Commanders, aircraft, and command staff. They may be used for flight following and for in route communications between responding and returning mobile units. Use car-to-car whenever possible.

CDF Command Nets 3-10 (below) are in the implementation phase for various locations throughout the state. These frequencies are available to ECC's and Incident Communications Unit Leaders for assignment, consistent with licensing and repeater deployment, in pre-approved areas of the state, with assignment by Region OCC.

Designator	Simple	Repeat	Kenwood Group 3	Kenwood Ch. #
CDF CMD 1	151.3550	159.3000	CMD1	1
CDF CMD 2	151.2650	159.3300	CMD2	2
CDF CMD 3	151.3400	159.3450	CMD3	3
CDF CMD 4	151.4000	159.3750	CMD4	4
CDF CMD 5	151.3175	159.3525	CMD5	5
CDF CMD 6	151.2500	159.3600	CMD6	6
CDF CMD 7	151.4600	159.3900	CMD7	7
CDF CMD 8	151.4450	159.3450	CMD8	8
CDF CMD 9	151.1750	159.4500	CMD9	9
CDF CMD 10	151.1900	159.2250	CMD10	10

All CDF CMD nets are Narrowband

LOCAL NET

This is usually the primary dispatch and operations net for each Unit. Most initial attack dispatching is done on the local net. Local net is used for emergency traffic, aircraft-to-ECC communications and routine administrative traffic, when the net is clear. Repeater locations are shown on the Unit maps.

TACTICAL NETS

Tactical frequencies are assigned to specific Units to allow for incident on-scene radio communications. Their purpose is to provide each incident a different frequency(s) to minimize interference in multiple incident situations, and to free up the local net for its designated purposes. Tac Nets are used for communications on an incident between the Incident Commander and the resources assigned to that incident. ECC's will manage and assign Tac Nets. Charts of Tac Net frequencies and assignments are located on page 12 of this booklet.

CALIFORNIA TRAVEL NET (CESRS)

The Travel net is a shared radio net under a formal agreement between Cal EMA and CAL FIRE known as California Emergency Services Radio System (CESRS) in the Kenwood TK790 Group 3

Repeater Input 154.980 MHz
Repeater Output 153.755 MHz

Additional authorized use of CESRS is limited to ground resources enroute to/from an incident outside their home unit. This channel will not be used as a tactical net, nor will it be used for routine administrative traffic. Authorized uses are:

- 1) Emergency vehicle to dispatch communications;
- 2) Emergency vehicle-to-vehicle communications;
- 3) Initial contact, recall and/or reassignment of personnel and equipment;
- 4) Contact channel during long distance travel by overhead, strike team, etc.
The purpose of this channel is limited to ground resources enroute to/from and incident outside their home base and not used for routine administrative traffic or a tactical net.

There has been no map created for this system at the time of printing this RCP.
We are only using this channel in the direct mode until further notice.

CONTINUOUS TONE CONTROL SELECTION SYSTEM (CTCSS)

CTCSS encoding provides continuous sub-audible tone to access mobile relays (repeaters) and provide access to receive tone protected radios.

Tone 1 110.9 Hz	Tone 9 100.0 Hz
Tone 2 123.0 Hz	Tone 10 107.2 Hz
Tone 3 131.8 Hz	Tone 11 114.8 Hz
Tone 4 136.5 Hz	Tone 12 127.3 Hz
Tone 5 146.2 Hz	Tone 13 141.3 Hz
Tone 6 156.7 Hz	Tone 14 151.4 Hz
Tone 7 167.9 Hz	Tone 15 162.2 Hz
Tone 8 103.5 Hz	Tone 16 192.8 Hz

*NOTE: The above tones are the standard approved by CAL FIRE, FIREScope Communications, BLM, BIA and the USFS.

AIRCRAFT COMMUNICATIONS

AIR TACTICS NETS

Air Tactics 1	166.6750 MHz	USFS
Air Tactics 2	169.1500 MHz	USFS
Air Tactics 3	169.2000 MHz	USFS
Air Tactics 4	151.2800 MHz	CAL FIRE
Air Tactics 5	151.2950 MHz	CAL FIRE
Air Tactics 6	151.3100 MHz	CAL FIRE
Air Tactics 21	151.2725 MHz	CAL FIRE
Air Tactics 22	151.2875 MHz	CAL FIRE
Air Tactics 23	151.3025 MHz	CAL FIRE

The air operations frequencies are shared throughout California by CAL FIRE and USFS. Communications on the air tactics net are restricted to air-to-air use. There are exceptions: CAL FIRE Helitack crews on CAL FIRE incidents may, with approval from the Air Tactical Supervisor, transmit on CAL FIRE Air Tactics 4, 5, 6, 21, 22, or 23 (whichever is assigned) for necessary coordination with their own helicopter.

Air Tactics 1, 2, 3 and 21 are assigned as air-to-ground frequencies by frequency coordinators for specific incidents occasionally.
No other ground units are authorized to transmit on the air tactics nets.

AIRGUARD (AIR SAFETY GUARD) 168.625 MHz

This frequency is monitored at all times by all USFS, CAL FIRE and BLM aircraft and ECC's. Its use is restricted to aircraft, ECC's, Air Attack and Helitack Bases. This frequency is restricted to the following uses:

- 1) Air-to-air emergency contact and coordination
- 2) Ground-to-Air emergency contact. Including emergency hailing by crews in critical danger.
- 3) Initial call, recall, and re-direction of aircraft when no other contact frequency is available.

CAL FIRE VHF-AM RADIO FREQUENCIES

VHF-AM ("Victor") radio frequencies are available for incident use. These frequencies are shared throughout California by CAL FIRE and USFS. Due to FCC regulations and the need for close frequency management, use of these frequencies is prohibited without the approval of the Region Command Center. ECC's will place request for VHF frequencies with the appropriate Region Command Center (North Ops or South Ops).

The following frequencies are authorized for CAL FIRE/USFS use:

VHF	FAA-FCC
122.850	Air to Air Operations
122.900	Air to Air Operations
123.975	Air Tanker Base Ground Control/Operations
122.975	Air to Air Operations Helicopter
123025	Air to Air Operations Helicopter
122.750	Air to Air Operations
122.925	Air to Air Operations

The Region Command Centers may assign other VHF frequencies for specific incident support, depending on current FAA/FCC authorizations.

AIR-TO-GROUND COMMUNICATIONS

- Designated air-to-ground frequencies for use in California are:
 - 151.2200 MHz CAL FIRE air-to-ground
 - 170.0000 MHz USFS air-to-ground
 - 166.8750 MHz USFS secondary air-to-ground
 - 169.1125 MHz USFS secondary air-to-ground
- Use the air-to-ground frequency assigned by ECC. Air Tactics 21 may also be used with coordination as Air-to-Ground 21.
- Normally, incident air-to-ground traffic is restricted to the Incident Commander and/or Operations Section Chief and Helitack crews. Individuals, crews, engines and dozers needing air support should place their request with the IC, Ops or other appropriate line officer on the assigned tactical net.
- CAL FIRE, USFS and BLM contract aircraft, including air tankers, lead planes, air attack planes, smokejumper planes and helicopters can dial up any frequency between 150 and 174 MHz. Copters 202 and 205 also have LF and UHF capability.
- CAL FIRE Call-When-Needed (CWN) air attack planes have limited frequencies. ECC's will assign the air-to-ground frequency to be used by CWN aircraft.
- ECC's are responsible for frequency management. Check with ECC if in doubt about an assigned frequency. Report serious interference to ECC ASAP.
- All CAL FIRE helicopters and air attack aircraft have tone encoders and can activate mobile relays when necessary.
- I.C.'s should know which air-to-ground frequency is normally assigned for initial attack in their area. Unless the ECC advises otherwise, assume all aircraft will be monitoring this frequency.
- If you are unable to contact aircraft on assigned air-to-ground frequency, call ECC for assistance.
- Remember to talk to aircraft when they are off to one side. Directly overhead = No contact.