



WHISTLER

**WS-1080/WS-1088 EZ Scan Digital Handheld Scanner
WS-1095/WS-1098 EZ Scan Digital Base/Mobile Scanner
TRX-1 Digital Handheld Scanner
TRX-2 Digital Base/Mobile Scanner**

**Remote Control Protocol
CC Dump Protocol
Audio File Header Format**

Version 1.7 – August 1, 2017

This document is intended for use by experienced software developers and is subject to the following disclaimer:

Whistler Group, Inc., provides the Remote Control Protocol, Clock Set Protocol, CCDump Protocol and Audio File Header Specifications (the "Specifications") AS IS for the convenience of scanning hobbyists and programmers who wish to develop software applications for use with the Whistler Scanners listed above. Use of the Specifications shall be AT YOUR OWN RISK. Whistler Group does not provide technical support for these protocols. Should you require assistance with the Specifications, we encourage you to visit one of the many Whistler User Group forums on the Internet. By using the Specifications, you agree to these terms.

Whistler Group Digital Scanner Remote Control Protocol, CC Dump Protocol and Audio File Header Format

Whistler Digital scanners include a simple remote control interface protocol (RCIP) that is suitable for use with a PC application designed to provide a remote control and display capability. The ideal application should provide a means by which a user can interact with a visual representation of the scanner's keypad and display.

As of firmware released in June of 2017 for the WS-1080, WS-1088, WS-1095, WS-1098, TRX-1, and TRX-2, it is also an option to get information about the currently active channel.

Remote Control Mode is active at all times, and does not require that the radio be placed in any special remote mode in order for it to be used.

The basic remote control command/response format is as follows:

<STX><msgCode><msgData><ETX><sum>

where:

<STX> An ASCII "Start of Text" symbol (0x02)

<msgCode> A single character code that represents the command or response message type. Please be aware that this code is case sensitive (i.e. T and t are not the same)

<msgData> The data that accompanies a command or a response. Not all requests require this item. The length and format of this data depends on the type of request being made.

<ETX> An ASCII "End of Text" symbol (0x03)

<sum> An unsigned char type sum of all bytes starting with <msgCode> up to and including <ETX> anded with the value 0xFF. This value must be calculated and sent with every command and response for error checking.

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The following commands are supported in the Remote Control protocol:

Get Status

Command:

STX A ETX <sum>

Response:

STX A <mode> <sq> <battL> <battH> <rssiL>
<rssiH> <zmL> <zmH> <ledR> <ledG> <ledB> <freq0>
<freq1> <freq2> <freq3> <rxmode> ETX
<sum>

sq:

bit 0: RF Squelch state

bit 1: Unmuted state

bit 2: /XF state (IMBE detect)

battL: Low byte of batt level

battH: High byte of batt level (OR 0x80 if USB)

rssiL: Low byte of RSSI value

rssiH: High byte of RSSI value

zmL: Low Byte of ZeroMatic value

zmH: High byte of ZeroMatic value

ledR: Red LED intensity (0-255)

ledG: Green LED intensity (0-255)

ledB: Blue LED intensity (0-255)

freq: Current frequency, little-endian

rxmode: 0=AM, 1=FM, 2=NFM

<mode> values (Values are in HEX):

00	Main Menu	0B	Weather
01	Browse Objects	0C	Skywarn
02	Browse Library	0D	Weather Menu
03	Location Select	0E	Sweeper Menu
04	Scanlist Edit	0F	Service Search Menu
05	Scanlist Set Edit	10	Search Lockouts Menu
06	Top Search Menu	11	Sweeper
07	Select Config	12	Search
08	Update from Library	13	Search settings Menu
09	Monitor Object	14	Sweeper Settings Menu
0A	Scan		

Get LCD

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Command:

STX L ETX <sum>

Response:

STX L <lcd0> <lcd1> ...
<lcd96><icons1><icons2><icons3>ETX<sum>

<lcd0> through <lcd96> are the characters found on the scanner's display (6 lines at 16 characters per line).

NOTE: Not all characters displayed on the scanner's LCD display are available on the screen data. Items such as check boxes and cursor arrows are not available in the data provided using this command.

<icons1>, <icons2> and <icons3> are bitmapped representations of display icon status, as follows:

icons1:
bits 0-2: RSSI bars level, 0-5
bit 3: S icon
bit 4: Batt icon ON
bit 5: Batt icon BLINKING
bit 6: Ext Power Icon

icons2:
bit 0: Fn icon
bit 1: 'G' icon
bit 2: 'A' icon
bit 3: 'T' icon
bit 4: Unused
bit 5: Unused
bit 6: Play Icon
bit 7: Pause Icon

icons3:
bits 0-2: Signal Type
bit 3: 'IF' icon
bit 4: Trunk2 icon
bit 5: PRI icon
bit 6: TrunkS icon
bit 7: Unused

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Signal Types:

0:	Off
1:	DG
2:	Dg
3:	AM
4:	FM
5:	NFM
6:	ENC
7:	D2

Get Active Channel Information

Command:

STX a ETX <sum>

Response:

STX a <lenH> <lenL> <data> ETX <sum>

Where:

<lenH> = High byte of the length of the response data

<lenL> = Low byte of the length of the response data

<data> = <len> bytes of data.

If the scanner is actively monitoring a transmission, <len> will be the size of the recording header defined later in this document followed by the contents of that recording header data.

If there is currently no transmission in progress, <len> will be set to 0 and <data> will be empty (Total length 6 bytes).

Note: The channel does not have to have the recording flag set in order to use this command.

Notes regarding the fields in the recording header:

1. All numeric fields are in big-endian format and will need to be converted for use on a PC.
2. The Talkgroup ID #2 field will contain the radio ID that initiated the call if available throughout the transmission
3. The Radio ID #1 field will be updated in real time

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with the current available radio ID value.

4. If no radio ID is available for either of the above fields, the value of 0xFFFFFFFF will be returned.
5. The Info alpha tag field will contain the Talkgroup ID in the format shown on the scanner's display.
6. This command requires firmware released in June 2017 or later.

Send Key

Command:

STX K <keycode> ETX <sum>

Response:

(no response)

Key codes for the Send Key command are as follows:

Key	Code	Key	Code
MENU	17	PLAY/SEL/PAUSE	9
SKIP	1	WX	3
ATT	15	▼	10
▲	8	▶	2
◀	16	PRI	5
Fn	12	. (decimal)	19
1	29	2	22
3	30	4	23
5	31	6	24
7	32	8	25
9	33	0	26
Knob CW	40	Knob CCW	41
Knob push	43	POWER	44

Note: CPU Firmware version 1.2 or higher is required for use with this command. Earlier versions of the firmware do not handle this command correctly.

Clock Set

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Command:

```
STX t <sec> <min> <hour> <mday> <month> <year>  
<weekday> <yearday> <isDST> ETX SUM
```

Note: All parameters for this command are 16 bit short integers as follows:

```
sec:      Seconds after the minute [0-59]  
min:      Minutes after the hour [0-59]  
hour:     Hours since midnight [0-23]  
mday:     Day of the month [0-31]  
month:    Months since January [0-11]  
year:     Years since 1900  
weekday:  Days since Sunday [0-6]  
yearday:  Days since January 1 [0-365]*  
isDST:    Time is Daylight Saving Time*
```

Items marked with an asterisk (*) are optional and may be set to a value of 0.

Response:

(no response)

Power Status Request

Command:

```
STX P ETX <sum>
```

Response:

```
STX P <status> ETX <sum>
```

Status indicates the current power state of the scanner as follows:

```
0:  Scanner is Off  
1:  Scanner is On
```

Version Request

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Command:

STX 'V' 0x00 ETX <sum>

Response:

STX 'V' 0x00 <mod1> <mod2> <mod3> <mod4> <mod5> <mod6>
<mod7> <mod8> <bb> <cc> <dd1> <dd2> ETX <sum>

<mod1> through <mod8> are ASCII characters of the model number identifier string. In the case of the WS1080, this model number is "WS1080".

<bb> Boot version
<cc> CPU version
<dd1> DSP version 1
<dd2> DSP version 2

These values contain the major version in the 4 high bits, and the minor version in the 4 low bits.

CCDump Control

Command:

STX C <value> ETX <sum>

Response:

(no response)

<value> determines if the CC Dump function to the USB Serial port should be turned on or off and may have the following values:

0: Turn the CC Dump off
1: Turn the CC Dump On

Note: Use of this command will set the CC Dump value in the scanner's configuration data. If the CC Dump to SD Card option was enabled before using this function, it will be automatically disabled. Manual intervention will be required to re-enable the CC Dump to file option.

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Control channel data dump format

Whistler scanners feature a trunked control channel decoding function called CCDump. When CCDump is turned on, the scanner sends decoded trunking control channel information and SAME weather alert data to the PC/IF port or to a file on the scanner's internal Micro SD card.

This data can be displayed using any simple terminal application, or, read by third party application software for additional analysis and decoding.

CCDump is turned off by default in the scanner. To activate CCDump, press the **MENU** key, then scroll down to the **SETTINGS** menu and press **SEL** to enter the settings menu.

In the Settings menu, scroll down to the **PC/IF CCDump** option. Press the **SEL** key to toggle the option on or off.

Once the option is set, press the **MENU** key and then the **SEL** key to accept the changes.

To view CCDump data, connect the radio to a personal computer using the USB PC/IF cable. Start a terminal program or your third party application software. Configure the communications parameters for "115200, N, 8, 1" as follows:

COM Port: The COM port number assigned to the scanner by your computer. If you are running a Windows operating system, you can find this information under "Ports" in the Device Manager.

Parity: None

Baud Rate: 115,000 bits per second

Word: 8 bits

Stop Bits: 1

Basic CCDump data includes the system type, the Object ID of the TSYS object (if applicable), and the "raw" control channel messages as they are transmitted by the system. This data is delimited by ":" symbols. Basic CCDump data is sent to the PC/IF port when the radio is monitoring a trunked control channel while in PAUSE or SCAN modes.

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CC Dump Message Format

The following describes the CCDump message format when used on trunked radio systems:

<Type>:T<xxxxxxxx>[:S<yyyy>][:CC<zz>][:<SubType>]:<CC Data>[:<Decode Data>]

<Type>: One of the following three ASCII character combinations:

P25: Project 25 control channel or voice channel data

MOT: Motorola 3600 control channel data

LTR: LTR low speed data

ED : EDACS control channel data (both Wide and Narrow)

<xxxxxxxx>: The hexadecimal representation of the TSYS's File System ID (for WXS and WXT, this is the current WX Chan 0000-0006)

<yyyy>: The site number within the current TSYS data. For P25 Conventional voice, this will be "0000". This field is not present when the <Type> field is WXS or WXT.

<zz>: The control channel within the site being decoded. This field is not present when the <Type> field is WXS or WXT.

<SubType>: The P25 packet subtype. This is only used and present when the <Type> is set to P25.

<CC data>: The "osw" from the CC. The format depends on the system type.

<Decode Data>: If present, how the scanner decoded the data.

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CC Data Formats:

- P25:** The format of P25 data depends on the SubType field. Each SubType field is listed below.
- P25TSBK:** This data sub type contains basic control channel messages in the following format:
- `<X1><X2><X3><X4><X5><X6><X7><X8><X9><XA><XB><XC>` where `<X1>` - `<XC>` are 12 2-digit hexadecimal bytes from the last message received. Each item is separated by a space character.
- P25ES:** This data sub type contains encryption sync control messages transmitted on the voice channel. These messages have the following format:
- `<X1><X2><X3><X4><X5><X6><X7><X8><X9><XA><XB><XC>` where `<X1>` - `<XC>` are 12 2-digit hexadecimal bytes from the last message received. Each item is separated by a space character.
- P25LC:** This data Sub Type contains link control messages transmitted on the voice channel. These messages have the following format:
- `<X1><X2><X3><X4><X5><X6><X7><X8><X9>` where `<X1>` - `<X9>` are 9 2-digit hexadecimal bytes from the last message received. Each item is separated by a space character.
- LCTG:** This data sub type contains the talkgroups advertised on a link control message.
- P25HDU:** This data Sub Type contains the Header Data Unit control messages transmitted on the voice channel. These messages have the following format:
- `<X1><X2><X3><X4><X5><X6><X7><X8><X9><XA><XB><XC><XD><XE>` where `<X1>` - `<XE>` are 15 2-digit hexadecimal bytes from the last message received. Each item is separated by a space character.
- P25PDU:** This data sub type contains extended control channel data messages. These are messages that do not fit into a standard P25TSBK data type. These messages have the following format:
- `<Position>/<Total> : <X1> : <X2> : <X3> : <X4> : <X5> : <X6> : <X7> : <X8> : <X9> : <XA> : <XB> : <XC>.`
- `<Position>:` Packet number of the sequence of data packets being transmitted within the extended data.
- `<Total>:` Total number of packets being transmitted in this extended data packet.
- `<X1>` - `<XC>:` The actual data being sent as 12 2 byte hexadecimal bytes. Each item is separated by a colon (:).

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MOT: This type indicates a Motorola system and has the following format from the control channel:

<cmd> <dir> <id>

<cmd>: 3-digit (10-bit) hex "command" value
<dir>: direction bit
<id>: 4-digit (16-bit) hex "id" value

When Monitoring a P25 CAI voice channel, the P25ES, P25LC and P25H DU P25 SubType fields will be presented to the PC/IF Port and will be in the following format:

<SubType>:<Data>

<SubType>: The P25 sub type (P25ES, P25LC or P25H DU)
<Data>: The data associated with the sub type. See the P25 section for a description of these sub type data formats.

When monitoring a non-P25 voice channel on this system type, the scanner will provide the sub-audible data found on the voice channel. Sub-audible data will appear as follows:

Sa:<data>

<data>: 16 bit hexadecimal value

The final sub-audible packet will be in this format:

Sa:End:pattern The Motorola end code was detected
Sa:End:noise Noise was received that cannot be voice.

LTR: This type indicates a received signal on an LTR channel and has the following format:

<RR>:<A>-<GG>-<HH>-<III>-<FF>

<RR>: Repeater on which the msg was received
<A>: area
<GG>: Goto/In-Use repeater #
<HH>: Home Repeater #
<III>: Group ID
<FF>: Free Repeater #

ED : This type indicates a control channel message from an EDACS system and has the following data format:

<W>:<ccc><pppppppp>

<W>: Which of the two blocks (0 or 1) in the msg pair this is
<ccc>: Command value. Represents a variable # of bits from the received data (since commands are variable length)
<payload>: remainder of msg, after removing the <ccc> command value

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CC Dump Conventional Data Message Format

The following describes the CCDump message format when used on conventional P25 channels:

C<xxxxxxxx>:<SubType>:<Data>

<xxxxxxxx>: The hexadecimal representation of the conventional channel's File System ID

<SubType>: The P25 packet subtype. Possible sub types are P25ES, P25LC and P25HDU. See the P25 section for a description of these sub types.

<Data>: The data associated with the sub type.

CC Dump Weather Data Message Format

The following describes the CCDump message format when used on weather radio decode:

<Type>:T<xxxx>:<Data>

<Type>: One of the following three ASCII character combinations:

WXS: WX SAME Data

WXT: WX 1050Hz tone detection

<xxxx>: A 4 digit representation of the current WX channel the messages was received from.

<Data>: The data received. The format depends on the system type.

WXS: This type indicates that a SAME data message has been received on one of the WX channels and has the following format:

ZCZC-<Origin>-<Code>-<Location>

<Origin>: The origin of the message. Weather events are usually "WXR".

<Code>: A three letter designation of the type of message being sent.

<Location>: A 6 digit location id.

More information on the <Code> and <Location> fields may be found at <http://www.nws.noaa.gov/nwr/nwrsame.htm>.

WXT: This type indicates that the scanner is operating the WX Priority mode and has detected a 1050Hz tone on one of the WX frequencies. This message takes the following format:

"1050Hz Detect"

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Audio File Header Information

The following section describes the header information located at the beginning of the audio files created by the scanner. 320 bytes are reserved at the start of the file to hold this information. This structure is also used for the Get Active Channel Information command.

Offset	Data Type	Default Value	Description
0	unsigned long	0x2E736E64 (".snd")	Magic Number, standard value for .AU files.
4	unsigned long	320	Offset to start of audio data.
8	unsigned long	0xFFFFFFFF	Audio data size, set to 0xffffffff to indicate "unknown". Use the file size – 320 to get the correct value.
12	unsigned long	1	Encoding format, always set to 1 (uLaw)
16	unsigned long	8000	Sample rate. Always 8000 samples per second.
20	unsigned long	1	Channel count (1=Mono)
24	unsigned char		Recording Type. Possible values are: 0: Conventional 1: Talkgroup 2: Search
25	struct stm		Date and time recording was started. See structure information below for more details.
43	char[17]		Object alpha tag
60	char[17]		Trunked system alpha tag (if trunked)
77	char[17]		Info alpha tag (Miscellaneous information)
94	unsigned long		Object ID
98	unsigned long		Talkgroup ID #1
102	unsigned long		Talkgroup ID #2
106	unsigned long		Radio ID #1
110	unsigned long		Radio ID #2
114	char[17]		Site Name (Multi-Site trunked systems only)
131	unsigned long		TSYS File Index
135	other[17]		Misc text info (e.g. DMR slot and color code)
152	unsigned long		Voice frequency
156	unsigned long		Control channel frequency (if applicable)
160	unsigned short		Squelch mode (0=No Tone,1=CTCSS,2=DCS,3=NAC)
162	unsigned short		Squelch value
164	unsigned char		TSYS Type
165	reserved[155]		Reserved for future data

The structure information for the recording start time is provided below. All values in this structure are in Little Endian byte order.

```
struct stm {
    short int tm_sec;           //seconds after the minute (from 0)
    short int tm_min;           //minutes after the hour (from 0)
    short int tm_hour;          //hour of the day (from 0)
    short int tm_mday;          //day of the month (from 1)
    short int tm_mon;           //month of the year (from 0)
    short int tm_year;          //years since 1900 (from 0)
    short int tm_wday;          //days since Sunday (from 0)
    short int tm_yday;          //day of the year (from 0)
    short int tm_isdst;         //Daylight Saving Time flag
};
```

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TSYS Type Values:

Value	System Type
0	Motorola
1	EDACS
2	LTR
3	Project 25 (P25)
4	DMR
5	NXDN

Notes:

- 1) All integer values are in Big-Endian format.
- 2) All frequencies are in Hertz.
- 3) For CTCSS and DCS, the following tables are used to look up the correct values. For NAC, convert the Squelch value to a three character hexadecimal value.

CTCSS:

Value	Tone	Value	Tone	Value	Tone	Value	Tone
0	67.0	1	69.3	2	71.9	3	74.4
4	77.0	5	79.7	6	82.5	7	85.4
8	88.5	9	91.5	10	94.8	11	97.4
12	100.0	13	103.5	14	107.2	15	110.9
16	114.8	17	118.8	18	123.0	19	127.3
20	131.8	21	136.5	22	141.3	23	146.2
24	151.4	25	156.7	26	159.8	27	162.2
28	165.5	29	167.9	30	171.3	31	173.8
32	177.3	33	179.9	34	183.5	35	186.2
36	189.9	37	192.8	38	196.6	39	199.5
40	203.5	41	206.5	42	210.7	43	218.1
44	225.7	45	229.1	46	233.6	47	241.8
48	250.3	49	254.1				

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DCS:

Value	Tone	Value	Tone	Value	Tone	Value	Tone
0	006	1	007	2	015	3	017
4	021	5	023	6	025	7	026
8	031	9	032	10	036	11	043
12	047	13	050	14	051	15	053
16	054	17	065	18	071	19	072
20	073	21	074	22	114	23	115
24	116	25	122	26	125	27	131
28	132	29	134	30	141	31	143
32	145	33	152	34	155	35	156
36	162	37	165	38	172	39	174
40	205	41	212	42	214	43	223
44	225	45	226	46	243	47	244
48	245	49	246	50	251	51	252
52	255	53	261	54	263	55	265
56	266	57	271	58	274	59	306
60	311	61	315	62	325	63	331
64	332	65	343	66	346	67	351
68	356	69	364	70	365	71	371
72	411	73	412	74	413	75	423
76	431	77	432	78	445	79	446
80	452	81	454	82	455	83	462
84	464	85	465	86	466	87	503
88	506	89	516	90	523	91	526
92	532	93	546	94	565	95	606
96	612	97	624	98	627	99	631
100	632	101	654	102	662	103	664
104	703	105	712	106	723	107	731
108	732	109	734	110	743	111	754

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Audio File Index File

In addition to the audio files created by the scanner, it will also create an index file to indicate what audio files are present on the scanner's SD Card.

File Name: ARINDEX.DAT

Location: Rec folder

Offset	Data Type	Default Value	Description
0	char[8]	ARINDEX\0	Identification/Verification string
8	unsigned long	Array of recordings	An array of unsigned long integers (Little Endian) each indicating an existing recording number.

To build the file name that matches the audio file, use the following process.

There are a maximum of 200 audio recordings (numbered 000 through 199) in each folder. Each folder is a zero padded 5 character folder (i.e. Folder 1 would be 00001) starting at folder number 0 (00000).

To calculate the folder name, use the integer portion of this formula:

FolderID = Index/200

The file name is a zero padded 3 character name with a .AU file extension. To calculate the file name from the index, use this formula:

FileID = Index%200